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A Sustainable Strawberry Shortcut? Governance of Value Chain Stakeholders for Environmental Upgrading in Horticulture in Huelva, Spain

GEO 511 Master's Thesis

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Pictures Cover Page

Left, above: A stork in the road leaving El Rocío towards the farms. (Own picture, May 2024)

Right, above: The roundabout artwork in Palos de la Frontera. (Own picture, May 2024)

Left, below: Quality controls of strawberries in a packhouse. (Own picture, May 2024)

Right, below: A biodiversity conservation area on a farm. (Own picture, May 2024)

Für Papa.

“There is only one way to learn…
It’s through action.
Everything you need to know,
you have learned through your journey.”
– Paolo Coelho

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My journey in writing this thesis would not have been possible without the people who have supported me along the way in manifold ways- from academically, to professionally, to personally, to emotionally.

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No puedo esperar a volver a Huelva.

Y a los amables desconocidos de toda Andalucía, que me prestaron el billete de autobús, me llevaron, cargaron mi maleta y hablaron pacientemente conmigo mientras yo asentía y repetía:

“Sí, claro.”

Foreword

When I moved to Switzerland at age 11, it was the first time in my life that I could grocery shop on my own. At first, I was overwhelmed by the sheer amount of information- prices, labels, name brands, and nutritional information. As I began to learn more about the environmental, social, and economic significance of this information, I developed a curiosity about our food system that has driven me ever since and has been my internal compass throughout my studies.

Returning to Switzerland during the COVID-19 pandemic was unexpected, but it ultimately led me to pursue a master's degree in Human Geography at the University of Zurich, with a minor Agroecology at the Federal Institute of Technology. Through engaging coursework, networking events, and hands-on projects on this path, I have been able to delve into the complex world of sustainable agri-food systems. Along the way, I discovered the crucial roles that trust and community play in building a resilient and future-ready food system.

A pivotal moment in my journey came with my internship in the sustainability department of a Swiss supermarket. There, I had the opportunity to apply the knowledge and skills acquired during my studies to practical issues in the strategies and goals of the company. I worked on developing a biodiversity strategy and operationalizing a freshwater strategy for the supermarket's supply chains. Immersing myself in concepts like supply chain due diligence and multi-stakeholder initiatives inspired me to explore the case study of Spanish strawberries in this thesis.

My fieldwork in Sevilla, Huelva, and El Rocío, Spain was one of the most demanding yet fulfilling challenges that I have ever undertaken. The adventure tested my resilience, adaptability, and perseverance, and humbled me to accept the imperfections in even the best laid plans. From moments where I found myself without travel options, to meetings in a new language in a new culture, I was challenged to accept the unexpected, find my sea legs, and navigated through. These experiences gave me a perspective that was invaluable in analyzing and interpreting the multifaceted issues and dynamics at hand with greater clarity and depth.

At moments during my fieldwork, I felt a little like Paolo Coelho's Santiago – on a journey to find a grand treasure- only to return home with many life lessons in my pockets, and the realization that the greatest gift – that of learning and growing – was waiting for me right where I had started. This experience has been the culmination of my master's studies and marks the gateway to my journey as a researcher. I greatly look forward to continuing my exploration of these themes and cases in my next adventures.

Contents

Diagrams and Tables

Glossary of Terms, Abbreviations, and Acronyms

ASD	*Anaerobic Soil Disinfestation*
AWS	*Alliance for Water Stewardship*
CGT	*Constructivist Grounded Theory*
CUMAS	*Comunidades de Usuarios de Aguas Subterráneas- Community of Subterranean Water Users*
ESG	*Environmental, Social, Governance*
FFV	*Fresh Fruits and Vegetables*
GLOBAL G.A.P.	*Global Good Agricultural Practices*
GSI	*Good Stuff International*
GVC	*Global Value Chain*
MLP	*Multi-Level Perspective*
MSI	*Multi-Stakeholder Initiative*
NGO	*Non-Governmental Organization*
SI	*Sustainable Intensification*
SAI	*Sustainable Agriculture Initiative*
SPRING	*Sustainable Program for Irrigation and Groundwater Use*

Abstract

In this thesis I examine the effectiveness of multi-stakeholder initiatives (MSIs) in addressing environmental risks within the Spanish-Swiss strawberry value chain, focusing on Huelva's intensive berry production adjacent to the Doñana wetlands. Through a critical constructivist approach combining global value chain analysis with the Multi-Level Perspective framework, I investigate how power relationships and market dynamics influence environmental governance in horticultural value chains. Through semi-structured expert interviews with value chain actors in Switzerland and Spain, as well as site visits to production facilities across Huelva's berry-growing region I collected qualitative data to analyze these relationships and dynamics within the MSI of a Swiss supermarket retailer. In analyzing the data produced by these interviews and site visits, I discovered that while MSIs facilitate the adoption of efficiency-enhancing technologies and environmental upgrading practices, their effectiveness in contributing to a sustainable transformation in Huelva's berry sector is constrained by market and political institutions that incentivize expanding intensive production. Three key dynamics emerged from the dialogue with stakeholders: Firstly, environmental innovations primarily focus on input efficiency rather than transformative agroecological change in production. Secondly, power asymmetries between retailers, traders, and producers characterize the implementation and outcomes of environmental governance mechanisms within the MSI. Lastly, the current misalignment between economic and environmental policies at the landscape level critically undermines the potential for a fundamental sustainable transition in the sector to promote both responsible natural resource use and the conservation of biodiversity in Huelva's intensive berry sector. With this thesis, I contribute to the literature on environmental governance in global value chains by demonstrating how market-based initiatives interact with institutional frameworks to shape sustainability outcomes. I contend that effective environmental risk management in fresh fruit and vegetable value chains requires harmonizing market and political instruments while addressing power imbalances between value chain actors. My findings have implications for the development of environmental strategies for value chain and food system actors and indicate the need for more integrated and agroecological approaches to sustainable intensification in horticultural production.

Keywords: Multi-stakeholder initiatives, environmental governance, global value chains, sustainable intensification, agricultural innovations

PART I: INTRODUCTION, CASE STUDY, THEORETICAL AND CONCEPTUAL FRAMEWORK, AND RESEARCH METHODS AND METHODOLOGY

In this first half of my thesis, I introduce the foundations of my research, including the research problem with which it engages and the relevance thereof, with the focus on ***multi-stakeholder initiatives*** *for environmental upgrading in agri-food value chains. To give this investigation context, I use the case study of the* ***Swiss supermarket****-led initiative for sustainable* ***strawberries*** *from the Spanish province of* ***Huelva****. Here, I explain the background of this case study in detail, outline the theoretical and conceptual frameworks that guide my research, and detail the methods and methodology which I employed in my fieldwork, and the analysis and collection of data through semi-structured expert interviews with actors throughout the Spanish-Swiss strawberry nexus.*

1. Introduction

Global food systems face a fundamental paradox: while intensive agriculture has enabled unprecedented progress in the efficiency and scale of food production, it simultaneously threatens the stability and availability of the natural resources upon which agricultural production depends (Pretty 2018). The tension manifests prominently in intensive horticulture, where the demand for year-round fresh produce and the establishment of markets to fulfill such demand have resulted in complex environmental challenges (McMichael 2021, 219; Clapp 2021). The mainstream fresh fruit and vegetable sector, an attractive industry generating significant income, has evolved to become characterized by expansive monocropping, involving capital-intensive infrastructure, high volumes of agricultural inputs such as fertilizers, water, pesticides and other agrochemicals, and significant labor requirements (Struik and Kuyper 2017). These characteristics generate consequences for the socio-ecological systems that underpin agricultural production at regional, national, and international scales (Levidow 2018; Krishnan, De Marchi and Ponte 2023). In recent years, due to evolving environmental factors such as water scarcity and biodiversity loss, Spanish strawberries from Huelva have emerged as the epitome of this paradox. In close proximity to the critical biodiversity hotspot of the Doñana National Park, strawberries are grown in expansive plastic tunnels across the southwestern corner of Andalucia — Europe's fruit and vegetable greenhouse. The management of intensive berry crops is under intense scrutiny, given increasing water scarcity in the region and the cascading consequences for local ecosystems (Stefano 2012; Doñana Biological Station 2024).

A trifecta of institutional, ecological, and economic parameters characterize the case of the environmental impacts of the onubense[1] berries: practices of illegal irrigation are notable in the region despite public regulation, the health of the Doñana National Park is implicated by stress on and management of limited water and other natural resources, and the geographical proximity to the production competitor of Morocco places increased pressure on price for Spanish growers (World Wildlife Fund España 2024). These aspects have led to the proliferation of collaborative programs designed to address the environmental impacts of berry production, led in part by private partners such as supermarket businesses (Lüthy 2022). The concentration of such programs in the region positions the case study of Huelva's berry sector as a critical opportunity to build an understanding of the complexity of the sustainability of fresh produce export markets along their value chains. Herein lies the core research problem which I engage with in my research: there is uncertainty whether these collaborative programs, or multi-stakeholder initiatives, are a sufficient format of effectively and sustainably improving the

[1] Onubense- the demonym of Huelva, Spain. Derived from *Onuba*, the Phoenician name for Huelva.

environmental performance of concentrated, export-oriented horticultural industries. To address this dilemma, I put forth the following research question: "What are the potentials and challenges of Multi-stakeholder initiatives in supporting the adoption of agronomic innovations to mitigate the environmental impacts of the Spanish-Swiss strawberry value chain?" The research questions are further specified in Section 2.1.1 of the theoretical framework chapter. Concretely, my primary objective in exploring this question was to generate an improved understanding of how multi-stakeholder initiatives can act as enablers for sustainable transitions in agri-food systems, and how these systems must strategically evolve to do so in the context of the case study of the onubense berries. Developments in this research direction have the potential to not only make valuable contributions to the theoretical foundations of value chain governance and environmental upgrading, but also may establish practical insights for the further engagement of stakeholders in the value chain and in the agri-food system beyond.

In Huelva, and across agricultural land management for food production, the debate of how to sustainability transform the food system distills into the discussion of intensification (using less land to produce more food) versus extensification (using more land to produce the same amount of food, with fewer potentially environmentally harmful inputs). In addressing this dynamic, answers are sought to the critical issue of managing limited resources of agricultural inputs, such as water, fertile soil, suitable climate, and local biodiversity, while maintaining and scaling food production (Pretty and Barucha 2014). The concept of sustainable intensification (SI) circumvents this duality by proposing a third way — applying technologies and agronomic methods in production to improve yields, allocate less arable land to production, and limit resulting negative environmental externalities, while maintaining the same scale of output (Pisante, Stagnari and Grant 2012). These methods and technologies represent innovations that offer disruptions and new trajectories to conventional production. However, the successful adoption of these innovations for sustainable agricultural intensification by producers requires coordinated action across diverse stakeholder groups in these value chains (Struik and Kuyper 2017).

Such coordination becomes particularly intricate in transnational markets of year-round fresh produce commodities due to discrepancies in incentive structures for stakeholder participation in implementing solutions to the negative environmental impacts of agricultural production. Within these complex agricultural value chains, coordination and governance roles are crucial for the uptake of sustainable agro-innovations. Retail actors in downstream value chain operations, particularly supermarkets, have gradually adopted a critical role in orchestrating and coordinating sustainability initiatives to promote these practices (Fernandez-Stark, Bamber and Gereffi 2011; Bakker, Rasche and Ponte 2019). In the complex landscape

of global food systems, supermarket businesses have established themselves as pivotal actors, wielding significant influence over supply chain dynamics and associated environmental impacts (Krishnan, De Marchi and Ponte 2023). The prevalence of supermarkets in the conventional Western and capitalistic context of the agri-food sector has emerged from the modernization and globalization of food systems and their associated regulatory, socioeconomic, and cultural frameworks (Lawrence and Dixon 2015). Simultaneously, supermarkets are recognized as one of the core drivers of environmental challenges faced globally by the agri-food industry.

The chance of negative environmental and social outcomes occurring — or the environmental, social, and governance (ESG) risks — associated with supermarket operations are accompanied by additional pressures, including comprehensive regulatory requirements (regulatory risks) and evolving consumer demands (reputational risks) (Giannakis and Papadopoulus 2016; Oliveira, Leiras and Ceryno 2019). For this reason, supermarkets increasingly adopt corporate social responsibility (CSR) strategies to strategically identify, monitor, analyze, and manage supply chain risks within sustainable business management frameworks (Clapp and Fuchs 2009; Lund-Thomsen 2019). These CSR strategies orient business operations toward mitigating negative social and environmental impacts, generating a sequence of pressures on upstream value chain actors to facilitate ESG risk improvements at each step of commodity value creation. The complexity of value creation operations and overall value chain structure demands engagement across sectors, communities, and institutions to successfully overcome barriers to innovation adoption and improve environmental impacts of agricultural production (Ransom, Bain and Higgins 2013; Krishnan, de Marchi and Ponte 2023).

A variety of collaborative efforts exist to coordinate these stakeholders, frequently termed multi-stakeholder initiatives (MSIs). These initiatives represent structured platforms where diverse actors—including businesses, civil society organizations, government bodies, and local communities—come together to address complex sustainability challenges through dialogue, shared decision-making, and collective action (Konefal 2015; Zeyen, Beckmann and Wolters 2016). In this research, I engage with MSIs and the associated decision frameworks of stakeholders involved in these networks. Moreover, I seek to understand how to reconcile individual motivations and constraining factors of these actors and their spheres of influence within networks for sustainable food systems and their production context. To demonstrate this, I employ the case study of a Swiss supermarket retailer's sustainable soft commodities procurement strategy and their multi-stakeholder project for improved social and environmental conditions of strawberry cultivation in Huelva, Spain.

The initiation of the project stemmed from multiple incentives faced by the supermarket retailer[2], including high reputational, regulatory, and ESG risks associated with out-of-season strawberries sourced from Huelva. Environmental impacts of onubense strawberries receive enhanced media attention given water management challenges during Spain's dry season. Despite public regulation of agricultural irrigation, a significant share of farms operate illegal wells, exacerbating water stress. Furthermore, monoculture practices with high infrastructural inputs and chemical applications place substantial pressure on local biodiversity near the Doñana National Park (Lüthy 2019; World Wildlife Fund España 2024; Stefano 2012).

The "sustainable strawberries" MSI of the Swiss supermarket was initiated to realize targets such as low-risk irrigation, fertilization, pesticide, and soil management at the farm level, while improving labor conditions and employment rights. The project focuses on capacity building, working with project managers, local stakeholders, and producers to identify implementation challenges and create action plans. Currently, the project is transitioning toward extending these environmental and social sustainability goals to other fruit, vegetable, and soft commodity products (Müller 2022; Lüthy 2022).

This case study provides practical insights into challenges and opportunities along the Spanish-Swiss strawberry value chain, particularly in the context of high environmental risks such as drought near the Doñana National Park (World Wildlife Fund España 2024). During five weeks of fieldwork between April and May 2024 in Sevilla, Lepe, and Huelva, Spain, I interviewed MSI partners and actors in the strawberry sector, visiting various berry cultivation sites with different research and commercial purposes.[3] With my fieldwork, I investigated the potential and challenges of such projects in implementing sustainability strategies that address both market demands and environmental risks in agricultural production. Furthermore, I explored the supermarkets' role and the interplay between production networks in Spain and marketing networks in Switzerland, examining how actors perceive their roles and interactions within the system. This immersion provided me with insights into the place-based context of environmental adaptation innovations in strawberry cultivation and their associated successes and challenges.

In the course of my research, the following key insights have become clear. Firstly, the uptake of agronomic innovations is both enabled and constrained by the MSI, by establishing an apriorist requirement of profitability and efficiency in their implementation (both in terms of production and environmental impact management). Secondly, the complex systems of public

[2] For anonymity, this supermarket chain is not mentioned by name in this thesis, and is referred to as the "Swiss supermarket retailer".
[3] Further details about the fieldwork design and execution are given in *Section 4.2* of the methods chapter.

and market governance of the environmental impacts of the strawberry sector in Spain establishes a context in which actors engage in divergent platforms, despite shared goals, reducing coherence and cohesion in the orchestrated effort for a sustainable transition in the strawberry value chain. Lastly, and arguably eminently, the established globalized markets for export-oriented produce in the European Union generate a systematic downwards pressure on price. This pressure is coupled with disincentives for the uptake of investment-intensive innovations for improvements in environmental sustainability in horticultural production. Institutionalized economic barriers hence establish a self-enforcing justification for the formation of protected spaces for targeted stakeholder engagement in the form of investment intensive multi-stakeholder initiatives for environmental and social sustainability in horticultural agri-food systems. In summary, the multi-stakeholder initiative facilitates the uptake of agronomic innovations that lead to an efficient use of natural resources in production through mechanisms of environmental governance. However, the potential of such initiatives to foster an agroecological transformation within the horticultural sector is limited by resilient market and political dynamics and tensions. Through a critical analysis of the results of my empirical qualitative research with expert interviews along the Spanish-Swiss strawberry value chain, I make these findings evident in their discussion, and tie these results into the existing conceptual and theoretical foundations of my research. These insights are valuable for the Economic Geography literature, and more specifically, value chain governance and environmental upgrading, as well as the practical applications of multi-stakeholder initiatives, given the context of recent policies targeting production and food retailing on the transnational, international, national and regional levels.

I structure this thesis in two parts – the foundational chapters, and the empirical research chapters. To begin, in chapter 2 I outline my research questions, aims, and relevance, and the theoretical and conceptual framework that I apply. To follow, in chapter 3 I introduce the case study of the Swiss supermarket-led multi-stakeholder initiative for social and environmental sustainability in Spain's strawberry sector in Huelva, Spain. I present the methodology and research methods that I applied in my data collection and analysis in chapter 4.

Chapter 5 marks the beginning of the presentation of the empirical elements of this research. There, I present the dynamics of environmental risk management and the development and adoption of agronomic innovations for sustainable practices. In Chapter 6 I explore the dialogue of the stakeholders involved both directly and indirectly with the case study MSI, along with an examination of the dynamics of governance between these actors at the regime level. Next, in chapter 7 I engage with the crucial economic and social characteristics that make up the complex systems of the strawberry sector. A common theme of the research results was the critical impact of price premiums for recognition of added value

through environmental and social responsibility in cultivation. Lastly, in chapter 8, I present the main themes that emerged from my empirical research and the groundwork concepts, as well as discuss opportunities for further research.

2. Theoretical Framework and Conceptual Foundations

In this chapter, I present the theoretical foundations and the core concepts for understanding the complex dynamics of the Spanish-Swiss strawberry value chain and the role of multi-stakeholder initiatives in promoting sustainable practices in horticultural production. Firstly, I outline my research questions and objectives, establishing their relevance. Then, I outline the theoretical framework that I contribute to with this thesis project. I begin by exploring global value chain analysis, with a focus on agri-food systems and their governance structures. Subsequently, I examine the concepts which underpin the case study of the Swiss supermarket multi-stakeholder initiative for strawberry production in Huelva, which comprise corporate environmental food regimes, analyzing how sustainability is conceptualized within this framework, and the role of environmental, social and governance factors in business risk management. To follow, I provide a critical analysis of sustainable intensification, highlighting its potentials and limitations in addressing the environmental challenges of horticultural production and fresh produce value chains. Lastly, I prepare a broad summary of the agronomic literature on management strategies and technological innovations for strawberry cultivation. By integrating these concepts into the chosen theoretical framework, I provide a comprehensive overview of the themes that emerge in examining the adoption of agronomic innovations to mitigate the environmental impacts in the Spanish-Swiss strawberry value chain. To follow, I introduce the multi-level perspective (MLP) as a lens for understanding the socio-technical sustainable transitions in food systems, and more specifically, in the Spanish-Swiss strawberry value chain. The MLP serves as an overarching analytical framework through which I interpret my case study, and facilitates an understanding for the development and implementation cycles for agronomic innovations for the sustainable intensification of strawberry production.

2.1 Research Questions, Objectives, and Relevance

In situating my research in the analytical frameworks of global value chain analysis and the multi-level perspective, I highlight the need to understand how solutions to the environmental challenges in industrialized horticultural value chains may establish themselves within a corporate environmental food regime. In particular, I seek an understanding of the development and establishment of these solutions in the context of supermarket-led multi-stakeholder initiatives. Hence, the primary research question which I investigate is as follows:

> ***"What are the potentials and challenges of multi-stakeholder initiatives in supporting the adoption of agronomic innovations to mitigate the environmental impacts of the Spanish-Swiss strawberry value chain?"***

To address the interplaying factors characterizing the context of this matter, I specify the following subordinate questions to effectively add nuance to the primary research question.

1. *How do power relationships between value chain actors within the MSI influence the initiative's capacity to drive the adoption of environmental agronomic innovations?*

2. *How do existing market-based and governmental requirements shape value chain actors' motivations for implementing environmental risk management practices in the value chain, within the framework of the MSI?*

In pursuing answers to these inquiries, I contribute to existing knowledge and literature on food system transformation studies and multi-stakeholder governance spanning the disciplines of economic geography and sustainability management. In my investigation, I employ a qualitative research approach that examines specific causal mechanisms within the case study while contributing to broader theoretical understanding multi-stakeholder governance in sustainable value chains (Gläser and Laudel 2010, 65).

Two main instances shaped and inspired my development of my routes of inquiry in this research project. Firstly, I encountered the Sustainable Agricultural Intensification Pathways for Europe (SIPATH) research project from the Swiss Federal Institute for Forest, Snow and Landscape Research (WSL) while exploring topics on the sustainable transformation of agriculture. The SIPATH project was initiated by Helfenstein et al. (2020) to develop a conceptual framework for the pathways for sustainable intensification in agricultural production. The tradeoff between sustainable alternatives in production and efficiency is a frequent debate in the agri-food literature, and presents a critical point which must be addressed in sustainably transforming our food systems. The researchers of this project from the WSL developed a new conceptual framework of sustainable intensification which recognizes that agricultural system sustainability outcomes are shaped by multiple interconnected factors across spatial and temporal scales. At its core, the framework identifies four main components: first, external forces like global trends, regional contexts, and local conditions shape agricultural systems. Second, internal forces stem from farmers' capabilities and their reasons for decision-making. Third, these forces drive changes in both how intensively land is managed and how the agricultural landscape is structured. Finally, these changes determine not just agricultural output but also broader sustainability outcomes and impacts. The results of the SIPATH research project critically highlighted the need to develop a stronger understanding for the decision-making processes that underpin the adoption of new agronomic innovations and responses to emerging mega-trends (Helfenstein et al. 2020, 174-

9). Furthermore, the authors highlight the need for further exploration of the institutional setting in which these management choices are adopted (180).

Secondly, through my experience interning in the administration of a Swiss food retailer's ecology and social responsibility teams, I gained firsthand insights into the development and implementation of corporate sustainability strategies in agri-food systems. Through my involvement with these initiatives, I learned of the retailer's sustainable strawberries project in Huelva, Spain. As a result of my experiences and learnings during the internship, I was inspired to explore the literature for information about multi-stakeholder initiatives. Specifically, I was curious to understand how such programs generate momentum for agronomic innovations that may contribute to the sustainable intensification of production. In exploring the literature further, I uncovered the prevalence of MSIs targeting the negative social and environmental production outcomes in supermarket value chains (Krishnan, De Marchi and Ponte 2023; Konefal 2015; Beermann et al. 2022; Taskforce on Nature-related Financial Disclosures 2024). The research on the topics of stakeholder relationships in MSIs, sustainable agricultural intensification, and the governance of environmental risk management in value chains respectively is extensive. However, a review of the literature indicated an emergent gap in scholarly inquiry that bridges these three phenomena. This research gap presents the groundwork for the justification of my thesis project.

My primary objective in pursuing this direction of investigation is to provide insights on how MSIs can effectively function as a governance mechanism for environmental improvements in agricultural value chains, using the Spanish-Swiss strawberry industry as a case study. Furthermore, I examine three critical dimensions of the MSI through a comprehensive analysis: governance structures, stakeholder dynamics, and implementation constraints. The analysis of governance evaluates environmental risk management mechanisms, exploring how different governance tools operate within the MSI framework and what motivates stakeholders to adopt environmental practices. The stakeholder analysis maps power relations between groups, examining how their roles influence innovation adoption, and assesses patterns of collaboration and conflict between actors. Finally, the implementation analysis reveals practical challenges, from economic barriers to agronomic innovation adoption to the carrying interpretations of sustainable practices that affect the implementation of the environmental goals of the MSI in value chain operations. Through taking a systematic approach to this exploration, I aim to illuminate both barriers to adoption of new technologies and methods, and identify potential pathways for transformative change towards a more resilient and environmentally sustainable globalized fresh produce industry.

This research offers both theoretical and practical insights into MSIs as tools for environmental risk management in agri-food value chains. In using the Spanish-Swiss

strawberry market as a case study, I examine how MSIs operate at the critical intersection of intensive agriculture and ecological preservation, particularly in Huelva's berry industry adjacent to the crucial wetland ecosystem of the Doñana National Park. Hence, my findings offer a contribution to advancing the theoretical understanding of sustainable value chain governance through MSIs, and may provide practical insights for actors involved in the sustainable transitions which these initiatives seek to facilitate.

Given the multitudinous definitions of the word *sustainability* across disciplines and my frequent use thereof, it is essential that I establish how I conceptualize this term. To do so, I refer to the explanation from Campbell (2009, 314): "sustainability is a quality that emerges dynamically over time as a quality of resilience in social-ecological systems. In other words, social-ecological systems that involve social mechanism of management, and thus can adapt and change in response to critical signals, have the redundancy or resilience to withstand shocks and, as such, are those most likely to survive over the longer term." Here, the need for adaptive management and system-wide resilience is aptly highlighted. Furthermore, it is well suited to my focus on agri-food systems, as it draws attention to goals such as resilience and the synergies between environmental and agricultural systems.

2.2 Institutional and Governance Theories

With my research, I seek to contribute in an interdisciplinary manner to institutional and governance theories, by exploring the development and establishment of sustainability transitions within the global agri-food system. I chose these theories to construct a bookending theoretical framework for my research, which allows for an orientation of the network of interrelated and partially dispersed concepts that I integrate. Institutional theory closely suits my research as it provides a scaffold for understanding the formal and informal norms and rules that define economic performance, and the processes by which these institutions change over time (North 1990). By adopting the institutional lens, I examine the forms of organization of actors, and the purposes of these organizations. I approach governance from the socio-environmental perspective at the core of collective action and common-pool resource theories from Ostrom (1990, 2009), which help to explain the social and natural setting in which these institutions and organizations are embedded. Governance theory offers insights into how actors and institutions interact and carry out decision-making with collective outcomes and how this interaction is coordinated (Ostrom 1990). The overlap between these two theories is aptly integrated into the multi-level perspective, presented by Geels (2004), that establishes a theory of the emergence of institutional change and transitions, as a result of governance within and across organizations at hierarchical and vertical levels of institutional bodies.

By merging the institutional and governance theories and adopting the multi-level perspective, I establish a broader framework that enables my analysis of how sustainability transitions emerge through the interplay of institutions that establish the rules of the game, and the governance dynamics which determine how interactions within and across these institutions and organizations take shape. The multi-stakeholder initiative is a prime example of where this tension manifests. Collaborative value chain initiatives represent a hybrid governance tool that challenge traditional hierarchical coordination in value chains, yet are constrained by institutionalized power asymmetries (Bakker, Rasche and Ponte 2019).

2.3 Global Value Chain Analysis of Strawberry Production

Fresh produce value chains have become increasingly complex and globally interconnected, with sustainability challenges requiring coordinated action across multiple actors and geographies. Global Value Chain (GVC) analysis provides an analytical framework to examine "the full range of activities that firms and workers perform to bring a product or service from its conception to its end use and beyond" (Fernandez-Stark and Gereffi 2019, 54). This framework illuminates how value is created and distributed across different production stages while revealing the mechanisms through which lead firms coordinate sustainability initiatives. In this section, I examine how GVC analysis can enhance our understanding of environmental governance in fresh produce supply chains, using the Spanish-Swiss strawberry trade as a case study. Beginning with core GVC concepts, I explore how the framework's six dimensions create a structure for analyzing sustainability transitions in agricultural production. I then examine specific governance mechanisms in horticultural chains, where lead firms exercise control through various coordination strategies. This foundation enables analysis of governance tools and multi-stakeholder initiatives as mechanisms for environmental upgrading within value chains.

2.3.1 Horticultural Value Chains

Fresh fruit and vegetable (FFV) value chains possess distinct characteristics that shape their operational dynamics and sustainability challenges. These horticultural value chains are characterized by high perishability of products, stringent quality requirements, and the need for precise coordination between actors along the chain (Fernandez-Stark, Bamber and Gereffi 2011, 11). The complexity of FFV chains is further amplified by heavily regulated market access through public and private standards, which makes market entry both challenging and potentially lucrative for producers (Gibbon 2004; Fernandez-Stark, Bamber and Gereffi 2011, 6). However, the distribution of value within these chains tends to favor retailers, who capture a significant share of the economic gains in value generation (Bain 2010; Krishnan, De Marchi and Ponte 2023).

The analysis of global value chains is typically systematically approached through six global and local dimensions: an input-output structure, the geographic scope, the organizational structure, upgrading potential, the local institutional context, and industry stakeholders (Fernandez-Stark and Gereffi, 2019, 55). Within the horticultural value chain, these dimensions are partially broken down into the value adding steps of agricultural inputs, production for export, packing and cold storage, processing, and distribution and marketing (see figure 1 below) (Fernandez-Stark, Bamber and Gereffi 2011, 11). Due to the close interrelationship between agricultural production and the environment, critical social and environmental concerns have emerged regarding water usage, pesticide application, labor conditions, and the overall sustainability of production (Ponte et al. 2023). These characteristics and challenges of FFV value chains highlight the need for effective coordination mechanisms and governance to ensure sustainable practices across the chain.

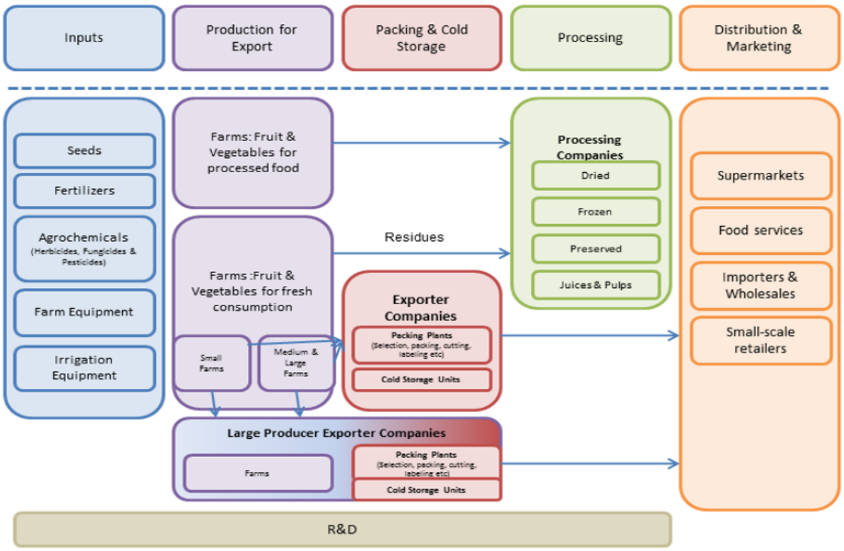

Figure 1. The fruit and vegetables global value chain

Source : Fernandez-Stark, Bamber and Gereffi 2011, 12).

2.3.2 Power and Governance in Horticultural Value Chains

Power in GVCs manifests through actor's ability to control resources, set rules, and influence value distribution. Two dimensions define the dynamics of this distribution: a) structural power, derived from control over critical assets like market access or technologies, and b) relational power, emerging from interactions such as bargaining or collaboration (Gereffi, Humphrey and Sturgeon 2005, 85). These power dynamics manifest through multiple coordination mechanisms, as the buyer-driven character of the value chain leads supermarkets to dictate quality standards, production processes, and pricing (Gibbon 2003, 615). Governance in global value chains in turn encompasses the power relations, coordination mechanisms, and quality conventions that shape how resources and value are distributed among chain actors. These

relations, mechanisms, and conventions vary based on transaction complexity, its codifiability and the capabilities of suppliers (Gereffi, Humphrey and Sturgeon 2005, 90-2).

As horticultural value chains are buyer-driven, their governance manifests primarily in captive governance, where lead firms, such as supermarkets, exercise control over suppliers through strict quality standards and contracts, but also is displayed in modular governance where suppliers adopt voluntary certifications, and relational governance, where collaborative partnerships emerge to collaboratively address sustainability challenges in production (Dolan and Humphrey 2000).These governance structures are characterized by significant power asymmetries between lead firms and suppliers, with supermarkets and large retailers wielding considerable influence over production and distribution practices (Ponte and Gibbon 2005; Konefal, Mascarenhas and Hatanaka 2005; Ponte and Gibbon 2005). While these asymmetries between actors persist, environmental pressures have catalyzed more complex arrangements between them. Lead firms exercise control through what Ponte (2019, 229) terms the ‘sustainability-driven supplier squeeze’, where environmental management becomes the fourth frontier of capitalist organization, alongside cost minimization, flexibility, and speed. Lead firms employ various governance strategies to manage environmental and social risks in their supply chains. These include standard-setting, implementation protocols, and verification systems (Konefal 2015; Lanari et al. 2024). Two primary approaches to governance emerge in this context: compliance-based mechanisms such as certification and audits, and cooperation-based strategies including capacity building and knowledge transfer (Lund-Thomsen 2019; Bain 2010, 16-17). The choice and implementation of these control mechanisms are a reflection of both the lead firm's risk management strategy and their position in the global market.

The evolution in governance structures towards environmental management demonstrates how lead firms increasingly leverage their power to address sustainability challenges while maintaining control over their supply chains (Konefal 2015). The resulting governance framework shapes not only economic relationships but also environmental practices throughout the value chain. The effectiveness of the implementation of these sustainability strategies in driving an environmental transformation of the value chain requires further examination (Lund-Thomsen 2019; Soundararajan and Brown 2016). Current frameworks, however, insufficiently explain how these governance mechanisms translate into environmental improvements at the producer level. Particularly in fresh produce chains, there remains limited understanding of how power asymmetries influence the implementation of sustainable practices (Lanari et al. 2024; Tort, Vayvay and Çobanoğlu 2022). Additionally, private agri-food standards, while increasingly prevalent, often reinforce existing power asymmetries rather than facilitating transformative change (Ransom et al. 2013). Hence, the

effectiveness of these market-driven forms of governance in affecting positive social and environmental outcomes requires critical assessment.

2.3.3 Horizontal and Vertical Governance for Environmental Upgrading

Environmental upgrading (EnvU) in global value chains refers to the processes by which actors improve the environmental impacts of their production systems and practices. This concept encompasses three main types of improvements: in processes (e.g., eco-efficiency strategies like water conservation), in products (e.g., developing environmentally friendly product lines), and organizationally (e.g., adopting sustainability certifications or standards) (De Marchi et al. 2019, 312–13). In horticultural value chains, such as the Spanish-Swiss strawberry trade, environmental upgrading often manifests through supermarket-mandated production standards, export firms implementing eco-certifications, and farmers adopting improved agricultural techniques like precision irrigation (Krishnan, De Marchi, and Ponte 2023, 39). The drivers of EnvU include external pressures (e.g., consumer demands, regulations), lead firm requirements, and internal motivations like cost savings or competitive advantage (De Marchi et al. 2019, 314-6). However, environmental risks—such as water scarcity or soil degradation—are increasingly recognized as critical yet overlooked drivers of upgrading in agricultural contexts (Lanari et al. 2024, 8). The costs and benefits of EnvU are often unevenly distributed, with suppliers bearing the brunt of compliance costs while lead firms capture reputational gains (Krishnan, De Marchi and Ponte 2023, 12). Outcomes also depend heavily on local power dynamics and institutional contexts; for example, smallholder farmers may lack the resources to meet stringent standards, inadvertently shifting environmental risks to other actors or ecosystems (De Marchi et al. 2019, 320; Lanari et al. 2024, 7). These complexities highlight the need for coordinated action across stakeholders, leading to the emergence of multi-stakeholder initiatives (MSIs) as hybrid governance tools.

The governance of EnvU in value chains takes on two primary forms: vertical governance, involving hierarchical structures, such as lead-firms imposing sustainability requirements on suppliers, and horizontal governance, where coordination between actors for a common environmental outcome is facilitated (Krauss and Krishnan 2022; Alexander 2020). The MSI emerges as a platform by which a hybrid of these forms of governance is enacted on value chain actors to encourage the adoption of specific standards and environmental practices in their operations (Bakker, Rasche and Ponte 2019).

2.3.4 Multi-stakeholder Initiatives for Environmental Governance

Multi-stakeholder initiatives (MSIs) take shape as governance mechanisms that bring together diverse stakeholders — including businesses, NGOs, civil society organizations, and occasionally governments — to promote sustainability and responsible practices in value chains, and are frequently focused on global agrifood systems (Bakker, Rasche, and Ponte

2019, 368; Konefal 2015; Hoffelmeyer et al. 2022). Emerging in the early 21st century, MSIs aim to address gaps in state regulation and corporate self-policing by developing standards, metrics, and guidelines for sustainable practices through interdisciplinary collaboration (Cheyns and Riisgaard 2014, 409-10). Unlike traditional governance modes in global value chains (GVCs), which rely on market or hierarchical coordination, MSIs represent an innovative approach characterized by multi-tiered governance structures such as representative councils and participatory consultation processes (Zeyen, Beckmann and Wolters 2016). These structures create new spaces for coordination beyond conventional buyer-supplier relationships, theoretically enabling collective action for environmental improvements. However, MSIs often struggle with power imbalances, as decision-making capacity tends to concentrate among corporate actors and institutional elites, marginalizing smaller producers and local communities (Cheyns and Riisgaard 2014, 415; Bakker, Rasche and Ponte 2019, 360).

These dynamics are reinforced by the self-selection of members — often firms motivated by reputational gains rather than ethical imperatives — and the embeddedness of MSIs in local contexts that replicate existing inequalities (Zeyen, Beckmann and Wolters 2016; Lanari et al. 2024, 4). The development of MSIs typically follows a four-stage model: pioneer member recruitment, initial negotiations, institutionalization-driven external dynamics, and internal dynamics shaped by corporate reputation-seeking (Zeyen, Beckmann and Wolters 2016, 347). While designed to foster egalitarian participation, procedural norms like consensus-based decision-making often prioritize incremental change over transformative action, reflecting corporate interests (342). The success of MSIs hinges on fostering deliberative capacity — defined by inclusiveness, transparency, and accountability — and a collective stakeholder orientation that balances competing logics of market efficiency and sustainability (Soundararajan, Brown, and Wicks 2019, 386-7; Konefal 2015, 621). Conceptualizing MSIs as governance innovations reveals their potential to enable collaborative solutions while highlighting limitations rooted in structural power asymmetries, underscoring the need to transition from symbolic compliance tools to institutions capable of redistributing power and resources (Bakker, Rasche and Ponte 2019, 360; Hoffelmeyer 2022, 405).

2.4 Concepts in Sustainable Food Systems: Governance to Practice

The transition toward a sustainable food systems requires building a comprehensive understanding of the complex interplay between corporate governance mechanisms by supermarkets and agricultural practices. In this section, I examine how different conceptual frameworks — from food regime theory to agronomic innovations — collectively shape environmental sustainability in horticultural value chains. Beginning with food regimes, I establish the socioeconomic context for corporate dominance in agricultural governance. This

foundation aids in explaining the emergence of ESG frameworks as mechanisms for managing environmental risks in value chains. These frameworks are aimed at improving the overall environmental impacts of production through strategic adaptations in production methods. Such adaptations include approaches to the sustainable intensification of production, which attempt to balance productivity gains with environmental protection, and are explored in greater detail in this section. Lastly, I investigate how strategies for SI manifest in specific agronomic innovations for strawberry cultivation. These concepts present the core elements of the research questions that I investigate in this thesis.

2.4.1 Insights of the Corporate Environmentalist Food Regime Epoch

The Corporate Environmental Food Regime (CEFR) represents a complex interplay between environmental activism and corporate power, where large corporate actors in agri-food systems co-opt green narratives through marketing mechanisms, while pursuing conventional productivity and efficiency-motivated agricultural models in their supply chains (McMichael 2021, 225). McMichael (224) characterizes the third food regime as defined by several key tensions and transformations such as a) the deepening contradiction between industrial agriculture and local farming systems, b) the growing concentration of corporate power in the agri-food sector and c) the emergence of new forms of control through digital technologies. In turn, Campbell (2009, 311) suggests that the CEFR is further defined by "wealthy consumption niches, supermarket retail strategy, environmental rhetoric, and complex new forms of audit, inspection, and traceability" which indicate that decision-making regarding sustainability strategies in supply chains is primarily concentrated with corporate powers. These characteristics of the CEFR have significant implications for sustainability initiatives and environmental governance within global value chains, particularly as large corporations increasingly shape markets, technology agendas, and policy frameworks in the global food system (Krishnan, De Marchi and Ponte 2023).

The sustainability strategies of supermarkets primarily manifest in environmental upgrading in supply chains and the implementation of governance mechanisms such as certificates and standards in production in the upstream supply chain (Clapp 2021, 8). Levidow (2018, 21) suggests that the primary motivation in the adoption of sustainability strategies for agri-food corporates is the fulfillment of consumer demands for green products by shifting agro-industrial production methods towards the reduction of negative environmental impacts, the strengthening of commodity relations in production, and the establishment of niche innovations that largely fit and conform to the incumbent regime, yet also have the potential to stretch and transform the contemporary paradigm of our agri-food systems. These strategic developments are aided by the implementation of new technologies and the digitalization of value creation in agricultural commodities. In particular, these digital innovations serve to deepen the control of

the retail sector over commodity chains and act as a new form of value creation through data generation and management (Prause et al. 2020). Furthermore, the growing popularity of climate-smart agriculture and advocacy for sustainable intensification within this regime have been criticized for rebranding agribusiness practices without fundamentally addressing underlying ecological issues (McMichael 2021, 224; Levidow 2018, 21). Hence, a critical analysis of the power dynamics that underpin the CEFR allows valuable insights into the shortcomings of corporate-led sustainability programs such as the Multi-Stakeholder Initiative for sustainable strawberries in Huelva, Spain.

2.4.2 ESG Risk Management Strategies in Agricultural Value Chains

Environmental, Social, and governance (ESG) risk management has emerged as a crucial framework for operationalizing corporate sustainability policies in agri-food value chains. Rather than viewing sustainability as an abstract concept, corporations increasingly conceptualize it a as nexus of risk requiring systematic management approaches (Giannakis and Papadopoulos 2015, 459). The ESG risks management framework distinguishes between endogenous risks arising from company activities and exogenous risks from external environmental interactions, encompassing environmental pollution, waste management, regulatory compliance, and natural hazards (Oliveira, Leiras and Ceryno 2019, 1261). Companies employ scenario analysis and strategic materiality assessments to understand future risks and build resilience, while implementing management strategies through life cycle assessments, traceability systems, and food quality standards (Tort et al. 2022). The effectiveness of such risk management strategies depends heavily on sector collaboration and transparency, particularly in critical sourcing regions facing high environmental risks due to resource scarcity or climate change impacts (Krishnan, De Marchi and Ponte, 2023).

The implementation of ESG risk management faces several critical challenges within the context of industrialized agricultural models and globalized supply chains. While large markets present opportunities for economies of scale, they also introduce complexities in stakeholder competition and sustainable sourcing (Lehtinen 2017). The increasing relevance of non-agrarian activities in food supply chains coupled with projections of doubled global food demand by 2050, necessitates efficient production and distribution infrastructures that balance cost minimization with environmental sustainability (Accorsi et al. 2017). Critics emphasize that certain environmental upgrading strategies may inadvertently increase risks for other actors and potentially decrease overall sustainability improvements (Lanari et al. 2024, 7). This emphasis highlights the importance of integrating both scientific and local knowledge in environmental decision-making, especially in contexts with significant uncertainties and value conflicts (Failing et al. 2007, 49). The complex dynamics of ESG risk management in agricultural in agricultural value chains highlight the need for concrete operational strategies

to achieve sustainability goals, particularly at the farm level, where sustainable intensification has emerged as a key framework for balancing productivity and environmental protection.

2.4.3 Sustainable Intensification Paradigms

As dominant downstream corporations in the agri-food value chain increasingly adopt ESG risk management strategies in their agricultural supply chains, sustainable intensification emerges as a key operational framework for achieving both environmental and productivity goals in primary production. Sustainable intensification (hereafter SI) has emerged as a response to the dual demands of increasing food production and mitigating the environmental impacts of the agri-food system. Pretty and Barucha (2014) define SI as a process by which agricultural yields are enhanced without adverse environmental impacts or the conversion of additional lands. This approach aims to contribute to food security and environmental risk management by integrating agroecological concepts, agronomic methods, and modern technologies (Pretty 2018; Wezel et al. 2015, 5). Notably, Struik and Kuyper (2017, 39) emphasize that SI must allow for context-specific approaches to the environmental and social challenges of agricultural ecosystems, rather than advocating for a predefined set of strategies, which must be applied to all cases. This flexibility fosters synergies between agricultural productivity and ecosystem services (Pretty 2018). In turn, Helfenstein et al. (2020) highlight the socio-political, technological, and environmental mega-trends that frame these synergies, and characterize the diverse pathways for sustainable agricultural intensification (See figure 2, below).

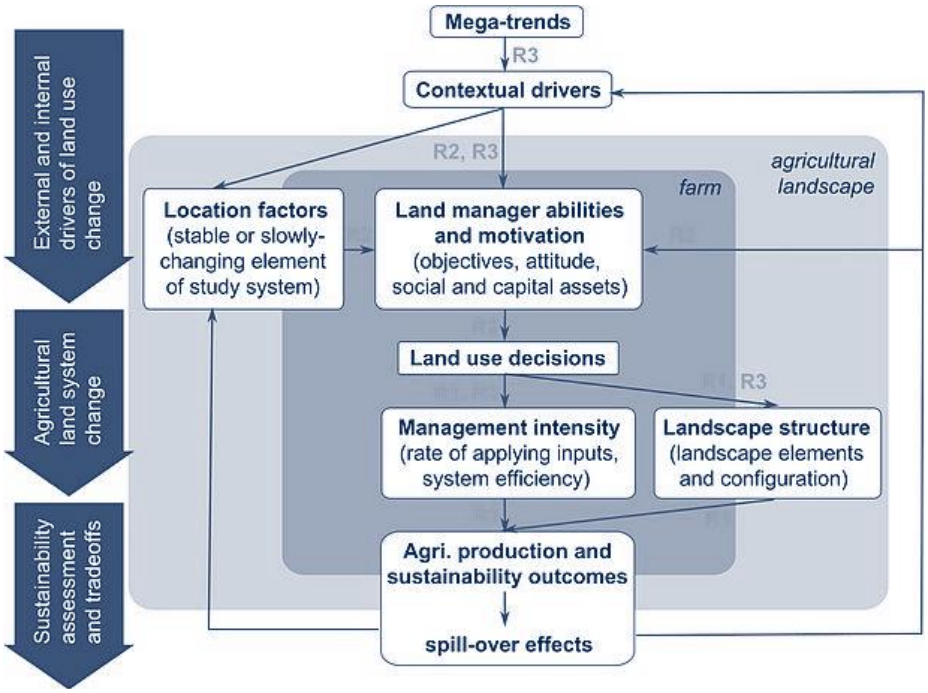

Figure 2. Conceptual framework of sustainable intensification

Source: Helfenstein et al. 2020, 172).

Levidow (2018) suggests that there are two distinctive approaches to SI: the “land sparing” philosophy, arguing for a technology-led increase in productivity per hectare while saving more land area dedicated solely to biodiversity conservation (Tittonell, 2014; Weltin and Hüttel, 2023), and that of the “land sharing” philosophy, where SI is approached from a transformative agroecological paradigm integrating biodiversity measures into the agricultural landscape (Kleijn et al. 2020; Rudel 2020, 9; Phalan et al. 2011). These contrasting approaches to SI highlight the ongoing debate about the most effective strategies for achieving a more sustainable agri-food system (Pretty and Bharucha 2014, 1578). Despite SI’s potential for reforming agricultural systems, it faces significant criticism and discussion of its limitations (Altieri et al. 2017; Struik and Kuyper 2017). Rudel (2020, 126) explains the natural tradeoffs that exist between productivity and environmental conservation, and challenges the simultaneous achievement of both goals. Wezel et al. (2015, 1293) suggest that there is a lack of clarity in the goals of SI, while others argue that SI does not represent a significant departure from conventional agricultural practices and fails to offer a structural reform to the system (Pretty and Bharucha 2014, 1590; Struik and Kuyper 2017, 6). Critically, Helfenstein et al. (2020, 175) suggest that an overdependence on technological solutions for SI is paired with issues of accessibility or suitability to the context of agricultural production.

A sociotechnical transition is critical for the success of SI in generating more sustainable agricultural systems. Levidow (2018, 88) identifies several key innovations driving the agroecological transformation of agri-food systems, including integrated pest management, conservation agriculture and land management, and intercropping. However, this transition extends beyond technological innovations and adoption to encompass fundamental shifts in the social, institutional, and cultural frameworks that shape agricultural practices (Struik and Kuyper, 2017). Participatory approaches, producer knowledge and adaptive management are therefore crucial in developing solutions that are contextually relevant (Altieri et al. 2017, 3). In line with this, is the common theme across SI literature of the importance of social capital in the form of trust in the horizontal and vertical relationships amongst stakeholders (Levidow 2018, 37; Pisante et al. 2012). Lécuyer et al. (2021, 46) suggest that SI calls for a systems approach considering stakeholder interactions in agricultural value chains across scales of influence, emphasizing the need for multi-level strategies in implementing sustainable practices. For such strategies to successfully improve the environmental externalities of agricultural production, they must furthermore be paired with adequate institutional tools and policy support (Helfenstein et al. 2020, 179; Pretty and Bharucha 2014). Thus, while SI offers a promising framework for balancing contemporary productivity goals with the demands of environmental changes in agriculture, its success ultimately depends on the effective

integration of technological innovation, stakeholder collaboration, and supportive institutional structures.

2.4.4 Agronomic Innovations in Strawberry Cultivation

The agronomic literature reveals numerous technological innovations aimed at the sustainable intensification of strawberry cultivation, and possesses a particular relevance to the environmental challenges faced by Huelva's berry sector, which are outlined in section 3.1.1. These innovations span multiple aspects of crop management, including soil quality, water use and efficiency, plant health, genetics, and pest control. Each technological advancement varies in its environmental impact, practical applicability, costs, and potential productivity gains (Hernández-Martínez et al. 2023). Through a basic review of current agronomic research and development, I present how aspects of SI manifest in strawberry production through various technological and methodological innovations.

Water management emerges as the most prevalent area of research in strawberry crop management (Gavilán et al. 2021; Kumar and Dey 2011). As an irrigated crop, strawberries require significant infrastructure for water delivery and nutrient provision through *fertigation*[4] (Gavilán et al. 2021). Additionally, the cultivation of strawberries in regions with abundant sunlight (paired frequently with limited rainfall) renders effective water management strategies crucial. Precision irrigation, irrigation scheduling and deficit irrigation are examples of management strategies to optimize water use efficiency through data-intensive monitoring systems (Martinez-Ferri et al. 2014; Gavilán et al. 2021). Real-time sensor network enable accurate assessment of plant water requirements and precise volume applications at appropriate intervals (Hernández-Martínez et al. 2023). Plant moisture retention, another critical aspect of water management, can be achieved by biodegradable alternatives to traditional polyethylene TIFF film mulching, that offer comparable efficacy, yet adoption barriers due to higher input costs in nascent markets (Costa et al. 2014). While water management innovations require substantial initial investments and technical expertise, long-term benefits include reduced water consumption, maintained crop quality, and decreased operational costs.

Pest management presents another critical challenge in strawberry production, particularly due to the absence of crop rotation systems. The continuous cultivation of strawberries in the same soil leads to nematode proliferation and other soil-borne threats to crop health, traditionally managed with chemical soil fumigation, as is described in section 3.1.1 (Hartz et al. 1993). Three distinct approaches to agronomic innovations for pest

[4] "'Fertigation' is a fusion of two words: 'fertilizer' and 'irrigation.' Fertigation is the process of applying mineral fertilizers to crops along with the irrigation water" (Kant and Kafkafi 2013, 1).

management have emerged, varying in their degree of system transformation: a) replacement technologies such as anaerobic soil disinfestation (ASD) (Hernandez-Martinez et al. 2023; Fennimore et al. 2013; Lopez-Aranda et al. 2016), b) adaptive management strategies such as integrated pest management (IPM) and intercropping (López-Aranda et al., 2016; Hata et al. 2019), and c) system transformation in soilless cultivation in hydroponic tabletop systems (López-Medina 2004; Martinez-Ferri et al. 2014). While ASD offers an alternative pathogen control method through utilizing organic material and plastic tarping to induce anaerobic conditions, techniques such as IPM and intercropping pursue an agroecosystem symbiosis and utilize natural deterrents to avoid crop damages and manage pest populations. In contrast, hydroponic tabletop systems offer a radical departure from traditional cultivation by eliminating pest concerns through environmental isolation and complete system control. Each of these methods present agronomic innovations with varied levels of uptake and acceptance across the berry industry, and offer opportunities for improving the environmental impacts of pest management.

The successful implementation of agronomic innovations depends on effective stakeholder management as well as consensus-building among growers, researchers, policymakers, corporates, and environmental advocates alike (Kalaitzoglou et al. 2021; González-Ramírez et al. 2020). While such innovations offer pathways toward enhanced productivity and environmental sustainability in strawberry cultivation, their adoption involves significant trade-offs between short-term costs and long-term benefits. The complex interplay of technological innovations, stakeholder dynamics, and systemic challenges points to the need for a broader analytical framework, which the Multi-Level Perspective provides for understanding socio-technical transitions towards sustainability in agriculture.

2.5 The Multi-Level Perspective

The approach of sustainable intensification (SI) in agriculture possesses opportunities and challenges for addressing environmental concerns in food production, yet also faces critical challenges. Implementing SI requires a transition in complex sociotechnical systems that involve changes in practices, technologies, and institutional frameworks (El Bilali 2019, 9). To investigate these transitions and their implications for the Spanish-Swiss strawberry value chain, I employ the multi-level perspective (MLP) as an analytical framework. By doing so, I build upon the GVC literature and explore the core concepts of EnvU, CEFR, and SI with the environmental governance of these in sustainable food systems.

The MLP can help to illuminate the complex dynamics between various actors, technologies, and institutional structures in the transition towards more sustainable strawberry production. The value for my research lies in its suitability to a) contextualize agronomic

innovations within broader systemic changes, b) identify potential pathways for transitioning towards more sustainable practices in the strawberry value chain, and c) analyze the interplay between technological innovations and socio-economic factors in sustainability transitions (Geels 2011, 209; El Bilali 2019). By applying the MLP to the Spanish-Swiss strawberry value chain, I identify how SI innovations in strawberry cultivation emerge and develop within niche environments, analyze how existing regimes in the strawberry industry may facilitate or hinder the adoption of these innovations, and examine how landscape pressures create windows of opportunity for sustainable practices. This framework allows for a comprehensive assessment of the potential and challenges of multi-stakeholder initiatives in supporting the adoption of agronomic innovations.

2.5.1 Regime Transitions in Agricultural Systems

The MLP offers a valuable lens for analyzing these transitions by conceptualizing them as non-linear processes resulting from interactions across three analytical levels: niches, socio-technical regimes, and socio-technical landscapes (Geels 2011; Geels and Schot 2007). At the micro-level, niches represent protected spaces where radical innovations originate, such as new agronomic practices or technologies in strawberry cultivation. These innovations, initially unstable and shielded from mainstream market pressures, are developed by smaller network of dedicated actors (Geels and Schot 2007; Vermunt et al. 2020). The meso-level comprises socio-technical regimes, consisting of established practices, rules, and shared beliefs that govern current systems- for example, existing strawberry production methods and supply chain structures. These regimes are maintained by a broad community of scientists, policymakers, and industry actors, stabilizing existing trajectories through cognitive routines, regulations, and sunk investments (Geels and Schot 2007; El Bilali 2019). The macro-level, or socio-technical landscape, encompasses broader contextual factors, for example climate change policies or shifting consumer preferences, that influence both regimes and niches (Geels, 2011; Konefal, 2015). Transitions in agri-food systems hence involve power structures such as the dominance of large agribusiness firms and retailers in shaping agricultural practice and markets, as well as institutional arrangements and government policies that may either help or hinder these transitions (Konefal 2015, 629).

2.5.2 Innovation Adoption Pathways

Ingram et al. (2015) demonstrate how learning networks facilitate knowledge exchange and innovation development within protected niche spaces. These networks prove particularly valuable in horticultural value chains, where technical knowledge and practical experience must be effectively combined to develop actionable sustainable practices. Niche developments occur in protected spaces that shield these innovations from the conventional market selection pressures (Geels and Schot 2007, 400). Multi-stakeholder initiatives can play a crucial role in

niche creation by providing resources, legitimacy and protection for emergent and developing innovations (Konefal 2015, 614; Vermunt et al. 2020). The transition process for the uptake of innovations is characterized by several pathways, such as transformation, reconfiguration, and de-alignment/re-alignment, as outlined by Geels and Schot (2007, 406). In the context of horticulture, these pathways involve an evolution of the existing knowledge base, adjustments to current practices in production, the reconfiguration of production systems, or technological substitutions in the methods and modes of production (Bui et al. 2016; Konefal 2015). Such systemic changes to the regime of conventional contemporary berry production inherently require significant monetary, labor, and time investments. Additional barriers to scaling these innovations at regime level, can include lock-in mechanisms in existing regimes and disconnects in infrastructure, regulations or consumer patterns (Geels 2011, 25).

For this reason, the value of the MSI in creating protected spaces for innovation as outlined by Konefal (2015) is critical in generating incentives to overcome the barriers which these investments present. The MSI enables the establishment of social networks, through which clear visions and expectations can be articulated and the learning process facilitated (Geels 2011, 28). Furthermore, the introduction of landscape pressures such as climate change, biodiversity loss, resource scarcities, and changing socio-economic demographics may create spaces for niche innovations to break through and re-establish the characteristics of the contemporary regime (Konefal, 2015, 613). Hence, the MSI presents a strong opportunity to create the spaces necessary for the uptake of sustainable innovations in response to changing landscape pressures. However, it is presented by

2.5.3 Institutional Change Mechanisms

The transformation of horticultural value chains towards ecological risk management is fundamentally shaped by power relations and the distribution of resources among stakeholders (Konefal 2015). Additionally, the place-based nature of agricultural systems and the public goods character of natural resources such as water and biodiversity add complexity to sustainability transitions in this sector (Vermunt et al. 2020).The capacity of different actors to influence institutional change varies significantly based on their position within the value chain. Lead firms, particularly large retailers, often exercise disproportionate influence in setting sustainability standards and determining price mechanisms for ecological adaptations. These dynamics are shaped by the institutional framework which encompasses formal governance structures, informal power relations, and market mechanisms that determine resource distribution. Changes to this framework occur through policy evolutions in response to ecological risks, market-based incentive structures, and the overall collaborative learning process (Ingram 2015).

The effectiveness of institutional change on the adoption of ecological risk management practices in production is fundamentally shaped by power relations and resource distribution among value chain actors. These dynamics are manifest in the Spanish-Swiss strawberry trade through complex negotiations between producers, exporters, and retailers over sustainability implementation and its economic implications. The transformation process reveals how different stakeholders' agency and capabilities influence both the direction and pace of institutional adaptation, particularly in establishing new governance mechanisms for ecological risk management. However, according to Konefal (2015, 616), these differences in agency and capabilities often results in a channeling of sustainability transitions towards the interests of regime actors, potentially limiting more transformative change.

Despite its robustness, the MLP has faced criticism for its perceived bias towards bottom-up niche-driven changes and under-theorization of power and agency dynamics within transitions (Geels 2011; Konefal 2015). Recent studies suggest that enhancing the analysis of agency and interactions across system boundaries could strengthen the explanatory power of MLP (Pigford et al. 2018). Nonetheless, in the context of this thesis, the MLP provides a valuable framework for examining the complex dynamics of sustainable intensification in the Spanish-Swiss strawberry value chain, offering insights into the potential pathways for transitioning towards more sustainable agricultural practices. Furthermore, the application of the MLP in the context of value chain governance in the case of the onubense berry sector allows for explicit engagement with themes of power through the corporate environmentalist food regime which characterizes the case. In particular, the analytical framework which the provides illuminates how MSIs can facilitate the uptake of sustainable practices in horticultural production.

In this chapter, I established the research questions and objectives which I pursue in this thesis, as well as the relevance of this pursuit. Furthermore, I provided an in-depth contextualization of my research through substantiating the theoretical, conceptual, and analytical frameworks that underpin the research problem which I engage with in this thesis of the effectiveness of the retail-led Multi-stakeholder initiatives in establishing sufficient and effective improvements in the environmental impacts of horticulture, by fostering the uptake of agronomic innovations in production as a sustainable transformation of the globalized agri-food system.

3. Mapping the Strawberry Value Chain

In the following chapter, I provide detailed information on several of the dynamic aspects of the case study, from operations in production and retailing, to characteristics of the transnational market for strawberries. In providing this outline, I foster a deeper understanding of the complex socio-ecological and political systems at play in the Spanish-Swiss strawberry value chain. These insights serve to form the contextual foundational context for my empirical research and fieldwork, during which I pursue an answer to determining the potentials and challenges of multi-stakeholder initiatives in fostering the adoption of environmental agronomic innovations in berry cultivation in Huelva. In this presentation, I address how coordinated multi-stakeholder action can overcome barriers to environmental innovation adoption in international agricultural value chains. To clarify the elaborate relationships and processes across the journey of the berries from Huelva to Switzerland, I present information here on strawberry production in Spain, with particular emphasis on the environmental and economic contexts of the horticultural operations. I then take a broader analytical altitude to examine the dynamics of the imported strawberry market in Switzerland. Building on this context, I provide information on Swiss supermarkets and their sourcing strategies from Huelva. In so doing, I illustrate a bridge between the production context in Spain and the retail environment in Switzerland. Lastly, I offer an in-depth look at the multi-stakeholder initiative led by a Swiss food retailer – the project which serves as the case study of my research. With this comprehensive overview of the case study, I set the stage for the subsequent analysis of the potentials and challenges in adopting agronomic innovations to mitigate environmental impacts in the Spanish-Swiss strawberry value chain.

3.1 The Environmental and Economic Context of Huelva's Berry Sector

Frequently referred to as the *oro rojo,*[5] strawberries and other berry crops such as blueberries and raspberries enjoy an industry that has expanded to encompass significant infrastructure for the operations of the value chain and has established a significant share of the region's agricultural sector. Strawberries, or in Spanish: *fresons* (fragaria x ananassa), were brought to Spain in the 1960s and soon after evolved into the emblematic crop of the region. The "pioneer period" of the strawberry industry that marked the beginning of the rapid expansion of the sector began with Antonio Medina in 1958 and the introduction of Californian strawberry varieties and technologies, such as plastic mulching and drip irrigation (Medina Mínguez 2008, 37). The following years saw rapid expansion of the production area, as well as the development of more sophisticated production systems. Over this period, Huelva became the

[5] Spanish for red gold.

main strawberry producing region of Europe, accounting for approximately 30% of European production (Taskforce on Nature-related Financial Disclosures 2024).

Today, the onubense berry sector continues to demonstrate this leadership and economic significance, despite facing various environmental, social, and operational challenges. These circumstances exemplify the dual challenges of Huelva's strawberry sector: the need to strategically adapt to changing environmental conditions and mitigate negative contributions to these conditions, while maintaining the economic well-being of the region. These challenges are characterized by a number of factors, including the physical geography of the region, land management practices to protect valuable ecological areas, the context of the local economy and market sectors, as well as the governance mechanisms for the local industry.

3.1.1 Physical Geography and Management of Agroecosystems

Berry cultivation thrives in Andalusia's Huelva province, where the coastal terrain and mediterranean climate create ideal growing conditions: hot, dry summers prepare the fields, while mild winters bring essential rain and sunlight for crop development (Márquez Domínguez 2008, 58). However, given shifting patterns in rainfall, rising average temperatures, and increased frequency of extreme weather events, Huelva, along with the other provinces of Andalusia, is particularly impacted by the consequences of climate change (Cano et al. 2019). Average temperatures in Cartaya, Huelva are projected to increase by 1.3 degrees Celsius by 2050, compared to averages between 1961-1990, and average rainfall is expected to decrease by 121.3 millimeters per year for the same time frame comparison (Junta de Andalucía 2025a; 2025b; 2025c; 2025d). In particular, the change in the volume of rainfall poses a significant challenge to the region, as the economically critical agricultural sector has depended upon abundant groundwater and surface water availability to irrigate crops (Márquez Domínguez 2008, 72). The berry sector must now adapt and undergo a reformation to be resistant towards current and future changes in climate and ecological systems that will implicate these optimal growing conditions.

Two river basins are critical to the hydrological systems of Andalusia, and more specifically, Huelva: the Guadalquivir (and its tributary, the Guadiamar) River basin, which feeds the Doñana National Park wetlands, and the Tinto, Odiel, and Piedras basin (51-52). Unprecedented and enduring drought conditions have persisted over the last six years, with the reservoir levels of Andalusia operating at 23% of capacity at a volume of 267 cubic hectometers in 2024 (Consejería de Sostenibilidad, Medio Ambiente y Economía Azul, 2024). As a result of climate warming, the water level in three of the five aquifers located in and around the Doñana wetlands have dropped by up to twenty meters since the 1970s and these aquifers are no longer assessed as operating at good-standing (World Wildlife Fund Spain 2020). The

disruptive impact of the change in water cycles and climate systems on agriculture was exemplified this past campaign season of 2023/24, where significant rainfall late into the season in early May caused unexpected unavailability of the berry crops (Junta de Andalucía-Consejería de Agricultura y Pesca, 2024). However, during the early season of April 2024, significant rainfall helped to contributed to some recovery of the aquifers and water bodies near the Doñana, in contrast to the year before. In figure 3 below, which compares satellite imagery from the 11th of April 2023 to the 11th of April 2024, the result of the increase in precipitation for the region including the Doñana wetlands is made visually apparent (European Union, Copernicus Program, 2024). Nonetheless, scientists warn that trends in the shrinking of the permanent water bodies and the temporary lakes (*mirasmas*) in the Doñana, along with the deterioration of the marshland vegetation, indicate that the National Park is rapidly reaching an irreversible ecological tipping point (Doñana Biological Station 2024). Beyond the current pressures caused by the declining availability and quality of water, other phenomena such as losses in local biodiversity, and changes in soil quality and fertility, pose cascading challenges to the agricultural sector of Andalusia in the long-term.

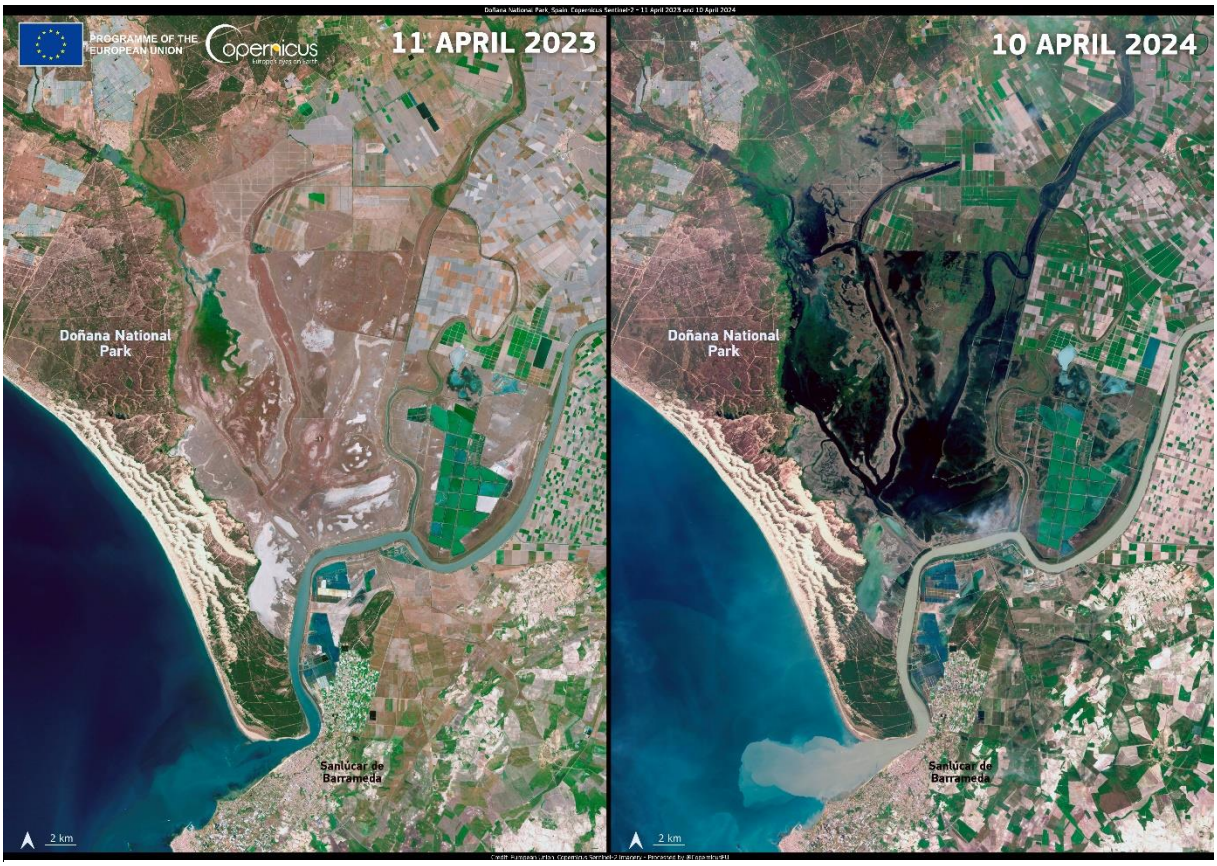

Figure 3. Satellite images of the Doñana Region from 11 April 2023 and 10 April 2024

Source: European Union Copernicus Sentinel 2, 2024.

The effects of minimal rainfall require soil, pest, water, and crop management, each of which come with a set of vectors of influence on environmental parameters. In the context of strawberries grown in the province of Huelva, the core issues that are faced by the sector can

be summarized in the following: the usage of chemical soil fumigation methods to combat the presence of damaging nematodes, fertigation system management to control nutrient levels in irrigation runoff, the widespread use of polyethylene-based plastic films in tunnels and soil mulching, and the fragmentation of valuable ecosystem corridors (López Aranda 2008; López Medin 2008; López-Aranda et al. 2016; López-Medina et al. 2004; Márquez Domínguez 2008). Here, I offer a short summary of each of these issues to facilitate greater clarity into the dynamics of these impacts.

Due to limitations on land and infrastructure availability, berries are typically grown in monocrops on the same allocated fields, season after season. The natural regeneration processes of the soil are not suitable for this type of agriculture, as the demands of the berry plants on the ground's nutrients reduce its overall resilience and health (López Aranda 2008). The continuous intensive use of these plots spawns cascading issues such as nematodes — small worms that often cause destruction to crops by attacking root systems — as well as other soil-borne pathogens thrive under these conditions. In order to combat the growing presence of these pests in the plots dedicated to the berries, producers use chemical-based disinfestation strategies such as soil fumigation, wherein volatile liquid compounds are applied to the soil. For maximum efficacy, these compounds must be highly toxic to a wide range of organisms. Additionally, the chemical properties of these compounds must allow them to rapidly disperse through the soil before volatilizing from a liquid or solid into a gas state. After volatilization, the compounds disrupt the basic and cellular structures of the targeted, and untargeted, organisms in the soil (Chellemi 2014, 456). Prior to the introduction of the Montreal Protocol and EU regulations (1107/2009) on the use of ozone-depleting chemical substances, these fumigant compounds were primarily based on a methyl bromide mixture (López-Aranda et al. 2016). Following the complete phase-out of methyl bromide-based fumigation in 2009, these compounds were based on dichloropropene and chloropicrin mixtures (Leader et al. 2010). Institutions such as the *Instituto Andaluz de Investigación y Formación Agraria, Pesquera, Alimentaria y de la Producción Ecológica*[6] (IFAPA) are tasked with testing new chemical compounds for soil disinfestation purposes that meet the specifications set by EU, national, and regional environmental regulations (IFAPA 2025). The regulation of these chemicals is critical for controlling the ecotoxicological effects in the agroecosystems in which they are applied, and into which they enter through irrigation runoff.

Water management in Spain is characterized by the dual issues of water quality and water availability (Gavilán et al. 2021). As most of the fertilizers and chemical pest management inputs are applied through irrigation systems, these nutrients and chemicals can

[6] English: Institute for Agricultural, Fishing and Ecological Production Research and Training

bioaccumulate into the surrounding environment through agricultural runoff, where managed improperly. Here, critical factors for environmental impacts are the quantity, time-period, and frequency in which these inputs are applied. Where the chemicals enter the surrounding aquatic ecosystems in harmful quantities through improper management practices, hypoxic conditions may occur. These conditions result from the presence of excessive nutrients leading to algal growth and the formation of dead zones, endocrine disruption to organisms in the ecosystem, and habitat degradation through sedimentation and impacts on nutrient cycling (Talavera et al. 2023). The ecological impacts of the application of chemicals in agroecosystems are further compounded by the scarcity of available water, due to persistent drought conditions.

Depending on their geographical position, production is based on either ground water from aquifers, or from surface water of the surrounding rivers (Márquez Domínguez 2008). Due to low availability of water for irrigation, water use is strictly allotted and regulated under the public land and water use management plans described below. The hydrographical association of the Guadalquivir River has placed the limit of water use per hectare at 4’000 cubic meters per hectare, while that of the Tinto, Odiel and Piedras Rivers has placed this allocation at 4’500 cubic meters per hectare. It is estimated that on average one hectare of strawberries requires approximately 7’000 cubic meters of fresh water over one growing season; significantly higher than the proposed new allowance limits (Gavilán et al. 2021; Junta de Andalucía- Consejería de Sostenibilidad y Medio Ambiente 2022). As a result of crop losses through unexpected climatic conditions or pests, some producers face the incentive to produce larger quantities of strawberries than is strictly allowed or allotted within these limits of water availability. Consequently, the WWF Spain estimates that nearly 16% of all berries grown near the Northern Crown of the Doñana are grown using illegal irrigation by utilizing boreholes and other techniques to circumvent the water use regulations and restrictions. Given the already delicate condition of the ecosystem in this area, further exacerbation on the limits of the water will have drastic consequences for the health of the ecosystem (WWF España 2024; Doñana Biological Station 2024).

Strawberry cultivation in Huelva relies heavily on plastic infrastructure for improving water and nutrient management through soil moisture retention (Fennimore et al. 2013). The infrastructure for mulching and polytunnels for season extension consists primarily of polyethylene-based totally impermeable film (TIF). Crop management in tilling and soil compaction from operations leads to the fragmentation of these films, hence releasing microplastics into the soil (Costa et al. 2022). In addition, end-of-life material management remains challenging, as sophisticated infrastructure for either biodegrading or recycling this

high volume of plastics is not yet widely established (European Innovation Partnership for Agricultural Productivity and Sustainability 2021).

3.1.2 Land Management Strategies for the Doñana National Park

Over the past decades, the expansion of Huelva's berry industry has occurred alongside evolving environmental protection measures for the neighboring Doñana wetlands. In 1964, the Spanish government, in collaboration with WWF, acquired 7'000 hectares of land, which gained National Park status in 1969. Today, the protected area spans 54'252 hectares and holds multiple international designations: a Biosphere Reserve, Ramsar Site, and Special Protection Area for migratory birds. Additionally, the Doñana National Park's ecological significance makes it a crucial component of the European Natura 2000 ecological network for preserving habitat connectivity and promoting biodiversity conservation (UNESCO 2024). To balance agricultural development with environmental protection, both the regional and national governments of Andalusia and Spain respectively implemented comprehensive land management frameworks. The *Plan de Ordenacion del Territorio del Ambito de Doñana*[7] of 2003 established the foundational regulatory framework for land use management in the Doñana area, complemented by the *Plan Especial de Ordenacion de las Zonas de Regadio ubicadas al Norte de la Corona Forestal de Doñana*[8] in 2014 (Consejería de Fomento, Articulación del Territorio y Vivienda 2014). This latter plan aims to create a sustainable land use model for urban, peri-urban, and rural areas surrounding Doñana, specifically addressing crop irrigation zones in the municipalities of Almonte, Bonares, Lucena del Puerto, Moguer, and Rociana del Condado in the province of Huelva.

Additionally, the constitution of a Groundwater user's communities (CUMAS) by the Guadalquivir Water Authority allows the creation of an abstraction plan to sustainably manage the water use in and near the Doñana National Park. The established regulatory framework aims to ensure the long-term viability of both agriculture and the ecological health of the Doñana National Park. These plans have been continuously adapted and expanded to reflect the changing demands of the ecosystems which they aim to protect and the economic and social situations in which they are embedded (WWF España 2024). By establishing a framework to manage land use, these plans demonstrate the efforts to balance the economic benefits of the berry industry with the need for sustainable water use and environmental protection in the Doñana area. To better understand how these land management plans are implemented and transform the strawberry sector, it is also necessary to understand the social and economic context of strawberry production in Huelva.

[7] English: Territorial Planning Plan for the Doñana Area
[8] English: Special Planning Plan for the Irrigated Areas located north of the Doñana Forest Crown

Figure 3. Marisma Gallega *(the largest semi-permanent lake) in the Doñana National Park, May 2024. Source: Own Image.*

3.1.3 Economic and Social Significance of Strawberries in Spain

The berry sector represents a cornerstone of Huelva's agricultural economy, generating significant employment and economic value despite recent challenges. While Huelva produces over 97% of all Spanish strawberries and contributes significantly to the region's economic productivity, the sector accounts for a relatively small share of agricultural area at 9% of the total, as can be seen in figure 5 on page 32 (bright pink demarcates greenhouses or plastic tunnels, which are most commonly used for planting berries) (WRAP 2024). The seven main strawberry producing municipalities (ordered by production in hectares) are Moguer, Almonte, Palos de la Frontera, Lepe, Cartaya, Lucena del Puerto, and Isla Cristina. These municipalities have experienced significant population growth since the inception of the modern Spanish strawberry sector in the 1970s, alongside higher economic development and generation of more employment positions. Recent economic challenges facing the sector include rising production costs and market pressures. Input costs have increased substantially, with fertilizer prices nearly doubling alongside significant increases in plastic and energy costs for irrigation. Additionally, the sector faces stagnant or declining market prices, despite production costs rising due to increasing wages, certification requirements, and necessary infrastructural adaptations (Gobierno de España- Ministerio de Agricultura, Pesca y Alimentación 2024). The industry's heavy reliance on export markets, particularly Germany and the United Kingdom as primary destinations, makes it vulnerable to market fluctuations and international competition. Despite these challenges, the sector remains largely resilient, adapting through diversification.

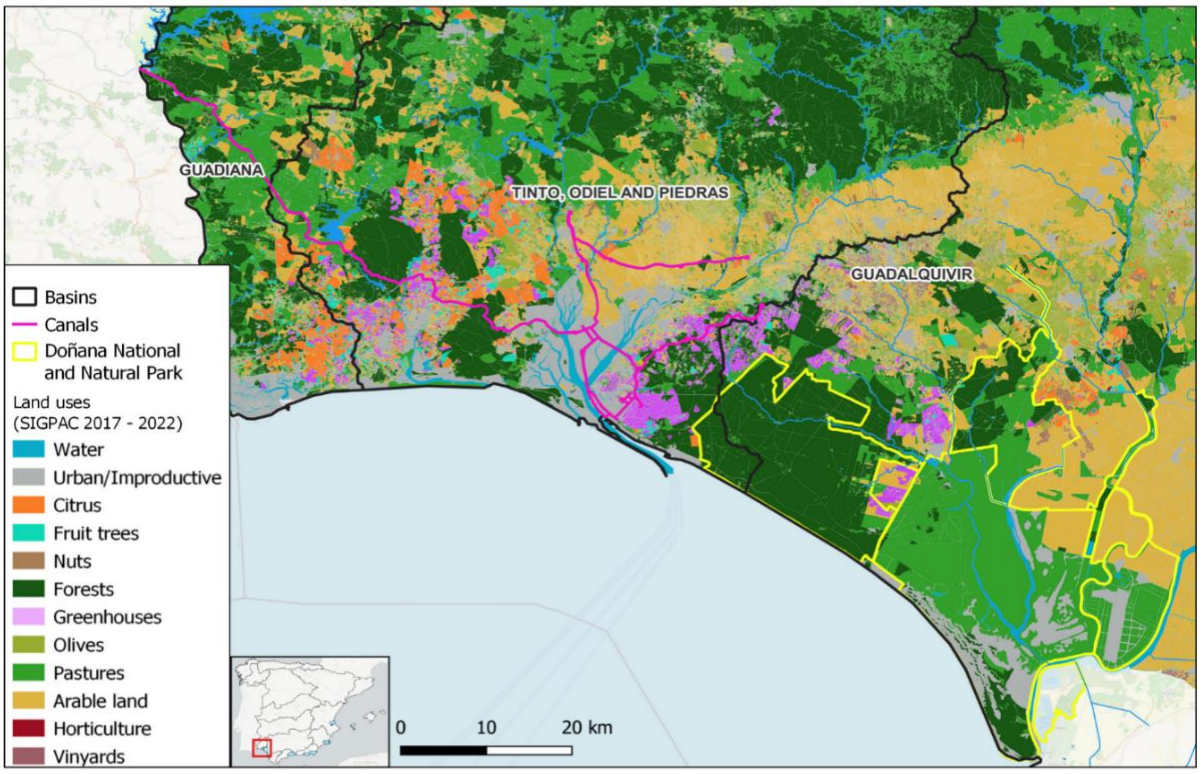

Figure 4. Land use categorization in the province of Huelva, 2017-2022.
Source: WRAP 2024

In the 2023/24 campaign, 6'470, 1'540, and 4'520 hectares of strawberries, raspberries, and blueberries respectively were planted, with a total production of 310'560, 29'260, and 57'256 tons of each crop. For strawberries, while there has been a decrease of 4.5% of the total area planted compared to the 2022/23 campaign, total production for 2023/24 only decreased by 1.8%. compared to the previous season, indicating increased production per hectar area (Gobernimiento de España 2024). By contrast, the volume of exported strawberries for the 2023/24 campaign was 204'018 tons, a 1% increase from the previous season, with a total economic value of €607'955.00 - representing a 9% increase. This increase is in despite of the 2023/24 campaign being effected by delayed strawberry planting was delayed due to unfavorable weather conditions, as a result of drought and cuts in irrigation provisions at the beginning of 2024. Later in the season, the volumes of marketed strawberries and raspberries suffered significant declines due to overly abundant rain. Consequently, the campaign season was lengthened to recover the for lost volumes (Junta de Andalucía, 2024). Despite these challenges in production in the 2023/24 campaign, the berry sector has remained a crucial economic driver in the region.

Overall, the berry sector is responsible for the creation of approximately 100'000 direct jobs, in various functions throughout the operations of value chain from production in Huelva to the export of the berries to European markets. Even more significant is the hidden numbers

of the GDP creation and job growth (ca 60'000 individuals employed indirectly indirectly by the sector) that has occurred in indirect relation to the strawberry sector. The labor-intensive nature of berry cultivation necessitates substantial seasonal workforce recruitment, with around 120'000 workers needed during the entire campaign (Interfresa 2023). There is a clear divide between the characteristics of the laborers in the packhouses, who are primarily Spanish citizens, and the laborers in the fields, who are typically from Northern Africa or Eastern Europe and are employed seasonally. Specific policies are in place to regulate seasonal labor, with agreements with the countries where the laborers are coming from. However, issues of illegal immigration and labor persist, along with poor labor conditions. Reports from 2024 indicate that for migrant workers, labor shortages and challenging working conditions remain of significant concern (FEPEX 2024). While these social issues are a critical element of industry in Huelva, they are not the core focus of my research. However, I explore aspects of the social dimension of the sustainability of the sector where they are critical for understanding the phenomena which I investigate.

The economic significance and social complexities of the sector have led producers to organize collectively to address shared challenges and opportunities. To represent their shared economic interests, several key organizations for the berry producers have emerged in the region. UPA Huelva, the smallholder farmer's association, primarily functions as a non-crop specific lobby group for the concerns of local farmers at the regional, national, and sometimes international levels. For example, in response to the rising competition from Morocco and recent health safety concerns with the foreign products, UPA Huelva lanced a campaign to position the onubense berries as a premium product with superior quality in terms of safety, flavor, and sustainability for European markets (UPA Andalucía 2024). By contrast, Interfresa and Freshuelva are both organizations focused on the berry sector. The interprofessional association for berry growers, Interfresa focuses on promoting sector-wide cooperation while providing a platform for quality improvement and environmental and social standard implementation (Interfresa 2024). Freshuelva plays a crucial role in representing the sector before public administrations, international producers, media, and other stakeholders. The organization manages research collaborations, finances innovative projects, and oversees the *Producción Integrada de Fresas de Andalucía* certification (Freshuelva 2024). These organizations additionally support producers in acquiring training and materials for various certification programs.

3.1.4 Production Certifications for Social and Ecological Practices

Given the significant environmental and social concerns associated with berry cultivation in Huelva, producers are practically required to obtain an array of certifications to communicate to other value chain actors, particularly retailers, that their products are compliant with

measures to reduce these environmental and social risks. Such certifications are partly publicly and partly privately managed. According to reports from the government of Andalucía, the majority of berry producers are certified with the *Producción Integrada*, (Integrated Production) certificate. Moreover, 5'340 ha of strawberry production, 1'447 ha of raspberry production, and 6'247 ha of other berry crops are under organic (biologica) production (Gobierno de España-Ministerio de Agricultura, Pesca y Alimentación, 2024). In terms of environmental risk management, certifications from GLBOAL G.A.P., the agency for good agricultural practices, serve as the foundational standard, with 672 strawberry producers in Spain certified under their Integrated Farm Assurance (IFA) standard (FoodPLUS GmbH 2024). This basic certification can be enhanced through specific add-ons, such as the Biodiversity Add-On certificate, and the Sustainable Program for Irrigation and Groundwater Use (SPRING) — launched in 2023, and focused on water risk assessment, legal compliance, and sustainable water resource management. This certification has been obtained by 61% of the IFA certified berry producers in Huelva. GLOBAL G.A.P. additionally conducts audits on its GRASP (Risk Assessment on Social Practice) module for social and labor standards certification. Further information on the GLOBAL G.A.P. certifications is given in the empirical discussion of governance in horticultural value chains in section 5.2.2 (FoodPLUS GmbH 2024).

The complex interplay of environmental challenges, economic significance, and regulatory frameworks in Spain's strawberry sector directly influences its opportunities in international markets and the sector's interactions with these. The following section examines the regulatory and market framework of the Swiss context as the destination for Huelva's berries, as well as the sourcing and sustainability strategies of the Swiss supermarkets where the strawberries are sold.

3.2 The Swiss Strawberry Market

An understanding of the financial flows and trade dynamics of Spanish strawberry imports to Switzerland, as well as the broader context of the Swiss strawberry retail market, is critical for comprehending the scale and relevance of this case study. These dynamics shape the motivations and decision-making of stakeholders at each level - from the public sector policies to private sector operations within the strawberry value chain, particularly in production and retailing. It is important to note, that the Swiss market for strawberries is composed of three principal channels: retail (supermarkets), direct sales (farm shops and wet markets), and the hospitality sector (HoReCa). For the purpose of answering the research questions which I put forth in section 2.1, I am primarily concerned with strawberries imported from Spain and sold through the retail (supermarket) channel (Kuhlgatz 2024).

3.2.1 Market Dynamics, Trade Relationships, and Regulations

The Swiss strawberry market operates within a carefully regulated framework designed to balance domestic production with import needs throughout the year. Switzerland covers nearly half of domestic demand with ca 491 hectares of strawberry fields, producing between 7'000 to 7'700 tons annually (Meyer 2024). To fulfill the other half of domestic demand, Switzerland employs a dual-phase import system. During the 'free' phase (between September 1st and May 14th), the EU benefits from a preferential import quota of 10 million kg of strawberries with zero tariffs. This period coincides with minimal domestic production. Notably, there is no quantity restriction on strawberries imported from developing countries and nations with free trade agreements (such as Morocco and Israel). During the 'managed phase' (from May 15th to August 31st), imports of strawberries from the EU is limited to 200 tons, with protective tariffs of up to 510 CHF/100kg for excess import quantities (Bundesamt für Zoll und Grenzsicherheit 2024). In addition to functioning as a trade measure for protecting domestic production from the influence of foreign pricing trends, this quota serves to stabilize trends in strawberry imports. The quota has been consistently fulfilled or nearly fulfilled each year. This quota system is at the foundation of the context for broader market dynamics and trade flows of strawberries in Switzerland.

Within this regulated trade framework, the Swiss strawberry market demonstrates distinct patterns in imports, pricing, and demand. The market for strawberries in Switzerland is characterized by a significant reliance on imports to meet consumer demands, especially during the off-season period. In 2022, strawberry imports for HoReCa amounted to 9'428 tons at an average price of 4.21 CHF/kg, representing a 4% decrease in volume and a 1% decrease in price compared to the previous year. Strawberries (combined domestic and imported) enjoy a strong position in the Swiss fruit retail market, with a total revenue of 124 million CHF (3rd highest fruit) and a retail sales volume of 14'300 (10th highest fruit) (Kuhlgatz 2023).

According to reporting from the government of Spain and the Data Comex of foreign trade statistics on goods in Spain and the EU, exports from Spain to Switzerland of strawberries amounted to 1'508 tons for the 2023/24 campaign (Gobierno de España 2024). However, this is not congruent with other data, as for one Swiss supermarket retailer alone, 35% of the ca. 5'500 tons of strawberries that they sell annually are sourced from Spain, amounting to ca. 1'925 tons (Wuthrich 2024). This quantity also does not account for sales of imported strawberries through other retail channels. Although exports to Switzerland constitute a relatively small share of Spain's berry sector, the Swiss market holds particular significance for onubense producers due to Swiss consumers' higher willingness to pay for premium products and their elevated demands for sustainability. This unique market characteristic

makes it essential to understand the role of Swiss food retailers in bridging the journey of berries from Spanish producers to Swiss consumers.

3.2.2 Fresh Fruit and Vegetable Sourcing

Power in the global value chains of fruits and vegetables has been marked by a transformative shift to be concentrated with supermarkets, marked by their market dominance as the key outlet for food retailing and direct interaction with consumers (McMichael 2021, 219). This transformation has positioned Swiss supermarkets as key decision-makers in determining not only what products reach consumers, but also how these products are sourced, processed and delivered through increasingly complex global value chains. However, as a result of this direct relationship with consumers, they also face greater public scrutiny regarding their impacts and influence on the environmental and social sustainability of their supply chains (Krishnan, De Marchi and Ponte 2023). To understand how Swiss supermarkets navigate these responsibilities, particularly in the context of fresh produce sourcing from critical ecological regions like Huelva, I examine three crucial aspects of their operations in this section- namely, their fresh fruit and vegetable sourcing, the sustainability strategies and the motivations behind these, and lastly, the regulatory context that shapes the risk management practices of the supermarket of my case study.

Swiss supermarkets face a multi-faceted challenge in meeting consumer demand for fresh fruits year-round that fulfills a variety of health, sensory, and sustainability related quality criteria (Medienstelle MGB 2019; Fernandez-Stark, Bamber and Gereffi 2011). The procurement and category management teams justify foreign sourcing strategies with the necessity to fulfill diverse preferences and needs, characterized in large part by health considerations and consumer preferences. The sourcing process for all fresh fruit and vegetables (of both domestic and foreign origin) involves multiple internal stakeholders, including procurement teams, category managers, and quality control specialists (Gibbon 2003). These teams work to identify and establish relationships with international suppliers who can meet the supermarket's stringent criteria for the sourced goods. These quality criteria include aspects such as appearance, taste, shelf life, pesticide residue limits, and compliance with social and environmental standards. Additionally, the sourcing process must navigate logistical challenges to ensure the timely delivery of perishable goods, often involving complex supply chains and road, sea, or air freight for out-of-season produce (Fernandez-Stark, Bamber and Gereffi 2011). This intricate sourcing strategy reflects the supermarkets' efforts to balance consumer expectations, regulatory compliance, and corporate sustainability goals within the global agri-food value chain.

3.2.3 Supermarket's Motivations and Strategies for Sustainability

Supermarkets typically organize their sustainability strategies through a comprehensive framework that encompasses environmental, social and governance (ESG) dimensions in the vectors of their direct operations in what is referred to as Scope 1, their indirect operations (Scope 2) and the impacts of their supply chains and related markets (Scope 3). These strategies are generally structured around key focus areas including supply chain management, waste reduction, energy efficiency, and sustainable sourcing practices (Krishnan, De Marchi and Ponte 2023; Konefal, Mascarenhas and Hatanaka 2005). In the Swiss context, the primary food retailers have developed robust sustainability frameworks, driven by both stringent regulatory requirements and heightened consumer awareness of environmental and social issues (Gavilano 2023).

In order to manage the complexity of maintaining oversight over these impacts, retailers and organizations are increasingly employing sophisticated and dynamic risk management approaches. The approaches balance reputational and regulatory risks with ESG risks in their supply chains that relate to the targets of their sustainability strategies. They employ this approach to risk management in conjunction with ESG risk assessment tools, which use monitoring software and algorithms to provide insights into specific commodities and sourcing regions. Such monitoring tools enable retailers to conduct risk analysis in greater detail across their supply chains and identify significant social and environmental risks in a targeted, efficient, and effective manner (Ofodile 2023). Given resource constraints, retailers make prioritizations in the projects that they initiate, leading to a focus on high-impact areas and 'lighthouse' issues — specific challenges that require targeted attention and efforts, and the results of which pioneer new strategies and approaches to sustainability throughout the retailer's operations.

The Swiss supermarket retailer's multi-stakeholder initiative for sustainable strawberries, that is the case study of my thesis, exemplifies this approach of a multi-tiered sustainability strategy that combines corporate-level commitments with specific commodity-focused initiatives. Such a framework enables the integration of sustainability considerations into core business operations — from procurement policies, to store management, while placing a core focus on supply chain transparency and responsible sourcing practices. Hence, sourcing decisions and supplier relationships are directly influenced by the sustainability strategies outlined by the company.

3.2.4 Risk Management and Regulatory Framework of Food Retailing

The regulatory landscape affecting the operations of Swiss supermarkets is multi-layered and complex. While Switzerland is not a member of the European Union (EU), EU regulations significantly influence Swiss retail practices due to the embeddedness of Swiss markets in the

EU context — the EU accounts for 59% of Switzerland's trade volume, making it the country's largest trading partner. This influence is particularly evident in the food retail sector, where EU regulations on food safety, quality, and environmental standards create a de facto framework that Swiss retailers must consider in their operations (Staatssekretariat EDA 2024; Gavilano 2023). Recent developments in EU legislation, particularly the Corporate Sustainability Due Diligence Directive (CSDDD) and the EU Deforestation Regulation (EUDR), are reshaping the ESG risk management landscape in the agri-food sector. While Switzerland's current regulations are less stringent, focusing primarily on reporting requirements for child labor and conflict minerals, Swiss companies operating in the EU market (with turnover exceeding €150 million) will be subject to these new EU requirements (Meyer et al. 2023). The Swiss government has indicated it will analyze how EU member states implement these directives before deciding on potential domestic regulatory alignment.

The intersection of these regulatory requirements with market demands and stakeholder expectations creates a complex operating environment for Swiss supermarkets. While Swiss domestic regulations primarily focus on food safety and quality standards, environmental and social responsibility requirements increasingly come from market pressures and voluntary commitments rather than direct regulation. Swiss retailers typically respond through a combination of compliance measures, voluntary standards, and capacity-building initiatives to address both current and anticipated challenges in their supply chains (Gavilano 2023). This approach is particularly evident in strawberry sourcing, where environmental and social concerns have prompted the development of specific risk management strategies and multi-stakeholder initiatives, as described in the following section.

3.3 Multi-stakeholder initiatives for Sustainable Strawberries

Multi-stakeholder initiatives (MSIs) are collaborative mechanisms that bring together diverse stakeholders to address sustainability challenges that are too complex for individual actors to effectively address in isolation (Zeyen et al. 2016, 342). These initiatives provide platforms for stakeholders to collectively tackle economic, social and environmental issues with greater effectiveness than when addressed by a single group of actors. In the agricultural sector, MSIs typically involve producers and their associations, packers, processors, exporters, importers, distributors, retailers, as well as governments, worker unions, civil society organizations and other such communities (Beermann, Freund and Fuentelsaz 2022; Hoffelmeyer et al. 2022). In this section I examine the landscape of water management initiatives in Huelva, analyze a specific Swiss retailer's sustainable strawberry project, and discuss how these initiatives operate within interconnected systems to achieve environmental and social improvements in the sector.

3.3.1 Landscape of Initiatives for Water Management in Huelva

A variety of platforms exist in the region that primarily address the environmental concerns of water management in the berry sector in Huelva, exemplifying the centrality and prominence of this issue. The SAI Platform's Doñana Berry Sustainability Project, initiated in 2013, brought together berry producers, private sector suppliers, buyers, retailers, and conservation organizations like WWF Spain to generate solutions to the water sustainability challenges faced by the sector (Edwards 2020). This initiative was extended by the FerDoñana project in 2016, which aimed to reduce water pollution risk, prevent the decline of local aquifers and improve the profitability and resilience of the berry sector through shared training and a knowledge exchange platform on water management practices. FerDoñana since became the Life4Doñana Project, and is supported by the European Union. Life4Doñana ran from 2020 until 2024 and supported the implementation of on-demand decision support systems (DSS) for efficient irrigation and nutrient provision in soil-based cultivation of strawberries in Huelva through knowledge and expertise sharing, (Life4Doñana 2024). More recently, the Alliance for Water Stewardship (AWS) initiated one of their Impact Accelerator programs in the region, supported by major European food retailers and the UK-based initiative Waste and Resources Action Programme (WRAP) (Alliance for Water Stewardship 2024). In parallel, Good Stuff International (GSI), in collaboration with the Sustainable Initiative for Fruits and Vegetables (SIFAV), launched a water stewardship project in 2021 focusing on improving water governance and reducing illegal water use (Good Stuff International 2023). These initiatives are endorsed by key regional stakeholders such as Interfresa, Freshuelva, and the WWF Spain, and primarily involve major European supermarket retailers along with the largest local export-oriented berry cooperatives, who each recognize the need for collective action to address water management challenges in their supply chains (TNFD 2024). The proliferation of these platforms demonstrates the criticality of sustainable water management in the region and the recognition of international retailers addressing these challenges through collaborative approaches. However, the challenges which the berry sector faces are more dynamic and multi-faceted than a reductive focus on only water will allow.

3.3.2 Swiss Supermarket Project Overview

While these collective initiatives have made important contributions to addressing water management challenges, individual retailers have also developed their own targeted approaches to address the broader spectrum of sustainability challenges in the region. The Swiss supermarket retailer, which is used as the primary case study of this thesis, developed their own multi-stakeholder initiative, which was titled the Sustainable Strawberries Project. This project was lanced initially in partnership with the WWF Switzerland and encompassed 74 distinct measures concerned with water management, pesticide reduction, soil

management, and social initiatives. Internally, the retailer's commercial department works closely with the sustainability team to integrate these requirements into supplier agreements and procurement processes, while maintaining the necessary volume and quality standards for the strawberries sourced from Spain (Medienstelle MGB 2019).

The implementation of this sustainability initiative relies on a network of stakeholders to foster collaboration and sharing of insights, knowledge, and best practices. On the production side of the value chain, strawberry growers are typically organized in cooperatives that mirror the organizational structure of the supermarket with dedicated sustainability and/or quality management and commercial departments. External certification bodies and consultants who conduct specific audits and help the producers to develop targeted action plans to meet the measures outlined by the project. Additionally, to manage the documentation and monitoring requirements effectively, the retailer works with dedicated logistics partners who coordinate between the Spanish producers and the Swiss retailer, and ensure that import requirements regarding food safety, quality and sustainability criteria are met through establishing traceability and certifications throughout the upstream value chain operations (Medienstelle MGB 2019; TNFD 2024). This multi-stakeholder approach has enabled the project to achieve crucial impacts in the areas of social and environmental sustainability of the berry sector in Huelva, as demonstrated by the implementation of water-saving technologies and social practice improvements across their supplier base in the Huelva region.

In this case study, I examined the characteristics that underpin the potentials and challenges of MSI for cultivating agronomic innovations for ecological risk management in berry horticulture. I have sought to impart a detailed and thorough understanding of the economic, social, and environmental contexts of berry cultivation along the value chain- from production in Spain to retailing in Switzerland. In the following chapter, I illustrate the methodology and the methods that I applied in my data collection and analysis, for which I conducted fieldwork where I investigated the case presented here in greater detail.

4. Research Methodology and Applied Methods

In the context of answering the research questions that I put forth in this thesis, I conducted fieldwork in Switzerland and Spain in English, German, and Spanish. The fieldwork consisted of semi-structured in-depth interviews with experts in the strawberry value chain, and the Spanish-Swiss food system within which it is embedded (Adams 2015; Bogner, Littig and Menz 2014b; Gläser and Laudel 2010). In addition, I visited production sites to generate added depth of insight to my research (Phillippi and Lauderdale 2018). I prepared and analyzed the data produced by these interviews and field visits using a combined grounded theory coding method and inductive theory building category construction, according to the methods outlined by Kuckartz (2018). My research design is founded in critical constructivism, which enables an examination of how knowledge is constructed within specific social, cultural, and historical contexts, while also encouraging a critical analysis of power structures and dominant discourses (Kincheloe 2005). This epistemological approach aligns with empirical research methods that investigate issues from a new angle in literature and offer the opportunity to investigate specific segments of the social world to further develop theories (Gläser and Laudel 2010, 24). A qualitative, inductive, theory generating approach to empirical research allows for identifying causal mechanisms and their effects (26). The research objective of this thesis — generating a deeper understanding of multi-stakeholder initiatives for environmental risk management in fresh fruit value chains — implies that a qualitative empirical epistemology is best suited to answer the research questions. The following sections outline the research design, methods for data collection, ethical and methodological challenges, methods for data processing, and explains the standards for the assessment of the obtained results.

4.1 Research Paradigm, Ontology, Epistemology and Methodology

Empirical research in social sciences aims to investigate and understand social phenomena through systematic observation and analysis. As Diekmann (2022, 19) notes, empirical social research involves the systematic collection and interpretation of data to test hypotheses or generate new theories about social reality. This approach allows researcher to draw connections between theoretical concepts and observable situations that allow richer insights into complex social dynamics. As a part of this research project, I conducted empirical research and primarily employed a combined interpretive and constructivist paradigm to explore the subjective meanings, perceptions, and complexities of stakeholders involved in the supermarket-led sustainability initiative for strawberries from the Huelva region. Guba (1990) describes the constructivist paradigm as following an ontology of relativism- that reality is constructed and co-constructed by individuals and accounts for the local context. The epistemology of this research approach is subjectivist, implying that the research findings are co-constructed by both the research participants and the researcher. This allows for a

hermeneutical and dialectic methodology, which fosters interpretation through a continuous process of understanding and engagement with the narratives of the research participants (27). Moreover, as I also seek to build a conceptual framework that questions and uncovers existing power dynamics within the strawberry value chain, this research is partially grounded in the research paradigm of critical theory. A core aim of critical research is to critique and transform social and political structures (Lincoln, Lynham and Guba 2024, 77). However, while I seek to critically analyze these social and political structures in the strawberry value chain, my research aims do not explicitly include a transformative agenda.

Given these considerations to the research paradigm, I chose to apply the *critical constructivist* approach presented by Kincheloe which draws on critical theory and offers a refined emphasis on the influence of political and cultural power in the construction of knowledge and realities (Kincheloe 2005, 33). This approach allows for a nuanced examination of how knowledge is constructed within specific social, cultural, and historical contexts, while also encouraging a critical analysis of power structures and dominant discourses. Hence, the critical constructivist paradigm and the associated ontology, epistemology, and methodologies are congruent with the research aims and case study that I put forth in this thesis. In particular, the aim to examine the emergence of sustainable innovations as a result of place-based stakeholder networks aligns with the view of constructivism that knowledge and meaning are constructed through social interaction in particular contexts. Furthermore, the critical approach to constructivism supports an investigation of power in the strawberry value chain, particularly the roles of supermarkets and stakeholder networks in multi-stakeholder initiatives.

To operationalize this approach, I employed a *grounded theory* methodology, which seeks to generate theory data through an iterative process of data collection, analysis and theory development, rather than starting with a predetermined hypothesis. Grounded theory is well suited to my research design and data collection and analysis, as it is epistemologically compatible with inductive category construction and content analysis, due to their shared inductive logic (Kuckartz and Rädiker 2022, 133; Glaser and Strauss 2017, 237). Furthermore, it aims to generate theory that closely fits the substantive area, is understandable, sufficiently general, and allows the user partial control over the structure and process of daily situations as they change through time (Glaser and Strauss 2017, 3). However, this approach does not specifically address other existing theories, nor issues of researcher bias or assumptions. For this reason, I choose to use the *constructivist grounded theory* (CGT) approach, as developed by Charmaz (2012). CGT acknowledges the researcher's role in constructing and interpreting data, aligning with the critical constructivist paradigm that I have applied. This approach to grounded theory allows for a more reflexive and interpretive analysis of the data (Charmaz 2012, 131). In the following sections, I explain the methods of data collection and analysis that

I employed in this thesis, demonstrating how they are aligned with my chosen research paradigm and methodology.

4.2 Data Collection With Semi-Structured In-Depth Expert Interviews

One of the core aims of this research is to uncover the complex normative values and decision-making frameworks underpinning the actions and pathways chosen by the stakeholders of the sustainable strawberry project of the Swiss supermarket food retailer. To achieve this, I employed semi-structured in-depth expert interviews as the primary data collection method. Gläser and Laudel (2010) qualify that all individuals have expert knowledge within their own field of experiences. This kind of experiential knowledge of the social contexts that each person acts within offers deeper insight to qualitative research on organizations. The diverse perspectives and observations provided by each interviewee contribute to a more comprehensive and nuanced understanding of the dynamics being investigated (13). The semi-structured in-depth interview method is best suited for gaining insights into these aspects of each stakeholder's role in the value chain and the MSI (Adams 2015, 494; Bogner and Menz 2002, 7). This approach allows for the exploration of the thoughts of the interview partner through probing, open-ended questions. In the following section, I explain the processes of selecting interview partners, designing the interview guide and critically reflecting on my data collection methods.

4.2.1 Selection of Interview Partners and Access to the Field

In applying the case study of the Swiss food retailer's multi-stakeholder project to answer the research questions which I put forth in this thesis, I effectively defined a group of experts to include in my research (Pfadenhauer 2002, 124). I conceptualized this group as referring to stakeholders who are formally involved in the *sustainable strawberries* project, as well as stakeholders who are involved in similar projects and initiatives, or are involved in the sector in Switzerland or in Spain in the functions of producers, traders/exporters/importers, consultants, non-governmental organizations, and governmental functions at the local, regional, national, and international levels (see figure 6 on page 45).

In order to identify these stakeholder groups, I searched for these actors based on the stakeholder roles in *global value chains*, as they are defined by Fernandez-Stark and Gereffi (2019). I conducted this search partly through my own network that I had established through an internship with the sustainability department of the Swiss food retailer, as well as through reviewing fruit industry periodicals from the Huelva region. In so doing, I identified the key stakeholders with functions that would be critical to the issues addressed in my research and searched for ways to reach these actors. I conducted my outreach primarily through e-mails, LinkedIn, or personal inquiries throughout my network. Furthermore, I employed the

snowballing method, which entailed asking interview partners following each interview if they would have further contacts that they could connect me with, who would be potentially useful for my research (Meuser and Nagel 2002, 269). In selecting stakeholders to contact, I chose to limit the scope of my focus to actors who are engaged directly, and partially indirectly, with the primary decision-making process for the operations of sustainability strategies in the value chain (Pfadenhauer 2002, 116). For this reason, as well as due to my limited Spanish communication skills, farm laborers were excluded as interview partners. However, I acknowledge that this group of actors is critical to the strawberry value chain, as they are instrumental in performing the operations which allow the strawberry value chain to take fruit.

Once I had obtained methods of reaching the critical stakeholders that I had identified, I reached out to these individuals, either independently, or through my contacts, with a short introduction of myself and the research project, and an explanation of my research purpose. Initially, I had anticipated challenges in scheduling and sought to reach out to these interview partners well in advance. However, the majority of my emails to Spanish stakeholders were either not answered, answered late, or I was requested to organize a meeting over WhatsApp closer to the starting date of my fieldwork. Adams (2015, 496) addresses this aspect of the fieldwork process, implying that flexibility in the research methods is required.

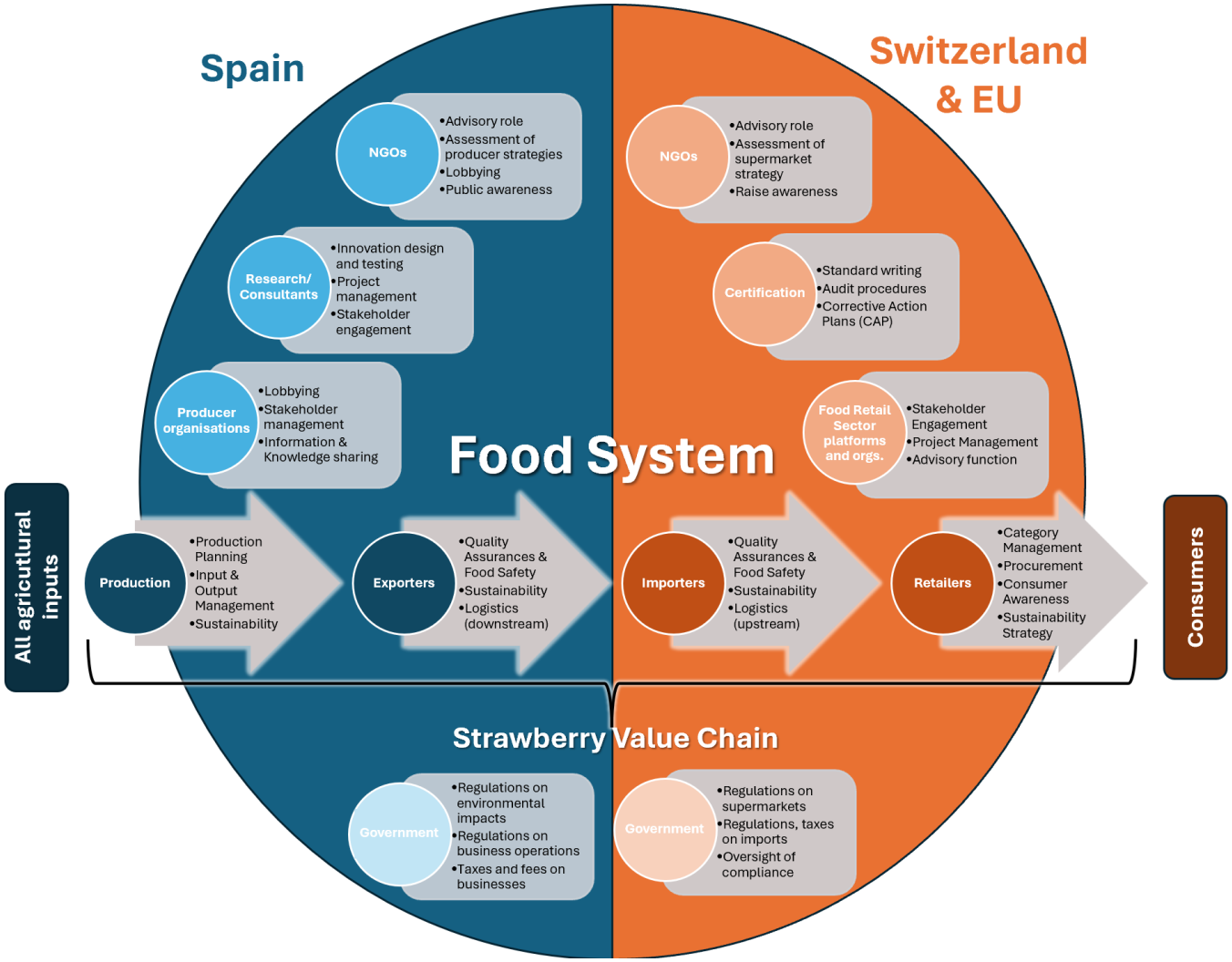

Figure 5. Depiction of the system of interview partners and the strawberry value chain.

Source: Own design.

4.2.2 Interview Design: The Guide, Implementation, and Transcription

To guide the interview process I constructed a catalogue of interview questions organized into broader categories such as motivations for participation in the MSI, goals, constraints, and perceptions of other stakeholders (Adams 2015, Gläser and Laudel 2010). The interview guide includes questions about the experiences, knowledge, background information, and opinions of the interview partners (Gläser and Laudel 2010, 123). Following Adams' (2015, 498) recommendations, I prioritized open-ended questions to elicit rich, detailed responses. I nonetheless took care to ensure that the questions remained neutral, as emphasized by Gläser and Laudel (2010, 135). The interview guide was designed as a flexible tool, allowing for continuous adaptation throughout the research process (149). This iterative approach enabled me to refine questions based on emerging insights and to tailor the guide to each stakeholder group and individual interview partner as needed (Adams 2015, 498). The contents and structure of the interview guide were furthermore informed by the literature review and continuously refined to address the evolving demands and insights of the research process. The versions of the German and English interview guides can be found under Appendix A.

In the setting of my fieldwork in Switzerland and Spain, I conducted a total of fifteen expert interviews with various stakeholders in functions related to the Spanish-Swiss strawberry value chain. The interviews were designed to require approximately forty-five minutes. However, the conversations lasted between half an hour, to nearly two hours in some cases. Most interviews took place in person at the offices of, or other nearby locations to my interview partners. In four cases, I held the conversations over Zoom, as arrangements to meet in person were not possible. Prior to starting the conversation, I reintroduced myself and the research project, and informed the participant that the data would remain anonymous and confidential, following which I asked if the interview could be recorded (Gläser and Laudel 2010, 171). The ethical considerations of the interview process are explained in detail in section 4.2.4 below. The interview guides provided a general structure to the discussions I had with each stakeholder which I used flexibly and tailored as necessary to the interview partner. Oftentimes, I noted early on in the conversation that the interview partner had a specific field of expertise and was able to answer some questions in greater detail, and others less explicitly. This flexibility allowed me to obtain richer insights from these conversations, as well as encouraged a natural flow to the discussion and rapport between the interview participants and myself as a researcher (Adams 2015, 496; Gläser and Laudel 2010, 174-175).

For the interviews held in person, I recorded the conversations with an audio recording app on my personal smartphone. For interviews held over Zoom, I used the program's recording feature to obtain an audio file of the interview. Following the interviews, I uploaded the audio data files to the cloud-based data storage of the University of Zurich and saved a

copy to my password-protected USB stick. In one case, my interview partner did not wish to be recorded, and I instead took notes actively while conducting the interview. To do so, I kept in mind the instructions of Gläser and Laudel (2010, 171) for explaining the benefit for the research process of audio recording to the interview partner, and after receiving feedback that I could not record the interview, to take as detailed notes as possible, and compliment this with a thorough interview protocol afterwards.

The transcription step of the research process is a time-intensive task which includes: the determination of the rules for transcription, the transcription of the audio files, the correction of the transcripts, the anonymization, formatting, saving and archiving of the transcripts, and lastly, the import of the files into a qualitative research software to aid in the data analysis (in this case, the MAXQDA software) (Kuckartz 2018, 164). I have summarized the rules that were applied to the transcription process in table 1 below. Gläser and Laudel (2010, 193) state that interviews should be as completely and accurately transcribed as possible, in order to effectively reflect the content of the conversation. For this reason, I transcribed the interviews in the manner in which they were spoken, and did not correct for repetitions, grammar, or phrasing. To aid me in this process, I used the transcription feature within the Word program offered by Microsoft 365 online. Due to a faulty recording, one interview was not discernible, and hence could not be transcribed, nor included in my analysis. Secondly, the Microsoft feature did not function for the interview which I conducted in Spanish. I instead used the MAXQDA integrated automated audio file transcription feature, which captured most of the conversation accurately. I then used the DeepL Pro translation service to translate this interview transcript from Spanish to English. The methodological challenges of the interview conduction, recording, transcription, and translation processes are described in section 4.2.4 below.

Table 1. Rules for transcription.

Symbol/Rule	**Use**
INT:	Demarcate interviewer speaking.
EI(#):	Demarcate interviewee speaking.
[…]	To add context of how something is said, or if something happened that was not recorded.
Italics within ordinary text	Particular emphasis on a phrase or word
[???]	Not distinguishable.
…: "…"	To show that the interviewee is telling a story.
(ESP: …) (ENG):	To show the original Spanish, as well as the English translation.
Repetitions of a word or filler phrase more than three times	Removed for clarity of reading.
Introduction of a new idea, from the same speaker	Paragraph break.

4.2.3 Field Notes During Strawberry Field Visits

Field notes offer richer meaning to qualitative studies by situating the research within the context of the time and place in which it is conducted (Phillippi and Lauderdale 2018, 382). Furthermore, field notes give further details about the basic information of the setting including the geography, demographics, societal pressures, as well as insights into the participants, the interview itself, and offers the critical reflection of the researcher themselves (Phillippi and Lauderdale 2018; Tessier 2012). In the context of my fieldwork and interviews while in Spain, I had the opportunity to visit strawberry production sites of two large cooperatives with both conventionally, integrated, and organically grown strawberries (in Moguer and Palos de la Frontera in the province of Huelva, and Lepe in the province of Lepe), as well as the testing farm of the government of Andalucia (in Moguer in the province Huelva). During these visits, I took pictures and asked questions that enriched my knowledge and the information that I had acquired through the literature and had been given to me during the expert interviews. I was not able to actively take notes while walking the fields, but I noted down the important aspects that stood out to me and used these notes to journal my experiences, thoughts, and information that I received during the visits. During my stay in El Rocío in the district of Almonte, the arrangements for interviews that I had made were unexpectedly changed. In place of this, I determined the nearest sites of the strawberry fields to my location that I could walk to, and went on an explorative and observational walk around these areas. In this sense, the field notes offered “thick context”, which complemented and enriched the meaning of data acquired through the expert interviews. In addition, the use of field notes further enhanced the quality of the findings from interview process by recording my memories and ideas during the research process (Tessier 2012, 447).

4.2.4 Positionality, Ethics, and Methodological Reflections

The intersection of power, oppression, and privilege with issues of suffering, equity, justice, and radical democracy creates a complex ethical landscape for qualitative research to navigate. As Cannella and Lincoln (2024) contend, this intersection forms a critical foundation that needs to be considered when approaching research ethics from a critical qualitative perspective. Furthermore, ethical orientations are believed to be played out within the personal core of the researcher as they examine and make decisions about the conceptualization and conduct of research as either oppressive or emancipatory practice (Cannella and Lincoln 2024, 61). Creswell (2007) suggests that ethics must be addressed in the research process by determining: the worthiness of the project, the competence of the researcher, establishing the informed consent of participants, acknowledging issues of benefits, costs, and reciprocity, as well as the potential for risks, in addition to considerations for honesty, truth, privacy, confidentiality, anonymity, the integrity and quality of the research, ownership of the resulting

data and conclusions, as well as proceedings for the use and misuse of the research results (66). From a critical qualitative perspective, I approached these ethical considerations with an awareness of my own positionality as a researcher. As Glaser and Strauss (2017) note, researcher insights stem not only from the research process itself, but also from the personal experiences of the researcher. I worked to cultivate these insights within the framework of the constructivist grounded theory methodology of Charmaz (2012), while remaining reflexive about how my own background and assumptions might shape my interpretations (Gläser and Laudel 2010, 178).

One methodological challenge which presented itself for this research project was navigating language barriers during my fieldwork in Spain. I have a working understanding of Spanish which was useful for reading documents and finding information prior to the fieldwork. However, I am unable to fully communicate effectively in Spanish on a professional level. For this reason, the majority of the interviews were conducted in English. As this was not the native language of most of my interview partners, I maintained a professional, yet simple and precise language choice and formulation of the questions, as is suggested by Adams (2015) for performing semi-structured interviews in empirical research. In addition, I used online translation tools such as Google Translate and DeepL to aid me in explanations where terms or questions were unclear to my interview partners. According to Gläser and Laudel (2010), this strategy is an acceptable and flexible approach to the interview process, as it allows the researcher to establish effective communication with the interview partner. Both field visits to berry producer cooperatives required me to speak Spanish with my interview partners (refer to Appendix B). During the first visit, a contact from Switzerland who works for a major fruit importer joined us and translated for me between German and Spanish, whereas during the second visit I had to use the online translation tools to aid me in translating the interview guide to Spanish and in communicating with my interview partner where my own language skills were insufficient. As I had not planned nor anticipated conducting part of my research in Spanish, I did not have the assistance of a translator to ensure the completeness of communication, nor to aid me in the transcription process. However, the translation tools that I used in place of this are highly accurate. In addition, the audio recording allowed me to account for the emphasis, emotions, and other nonverbal communication cues that added depth to the content of the translated transcript.

Culturally, I had to remain flexible and agile, and adapt to the different norms and expectations of the individuals that I encountered throughout my fieldwork. At times this could be overwhelming and I felt unprepared, highlighting the need for my ongoing cultural competence development. However, it was apparent to me that with time this became easier, and that generally if I approached individuals in a well-meaning manner, that they were both helpful and receptive. By demonstrating goodwill and motivation to communicate effectively

and understand my interview partners, I established rapport and trust (Pfadenhauer 2002, 120). My association, though no longer formal, with a major Swiss food retailer created power dynamics that I had to carefully navigate, especially in gaining access to and trust from Spanish stakeholders. I worked to be transparent about my role as a non-affiliated researcher, as well as my research aims, while emphasizing the confidentiality of the data provided during the interviews (Gläser and Laudel 2010, 159). Throughout the research process, I practiced the active listening suggested by Gläser and Laudel (2010, 150) and adapted my approach to each interview partner. I remained cognizant of how language barriers, cultural differences, and power imbalances could impact the research process and worked to mitigate their effects through reflexivity, transparency, and ethical decision-making grounded in critical qualitative principles.

4.3 Data Analysis

I follow a critical constructivist epistemology in this empirical research, aligned with a critical grounded theory methodology (Kincheloe 2005; Charmaz 2012). In the steps of data analysis, I aimed to generate categories based on the collected materials while critically examining elements of power structures and contextual factors of the emergence of sustainable production strategies in the strawberry sector. Here, I explain the methods for the code and category development and the content structured analysis steps of the data analysis process.

4.3.1 Qualitative Content Structured Analysis

Qualitative content analysis allows for the systematic, rule-guided analysis of textual data, while retaining a degree of flexibility in interpretation (Mayring and Fenzl 2019, 634; Gläser and Laudel 2010, 204). While Mayring and Fenzl's (2019, 636) conception of qualitative content analysis offers a rigorous method for analyzing textual data, it is limited in its applications to a constructivist approach by its rigid adherence to predefined categories and rules. For this reason, I draw instead from Kuckartz's more flexible approach to qualitative content analysis as an evaluation method for the transcripts of the expert interviews, as it allows for a more inductive and interpretive approach (Kuckartz 2018). In the data analysis process, I followed an adapted version of Kuckartz's seven steps of qualitative content-structured content analysis, which are depicted in figure 7 on the next page (168). This approach to content analysis follows the logic that the codes, subcategories, and categories should emerge from the data, rather than be entirely predetermined (177). I modified this model of qualitative content analysis to incorporate the emergent and inductive nature of constructivist grounded theory. Constructivist grounded theory is congruent with this approach to content analysis, as they share an inductive logic (179; Charmaz 2012). This adaptation allows for a more open-ended exploration of emerging themes while maintaining a systematic analytical framework, aligning better with the critical constructivist paradigm of my research and the complex nature of the dynamics of the strawberry value chain.

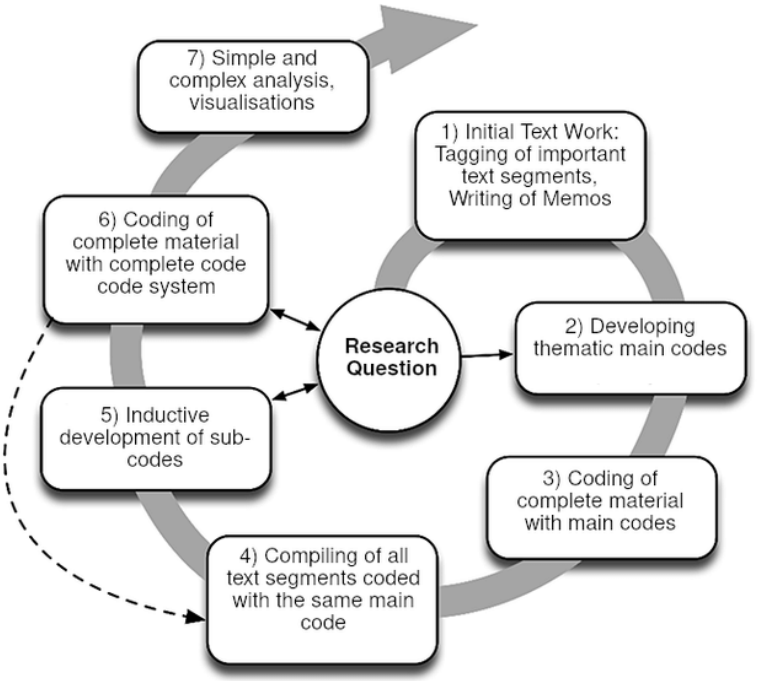

Figure 6. Content Structuring content analysis by Kuckartz.

Source: Höppner et al. 2022, 9.

4.3.2 Reflexive Coding and Critical Category Development

After importing my transcripts and field notes, I used MAXQDA software to code the entire bodies of text from these documents, using short phrases to capture the essence of the meaning of the text segment (Gläser and Laudel 2010, 177; Kuckartz 2018, 33). I primarily employed open coding in the initial phase of the data analysis process, followed by axial coding and the construction of categories and subcategories, followed lastly by selective coding to refine these categories (Glaser and Strauss; Kuckartz and Rädiker 2022, 33). As the coding process continued, I could either reuse codes that I had already coined, or I created new codes to capture a different aspect of the meaning which it encapsulated. This initial coding work was informed and led in part by my review of the literature on the strawberry GVC, the MLP, MSIs, and SI, and in part by the experiences and knowledge that I acquired during my fieldwork. After this process, I reviewed the collection of codes and consolidated them based on a critical evaluation and comparison of their meanings and content of coded text segments. This consolidation left me with a set of codes that I then grouped into categories based on their content. To distinguish between the specific meanings of sets of codes with similar terms, I furthermore established subcategories by which to organize them (Kuckartz 2018, 32). With this completed structure of the categories, subcategories, and codes, I then completed the coding of the material, by reviewing the transcripts and field notes, and the codes which had been assigned to each text segment (179). Lastly, I completed case-related summaries of the

information and main points of the most relevant aspects of the categories and their codes (111-7). This adaptation enabled me to develop and iteratively adapt a critical stance throughout the research process, rather than relying primarily on a predetermined critical framework and set of themes and categories to guide my research. I could embrace a degree of indeterminacy in the framework, by allowing the empirical data to guide the development of the critical insights which I drew. Furthermore, I maintained a reflexive approach throughout the coding process, acknowledging my own positionality and its potential influence on my interpretation of the data. This adapted approach to the coding and category development processes allowed explore not only the manifest data, but also the underlying power structures, contextual factors, and potential for transformative change within the multi-stakeholder initiatives and broader value chain dynamics.

4.4 Quality Criteria of Qualitative Research Methods

Assessments of the quality of the results of quantitative research is typically done on the basis of objectivity, reliability, and validity criteria (Diekmann 2022, 247). Objectivity refers to the impartiality of the researcher, while reliability implies the relative stability of a finding, and validity expresses the truthfulness of a finding (249-56). This type of assessment is both plausible and possible given the objective nature of quantitative measurements and systematic reproducibility of results in the controlled quantitative research setting. However, in the context of qualitative research, complete objectivity of the researcher is neither possible nor effective in achieving the goals of the research method (Kuckartz 2018, 201; Bogner, Littig and Menz 2014c, 94).

For this reason, I instead lean on the quality assessment criteria posed by Whittemore, Chase and Mandle (2001, 522) for methodological validity which are in harmony with the inherent ambiguity in the immaterial framework of the qualitative research setting. As qualitative research is highly contextual and subjective, validity may instead be tested by assessing the credibility, authenticity, criticality and integrity of the applied research methods (530). Credibility is assessed through ascertaining whether the results accurately reflect the meaning of participants providing the information. Authenticity assures that a variety of perspectives are included in the narrative. Criticality conveys whether a holistic assessment of all elements of the research are covered. Lastly, integrity determines whether the researcher has been reflective in the research process (531). These standards overlap in part with what Miles, Huberman and Saldana (2014, 272-3) term internal validity and external validity. Through these criteria, an assessment of the descriptive and interpretive validity of my research design may be achieved.

In the context of qualitative research, Miles, Huberman and Saldana (2014) further define an approach for assessing methodological reliability. They put forth criteria from a critical

realist tradition that is still “responsive to the contingent, contextual ,and personally interpretive nature of any qualitative study” (271). Here, the main aim is to determine the consistency and stability of the research process. Reliability is conceptualized further as the dependability and auditability of the researcher and methods. This criteria is critical for securing the applicability of the research results within the context of the case study and the theoretical literature.

These standards allow for an effective means to demonstrate the rigor and legitimacy of the qualitative research design which I have put forth. I have sought to implement these standards to the best of my ability during the research process, in both the data collection and data analysis steps. I have further applied the checklist offered by Kuckartz (2018, 204) to ensure these quality standards in my research process. In critically reflecting on the research design and research process, I have done my best to produce results that offer a valuable contribution to the literature.

In summary, in this chapter I presented the critical constructivist paradigm and constructivist grounded theory approach that I adopted to conduct qualitative, inductive empirical research. To this end, I collected primary data through semi-structured in-depth expert interviews and field notes, which I coded and analyzed using an iterative process of category construction. This methodological framework helped to facilitate a robust theoretical understanding of the complex dynamics within the Spanish-Swiss strawberry value chain. The resulting discourse and conceptual framework are presented in the following empirical chapters.

PART II: EMPIRICAL RESEARCH RESULTS, DISCUSSION, AND CONCLUSION

In the empirical section of my thesis, I analyze findings from semi-structured expert interviews that I conducted across the Spanish-Swiss strawberry value chain. I interviewed stakeholders from retail (quality and sustainability departments), logistics, certification agencies, production (cooperatives), government (agricultural and environmental research), and civil society (NGOs in Spain, Switzerland, and abroad). Through my interviews, I found stakeholders shared key perspectives on sector challenges: environmental pressures from intensive production, ***inadequate pricing****, consumer sensitivity to strawberries,* ***certification burden*** *on producers, and the need for* ***political solutions****. I structure my analysis of the results of the interviews in three chapters: I firstly examine environmental risks in production practices and the emerging innovative responses. I then analyze governance dynamics within multi-stakeholder initiatives, focusing on network structures and implementation mechanisms. Lastly, I explore how broader institutional and market forces shape sustainable transformation possibilities. Throughout these chapters, I integrate my empirical findings with the relevant theoretical frameworks to advance the understanding of* ***environmental governance and upgrading*** *in horticultural value chains.*

5. Innovation Niches for Environmental Risk Management

Environmental innovation in agricultural systems emerges at the intersection of technological feasibility and ecological necessity. In intensive horticultural production, such as the strawberry sector in Huelva, agronomic innovations represent critical responses to mounting environmental pressures while maintaining productive capacity. In this chapter, I explore how actors involved in the Spanish-Swiss strawberry value chain firstly perceive the environmental challenges of strawberry production in Huelva, and secondly, how they conceptualize the emergence and evolution of technological and agronomic innovations to address these challenges within protected spaces. Specifically, I examine the discussion of the complex dilemma of balancing economic development with a sustainable level of resource use through practices of water, soil, and biodiversity management. In the analysis of the discourse with these actors, I draw upon the multi-level perspective to understand how niche innovations in these areas develop and potentially transform existing production practices. By examining both technical solutions and their implementation dynamics, I illuminate the complex interplay between productivity demands and environmental protection in the industrialized horticultural sector. In particular, I pay attention to how actors individually and collectively engage with and shape the processes of innovation development and uptake, revealing both opportunities and barriers in the transition towards more sustainable production methods. Furthermore, in the analysis of this chapter of environmental upgrading through innovation, I offer a foundation for understanding how protected spaces in the Multi-Stakeholder Initiative can nurture solutions to complex ecological challenges, while acknowledging the technical, social, and institutional factors that influence innovation trajectories.

5.1 Environmental Challenges and Technical Innovations

The environmental pressures facing Huelva's strawberry sector manifest in three critical and interconnected areas: water scarcity, soil degradation, and biodiversity loss (see section 2.1.1). In this section, I examine how stakeholders in Spain and abroad understand and assess these environmental risks and the corresponding innovative solutions that emerge to address them. Through an analysis of both the expected technical responses and surprising social-ecological dynamics, I consider the factors which determine the selection and uptake of innovations in the structural adaptations to berry production to improve its environmental sustainability.

5.1.1 Water Resource Risks and Technical Solutions in Management

Water is arguably amongst the hottest debated topics in Huelva — whether the discussion is about its availability, management, or regulation. Contrary to other debates, discussions around water use and management center not on whether the resource is becoming scarce. Rather, discussions revolve around how limits on existing resources can be managed — either

through innovations in irrigation technologies, equipment, and methods (EI5, Pos. 172), infrastructural developments to make water more available (EI9, Pos. 32), or policy instruments to regulate and limit its use (EI15, Pos. 128).[9] Through the stakeholder interviews, key themes emerged around mounting pressures of water scarcity, the establishment and adoption of water management infrastructure and technology and the critical issue of unauthorized irrigation through illegal boreholes in proximity to the Doñana National Park (EI6, Pos. 32; EI14, Pos. 169; EI15, Pos. 116).

Historically, Huelva has been a favorable place to grow berries due to a) its hydro-geographic and physical position with a southwestern coast facing the Atlantic, bringing sufficient rain to the region and b) previously abundant groundwater and surface water from the river basins of the Guadalquivir and the Tinto, Piedras, and Odiel (Márquez Domínguez, 2008). However, the region now faces significant concerns of drought due to exacerbated pressures on these water systems from both intensive water use and systematic issues such as climate change (EI7, Pos. 67). Actors in NGOs, government organizations, and corporate functions in both Spain and abroad are in consensus that water scarcity is of paramount concern to the industry, and an effective management strategy is conducive to both environmental and economic interests (EI1, Pos.167; EI3, Pos. 76; EI15, Pos. 116).

The largest risks to critical water systems from illegal operations are in berry production near the Doñana National Park in what is called the “Northern Crown” (EI1, Pos. 183). It is also here, where greenhouses surround the town of El Rocío in the district of Almonte, that NGOs have identified the regular occurrence of irrigation aided by illegal boreholes. Estimates state that nearly 20% of the production in the area relies on illegal irrigation practices (EI5, Pos. 222). This dilemma was made tangible to me during my field stay in El Rocío, where on a walk near the berry greenhouses, I encountered a stream with perfect mechanical ripples across its surface, confirming what I had been told about the obvious nature of these practices (see figure 8) (FN1, Pos. 10). The prevalence of these illegal operations generates further entrenched challenges in water management for producers implementing good practices. One researcher stated:

> *“…for example in the spring this year, this time of the year or a bit earlier in March last year- About 25% of the area irrigated legal area had to stop production because they… they didn't have any water left. the legal farmers were coming to us asking for help, how we can change things. And then the first step is reducing the consume of the illegals. I'm sorry but this… before the legals should be the illegals, yes, this is clear.” -EI13, Pos. 82*

[9] See Appendices B and C for the list of expert interviews (EI*X*) and field notes (FN*X*). As all interviews and site visits took place in 2024, the dates are not given for in-text citations. Instead, citations are given with the document code (*X*), and the position number (Pos. *X*) of the content within the document.

Such a statement demonstrates the collective nature of the management of the scarce water resources, and how illegal operations also generate negative outcomes for other producers that implement responsible practices. For this reason, the primary goal in water management of most stakeholders is firstly to eliminate all illegal wells and to produce the berries with only legally obtained resources (EI2, Pos. 126; EI5, Pos. 25).

Figure 7. Ripples across the water of the Arroyo de la Cañada Martin *stream in El Rocío near the Northern Crown intensive growing area, likely indicating the presence of an illegal water pump. El Rocío, Spain. May 2024.*

Source: Own Image.

Secondly, actors encourage that remaining irrigation operations needs to be managed as efficiently as possible (EI6, Pos. 27). The use of sensors and technologically advanced systems in precision irrigation which enable a consistent monitoring of the crops' water use and demands is wide-spread in the sector, with many producers investing significant resources in these innovations and structural improvements (EI13, Pos. 200; EI14, Pos. 174; FN2, Pos. 12, FN4, Pos. 11). Other innovations in water management include hydroponic systems consistently of a mechanized tabletop design where plants grow in a coconut fiber-based substrate, allowing a complete controlled closed system for the production of the crops (FN3, Pos. 12; FN4, Pos. 18). Some value chain actors firmly support the rising popularity of the tabletop system and that this innovation presents an opportunity to fundamentally address environmental sustainability challenges (EI1, Pos. 276). On the topic of water management infrastructure, there is some disagreement on how much further producers can improve in this

area, as they believe to have maximalized on innovations in efficient irrigation (EI11, Pos. 131; EI14, Pos. 174). However, downstream value chain actors also express doubt whether the adoption of these technologies suffices to address demands on sustainable water management. They suggest that installing the system is one thing, but using it correctly is another issue apart (EI15, Pos. 143). Additionally, others still point out that efficient water use cannot be an effective strategy, where it is not coupled with practices that ensure water quality, through the management of runoff of pesticides and fertilizers, and other agricultural inputs (EI5, Pos. 176; EI13, Pos. 210). Hence a comprehensive strategy must also consider other aspects of the interwoven agroecosystem (EI14, Pos. 13).

5.1.2 Soil Health and Innovations in Improvement

The sandy soils of Huelva present unique challenges for berry cultivation, requiring specific fertilization practices and careful management of nutrients and pests (FN3, Pos. 13). The intensive monocropping system under plastic tunnels accelerates soil nutrient depletion, creating a cycle of dependency on chemical inputs (EI6, Pos. 124). Among operational challenges, the persistence of nematodes in the soil emerges as particularly significant, second only to water management concerns (EI10, Pos. 16; EI11, Pos. 80). Nematodes thrive under the soil conditions established through the monocropping system – a characteristic of the agricultural landscape that is further entrenched by public regulations and limitation of land rights for berry production — and contribute to devastating crop losses where left unaddressed (EI11, Pos. 80). Hence, the berries are always grown on the same plots, year after year, with significant chemical inputs to manage these pests (EI15, Pos. 177). Actors responsible for research and development from the regional government explain that the application of these chemicals is highly controlled (EI11, Pos. 157) and can only be applied by certified specialists in quantities such that they target the crop only and biodegrade before they infiltrate into the soil (EI11, Pos. 249). Both actors in Huelva who are directly involved with the production of the berry crops along with foreign actors in more indirect functions unanimously identify soil disinfestation as a prominent challenge that must be addressed to maintain productivity of the crops, though acknowledging the absence of an ideal solution (EI5, Pos. 170; EI7, Pos. 165; EI15, Pos. 76). When questioned about alternative approaches such as anaerobic soil disinfestation (ASD), both producers and specialists agreed that the technique is effective, but not to the extent that can be achieved through chemical alternatives (EI10, Pos. 35; EI11, Pos. 213). A research representative explained to me that ASD is an non-synthetic chemical method of creating conditions in the soil that generate methanol gases that combat pathogens (EI11, Pos. 221). The method itself has reached its maximum potential, however it can be combined with other techniques to increase its efficiency (EI11, Pos. 229). Consultants in the berry sector along with NGOs advocate for the improvement of pest management techniques so as to be

able to harmonize the necessity to maintain crop productivity and ecological impacts (EI5, Pos. 170; EI7, Pos. 165).

By contrast, the implementation of plastics in berry horticulture receives notably less attention despite its visible impact on the landscape. When traveling between towns in Huelva during my field visits, I would pass long stretches of plastic tunnels that dominated the landscape (FN4, Pos. 9). The high volume of plastic needed to accommodate the berry industry in Huelva is immediately apparent – at ground level and from satellite imagery (European Union, Copernicus Program 2024). Actors note that certifications have made significant improvement on the management of the plastic waste that is generated (EI5, Pos. 85; EI7, Pos. 83), and the general impression given by stakeholders is that the plastic does not cause a significant ecological impact. The use of plastics is perceived to be highly managed given the significant expense for employing them in the management of crops (EI8, Pos. 60). When discussing these inputs, an interesting point came up with a specialist consultant, where the challenges in innovating in alternatives to petroleum-based TIF films used to cover the strawberry beds were described:

> *"I know a company that was making the TIF film, you know the TIF film? That goes over the strawberry bed? They made a biodegradable film, but they won't you use it. And you know why? Because at the end it means that the strawberries will be two cents more expensive per kilo." -EI9, Pos. 51*

Producers in turn confirm that they adopt what innovations they can in terms of plastic use in the infrastructure, but that it is the business of private companies to develop solutions that work and are economically feasible (EI10, Pos. 55). Hence, innovations and infrastructure in soil management face barriers to adoption either in that there is a strong perceived environmental impact of addressing the issue, despite potential economic losses, or that a fundamental systematic change receives little attention in that it does not pose much benefit either economically or environmentally.

5.1.3 Biodiversity Conservation Measures

While Huelva is known for its berry industry, it is equally renown for the valuable biodiversity hotspot of the Doñana National Park wetlands (EI14, Pos. 147). A significant trend in the discussions with stakeholders that addressed biodiversity was the establishment of synergies between agriculture and the environment (EI5, Pos. 33; EI6, Pos. 136; EI8, Pos. 70; EI14, Pos. 38). Actors involved in supply chain operations between Spain and Switzerland acknowledge the immediacy of addressing the risks posed to the health of species, habitats, and ecosystems by intensive crop cultivation. They recognize that without this foundation of ecosystem services and natural resources, agricultural production would not be possible (EI1, Pos. 173; EI4, Pos. 177). While advocacy from a broader level and the consumer base tends towards a focus on species and ecosystem biodiversity (EI13, Pos. 50; EI3, Pos. 60), other actors emphasize

aspects of functional biodiversity that present opportunities for synergetic crop management (EI11, Pos. 163; EI14, Pos. 213). The criteria of certifications for responsible environmental management has evolved to encompass biodiversity concerns, such as strips of protected areas and infrastructure and techniques for integrated pest management (IPM) (EI3, Pos. 60). IP management utilizes the natural relationships between flora and fauna to create conditions that systematically reduces the attraction and proliferation of pests to crops (Pretty 2018). The benefits for biodiversity in applying the integrated approach to pest management as opposed to chemical controls are clear as the application of persistent chemicals in the agroecosystem is significantly reduced, and the presence of flora and fauna beyond the managed crops are favored (FN2, Pos. 28). The implementation of flowering strips and biodiversity protection areas on farms presents challenges for producers, as this requires reducing their overall production surface area to accommodate biodiversity compensation areas, thereby affecting productivity (EI4, Pos. 177). IPM, by contrast, is viewed favorably by producers, consultants, and researchers, as the technique generates clear benefits with high effectiveness and ease of implementation (FN2, Pos. 10; EI7, Pos. 75; EI10, Pos. 96). IPM practices are widely adopted throughout Andalusia, though its significance became apparent to me only during a visit to a *finca* in Palos de Frontera. The cooperative's quality manager explained that the Junta de Andalucía manages its own integrated production label, and that this is widely employed in crops throughout the region (FN2, Pos. 18).

While in-crop measures such as IPM enjoy significant uptake, other agronomic methods that incorporate agroecological principles in production such as crop rotation and intercropping face more structural barriers to adoption (EI7, Pos. 169). Crop rotation is generally considered by actors as an effective technique in crop management — it allows for natural soil regeneration and leads to lower overall demand for additional synthetic or organic inputs (EI10, Pos. 45). However, implementing alternating crops in one parcel is perceived to be structurally impossible to implement in Huelva's berry fields for two reasons: a) the berry season is long and labor-intensive, leaving little additional time or financial resources for short-term cover crops (EI7, Pos. 169), and b) publicly managed land rights and allocations do not allow for the berry crops to be grown on alternative parcels (EI10, Pos. 53). One specialist in berry cultivation and environmental impacts described that a suitable approach to managing the impacts on biodiversity in cultivation would be to employ a "mosaic in the farm" (EI6, Pos. 124), enhancing the effectiveness of natural predators to pests, and pushing the integration of biodiversity-promoting cultivation techniques beyond boundary-line adaptations.

When asked about the potentials of intercropping, researchers from the regional government institute for agriculture emphatically explained that it is a solution that "doesn't work" (EI11, Pos. 269), as demonstrated by tests of planting garlic between strawberries. During a site visit to this institute, I observed the test row of strawberry and garlic plants, where

my interview partner explained that the garlic cast too much shade over the berry plants, affecting fruit development and quality (see figure 9) (FN4, Pos. 17). The example of garlic-strawberry intercropping was evocative of a critical issue at hand: although radical innovations and solutions to the environmental challenge of strawberry cultivation are desired (EI6, Pos. 124), they face strong barriers to effective implementation. While less radical innovations like IPM are favorable to the industry, they appear to possess less potential to fundamentally address the complex challenges of negative impacts on biodiversity from cultivation practices.

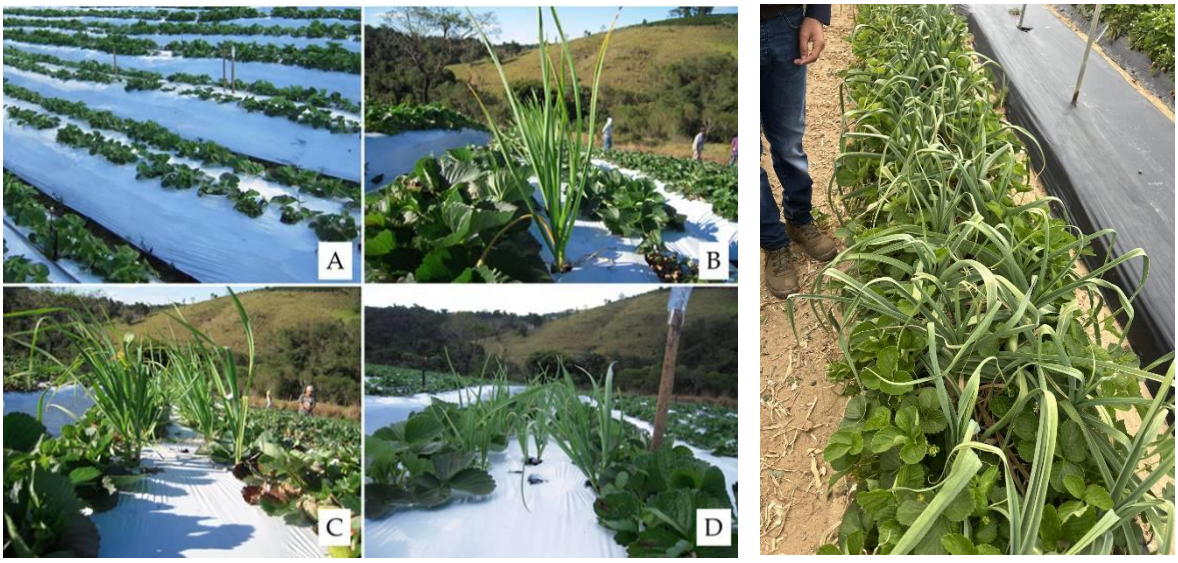

Figure 8. Left: Intercropping experimental design of garlic and strawberries, control, one plant, two plants, and three plants. Right: An experimental test of intercropping at a research institute finca in Moguer, Spain. May 2024.

Source: Left- Hata et al. 2019. Right- Own Image.

What emerges from the discourse on the environmental challenges in water, soil, and biodiversity management and the generation and uptake of innovations to address these challenges, is that neither the risks nor the solutions can be completely extricated from one another. Intensive use of scarce water resources that pollutes the remaining groundwater or surface water generates consequences for the quality of the soil as well as the ecosystems which rely upon these resources. In the same way, the implementation of integrated pest management techniques may lead to improvements in soil, water, and overall ecosystem quality and health. The use of natural resources needs to be in harmony with the natural environment, otherwise we have no basis for agricultural production and agricultural production will suffer from degradation to the natural environment (EI2, Pos. 14, EI3, Pos. 185). Especially in the context of Huelva's berry industry in close proximity to the National Park wetlands, which is encapsulated by this statement from an environmental research institute:

> *But something very important to me is that Doñana can be and- if it works- Doñana will be an example of how to solve this adaptation in the… in the sustainability. The interaction of different drivers of global change in this case is land use change through intensification- irrespectively if it is legal or illegal, that's not very relevant for the… from the- The sense of the impact*

is the same. It doesn't make any difference. And climate change, we have less and less water and warmer climate, which is also traditional availability. And this is… this interaction is generating a problem which requires adaptation. Adaptation is going to happen. That's something that we have to be aware -EI13, Pos. 67

For this reason, the agroecosystem must be treated as a whole with holistic management to generate and facilitate effective solutions that not only are environmentally suitable, but economically feasible.

5.2 Outcomes in Environmental Upgrading in Cultivation

Building on the examination of the environmental challenges and opportunities for innovations in berry cultivation, this section analyzes the concrete outcomes of environmental upgrading efforts in Huelva's berry sector. While certain technological improvements and management practices have been widely adopted and celebrated as evidence of the sector's sustainability transition, these changes reflect specific power dynamics and interests. Understanding which innovations have been successfully implemented and how these implementations position producers in the value chain, reveals whose knowledge and priorities shape the transformation of these horticultural practices.

5.2.1 Product and Process Improvements

The berry industry in Huelva has undergone significant transformations in production practices, particularly in irrigation management and integrated pest control. While some actors herald these changes as evidence of a successful sustainable intensification of berry cultivation, an examination of who defines and benefits from these improvements reveals complex power dynamics in knowledge creation and implementation. Interestingly, a frequent topic that was discussed across the interviews with stakeholders was that of the importance of plant breeding (EI1, Pos. 246; EI8, Pos. 34). Initially, this was not an agronomic method that I had investigated prior to my field stay, nor was it a topic that I specifically brought up in the interview guides (see Appendix A). This was primarily due to the connect between the crop varieties and sustainability not immediately appearing to fall into scope. Actors in NGOs and research institutes in Spain explained that innovations in plant breeding have enabled a higher yield per crop, and that these innovations have reached their maximum potential (EI5, Pos. 241; EI6, Pos. 136). These new varieties adopted by producers are said to not only improve the quality of the fruit (EI1, Pos. 246) but also are more resilient to the effects of climate change, such as lower availability of water, persistence of pests, and higher average temperatures (EI4, Pos. 199; EI11, Pos. 3). Hence, plant breeding emerged from the interviews as an area of *product* (fruit) improvements that has allowed a more efficient use of resources, while furthering leadership of Huelva's sector in competitiveness in fruit quality. This is a prime example of fulfilling the goals of actors in upstream value chain operations of maximizing on yield and

quality in production (EI10, Pos. 6), as well as those of NGOs who advocate for balancing between best practices, efficiency, and impact on ecosystems (EI5, Pos. 59). However, in discussing innovations for the sustainable intensification of cultivation, a representative from a Spanish NGO described:

> *Well produce more is possible with the new technology, new varieties. But it depends, because at the end for produce more maybe you need more water and you don't have more water. The water is the key at the end, but also farming and adapting to with new varieties and and and now the varieties have higher production that years ago." -EI5, Pos. 241*

This brought up a crucial point that being able to produce more with less resources as a result of improvements in plant breeding, will not necessarily mean a less intensive use of those resources.

The opportunity for sustainably intensifying strawberry production is accelerated by the combination with the widespread adoption of environmental upgrading in the operations, or *processes*, of crop management through efficient irrigation systems and integrated pest management. Specifically in the area of water management, the immediacy of the pressure of scarce water has pushed the region to develop and innovate on infrastructure and technologies that are said to place Spain as a global leader in irrigation efficiency (EI8, Pos. 60; EI11, Pos. 43). Actors in Spanish NGOs discussed the benefit of integrating these innovations in irrigation infrastructure to accurately monitor resource use and inform decisions on crop management (EI5, Pos. 172; EI11, Pos. 145). One consultant conveyed that these technologies are widely available. Furthermore, their effectiveness and efficiency lead to a significant uptake that is generating an overall improvement in the pressures placed on limited water resources (EI7, Pos. 161).

In turn, while water scarcity created immediate pressure for innovation in irrigation, the transition to integrated pest management reflects a different pathway of environmental upgrading. IPM adoption emerged not from resource constraints, but from a combination of market demands, production benefits, and environmental best practices (FN2, Pos. 28). An expert consultant described Huelva as a 'pioneer' in the implementation of production standards and integrated management techniques (EI14, Pos. 133). Although IPM is limited in its ability to fully address negative pressures on biodiversity, its synergetic approach has an overall more positive impact on the environment than conventional strategies employing chemicals and other synthetic inputs (EI11, Pos. 381). Both of these advances in sustainable practices for berry cultivation reflect the prime goal of the industry to maintain productivity and achieve efficiency. Nonetheless, stakeholders also note the necessity to compensate producers for sustainable practices with adequate financial incentives to further make this transition concrete (EI3, Pos. 60).

5.2.2 Value Chain Positioning

The adoption of advanced varieties, efficient irrigation technologies, and integrated pest management practices has enabled Huelva's berry producers to position themselves as global leaders in the sustainable intensification of berry cultivation. Nonetheless, the market recognition and value captured from these environmental improvements varies significantly — reflecting broader patterns of power in the global value chain. While some producers successfully leverage their sustainable practices to access premium market segments (EI15, Pos. 153), others find the costs of environmental upgrading in their products and processes to exceed the benefits offered by the market (EI3, Pos. 95). Producers express an understanding for the primary concern of consumers to be minimizing the price they pay, while the seller of the fruit would wish to maximize on profit, and the natural division of opinion that arises out of this tension (EI10, Pos. 84). This paradigm reflects a common understanding across actors that the core driving force in these contexts is the market in establishing a demand for specific criteria of the product (EI14, Pos. 137; EI1, 201). However, it is also recognized that consumer perceptions of the quality and sustainability of a product are affected by the price of the product, with consumers generally accepting the superiority of a product with a higher price (EI6, Pos. 144). Across the value chain, actors generally understand that compensation for sustainable practices is a byproduct of consumer demands for these practices, where they deem environmental impacts in production relevant for their purchasing decisions (EI1, Pos. 199; EI4, Pos. 83; EI15, Pos. 9).

Conversely, other actors feel that the additional differentiation between responsible practices and, for example, illegal practices should be made in a price premium for the product (EI11, Pos. 333). In turn, retailers agree that producers must be compensated for the additional labor of certification in distinguishing their production (EI15, Pos. 34). One consultant remarked that there is an additional economic benefit for producers beyond a price premium for sustainable practices, in that in adopting more efficient practices they are saving money on inputs, whether these be energy, water, or fertilizer (EI6, Pos. 60). The matter of adopting efficient water practices is hence not just an issue of environmental consideration, but one of long-term viability (EI6, Pos. 27). Retailers additionally acknowledge that opportunities for differentiation and a competitive market position emerge for producers who adopt better practices in the context of rising environmental pressures (EI15, Pos. 216). However, other researchers indicate that this is structurally difficult as the media assigns a certain reputation to the entire region and mixes "all people in the same bag" (EI11, Pos. 297). This generates increased pressure for the sector to explicitly communicate that their practices that do not fulfill these expectations of the media, and to distinguish themselves clearly from illegal practices (EI5, Pos. 117; EI8, Pos. 52; EI13, Pos. 54). Interestingly, the opportunities to position themselves favorably in the value chain as suppliers of higher quality sustainable fruit may also

generate disincentives to collaborative approaches amongst producers in the sector, according to a consultant (EI9, Pos. 52). In the following section, I examine how this uptake is fostered by the multi-stakeholder initiative, to generate a deeper understanding of the decision-making for environmental risk assessment and management in berry cultivation.

5.3 Innovation Adoption in Practice

The transformation of Huelva's berry sector through environmental upgrading reflects complex interactions between diverse stakeholder interests and capabilities. Understanding how these changes materialized requires examining both stakeholder perspectives on sustainability goals and the mechanisms through which innovations are implemented and shared. In this section, I examine how the multi-stakeholder initiative serves as a platform where different interpretations of sustainability converge, and where knowledge networks facilitate the practical adoption of improvements in the environmental impacts of operations.

5.3.1 Stakeholder Perspectives and Goals

Different actors across the value chain interpret and prioritize sustainability objectives according to their position and interest. Understanding these varying perspectives reveals how power relations and institutional contexts shape which environmental improvements are deemed feasible or necessary, and ultimately, which innovations are pursued. Some producers are intrinsically motivated, and perceive a strong obligation towards nature as the foundation for their business, and hence adopt a more proactive approach to adopting environmental practices (EI9, Pos. 25; EI15, Pos. 19). Other stakeholders approach innovations in sustainability from a more pragmatic angle, than from an ethical imperative. A certification specialist emphasized the point that farmers are those that work the closest with nature, and hence have even greater implicit incentives to take action in protecting it (EI3, Pos. 144). Another researcher later built on this point, by pointing out that Huelva is a traditionally agricultural region, and that agriculture is an important source of employment that is highly regarded and respected (EI11, Pos. 66; EI9, Pos. 46). By contrast, an environmental researcher from the national government explained that:

> *"Yeah, but in most cases I would say it's a lack of willingness to change because there is an opportunity cost. In terms of inertia, I used to do things in this way and I know it works and changing- its effort and time- and that's that means money." -EI13, Pos. 234*

This indicated that entrenched practices have expanded over time and the experience of producers has led to resistance to adoptions of new directions in practice. Such an attitude is not necessarily prevalent throughout the industry however, as the organizer of a forum to improve both social and environmental practices in horticulture suggested. They explained that producers and cooperatives generally show a high interest in making improvements in their

practices, and that this attitude is more easily fostered where there is no immediate pressure to achieve “perfect” practices and standards in operations (EI8, Pos. 16).

Additionally, a consultant highlighted the importance for producers to be able to jointly improve the overall reputation of the sector, requiring collective action and common approaches (EI6, Pos. 101). This was reflected in a later conversation with another sector advisor who stated:

> *“Don’t forget that our business is to sell strawberries, same as you! So let’s try to make this look good. I agree we are here to do business, but there are many ways to do business.” (EI9, Pos. 41).*

Here, the need for collaboration despite competition within the sector was emphasized. There are two factors at play that further incentivize this collaboration: a) as a result of illegal practices near the Doñana National Park, the entire berry sector in Huelva receives raised public attention from increased media scrutiny (EI6, Pos. 27; EI5, Pos. 199) And b) downstream actors, in particular retailers, emphasized that their customers increasingly demand evidence of sustainable practices (EI15, Pos. 191). For this reason, many producers feel pressured to explicitly address environmental concerns to justify their operations (EI10, Pos. 53; EI5, Pos. 199). This market pressure, combined with media scrutiny, creates a complex dynamic where environmental improvements must balance multiple stakeholder expectations. While producers acknowledge the need for change, they emphasize that sustainable transitions require both technical support and market recognition (EI8, Pos. 44). These varying perspectives on sustainability objectives and implementation capabilities significantly influence which innovations are adopted, and how they are put into practice – shaping the pathway toward environmental improvements in the sector.

5.3.2 Implementation Pathways and Collective Learning Networks

The challenges of environmental sustainability in cultivation extend beyond merely having technical solutions, as one sustainability specialist explained. They elaborated that while technological advancement is crucial, successful implementation requires engaging people, providing training, and building practical know-how (EI15, Pos. 206). Thus, the implementation of environmental improvements often faces practical challenges in translating theoretical knowledge to effective action. A revealing example comes from biodiversity protection measures, where superficial compliance with requirements – such as poorly constructed and inappropriately placed insect hotels – demonstrates the limitations of checklist-based approaches to sustainability in fostering critical knowledge and practice uptake (EI15, Pos. 153). This highlighted how implementation success depends not only on technical knowledge but also on producer motivation and meaningful integration into existing practices.

The practical adoption of environmental improvements in Huelva's berry sector depends on complex networks of knowledge sharing and collective action. While technical solutions exist, their implementation relies on mechanisms that facilitate learning between stakeholders and enable producers to overcome barriers to adoption. Where knowledge transfer mechanisms are made accessible to producers, there is a greater likelihood for the uptake of new, environmentally-aligned practices (EI15, Pos. 153). Stakeholders emphasize different aspects of knowledge networks and their effectiveness. Meanwhile, consultants acknowledge that producers often possess deeper practical knowledge than external experts, suggesting that actionable knowledge originates from producer experiences rather than top-down expertise (EI9, Pos. 8). In turn, NGOs and consultants particularly favor collaborative approaches to knowledge sharing, where collective issues are addressed through shared resources of time, money and experience (EI2, Pos. 63; EI5, Pos. 99; EI14, Pos. 302). Hence, the effectiveness of these networks hinges heavily on trust and shared values among participants (EI9, Pos. 20; FN2, Pos.12). However, significant gaps in knowledge transfer persist. One expert highlighted the lack of knowledge sharing in organic farming practices in Huelva compared to in South America, particularly regarding soil management and nutrient cycling (EI6, Pos. 124). This revealed how regional knowledge networks can either facilitate or constrain innovation adoption.

5.4 Concepts at the Niche Level of Analysis

In this chapter I examined the emergence of environmental agronomic innovations in cultivation in response to rising environmental risks due to intensive resource use. By doing so, I established the context which presents the groundwork for understanding engagement with these innovations in the setting of the multi-stakeholder initiative. This examination brings to light congruencies with concepts that emerged in my review of the global value chain and food systems literature. In particular, the duality of the cause and effect between risks and innovations is captured by the literature on sustainable intensification (Pretty 2018; Pretty and Barucha 2014) and environmental upgrading (De Marchi et al. 2019; Krishnan, De Marchi and Ponte 2023). What became apparent through my interviews with stakeholders was the difference in perception between risks that immediately concerned the provision of natural resources as horticultural inputs (for example, water), and those that have a more indirect effect (for example, biodiversity). In tandem, the innovations which experience significant uptake primarily relate to an efficient management of production inputs (for example, water management technologies, and integrated pest management practices that reduce the need for pesticide inputs) and can be considered process improvements in environmental upgrading. Similar findings are established by Pisante, Stagnari and Grant (2012), who find that practices for SI enjoy greater popularity where they lead to an overall reduction in input use, and hence production costs for growers.

Other innovations in process upgrading such as anaerobic soil disinfestation (Márquez-Caro et al. 2022), biodegradable plastic mulching (Goldberger, DeVetter and Dentzman 2019), and intercropping (Hata et al. 2019) face more structural barriers to adoption in Huelva, due to their limitations in the potential to effectively address environmental risks and maintain efficiency in production. Altieri, Nicholas and Montalba (2017) address a similar resistance to the adoption of transformative agroecological measures beyond monocropping in agricultural systems and the framework of sustainable intensification. Levidow (2018) contests the appropriation of these agroecological principles in agroecosystem transitions, and discusses the importance of producer alliances to advocate for favorable environmental policies to a more transformative change agenda. In a similar manner, the importance of networks, particularly for joint advocacy and knowledge sharing, became apparent throughout my fieldwork in Spain. In particular, how environmental upgrading through innovation adoption materializes in practice depends largely on the interaction between stakeholder perspectives, implementation pathways, and knowledge networks (Krishnan, De Marchi and Ponte 2023). With this analysis at the niche level, I demonstrate that environmental upgrading in berry production reflects not only technical capabilities but also power relations in defining and implementing sustainability practices across the global value chain of Huelva's berries.

6. Environmental Governance at the Regime Level

The governance of environmental innovation in agricultural value chains increasingly occurs through multi-stakeholder initiatives that create new spaces for collective action. These governance innovations represent attempts to bridge conventional market mechanisms with sustainability imperatives in global food systems. In this chapter, I advance the conceptualization of MSIs as innovations in value chain governance, examining how they create novel mechanisms for collective action beyond conventional market coordination. Furthermore, I explore how MSIs function as regime-level governance mechanisms in the Spanish-Swiss strawberry value chain, focusing on their role in orchestrating environmental innovation and risk management. In the analysis, I draw on concepts of value chain governance and corporate environmental food regimes to understand how different stakeholders construct and engage with collective governance mechanisms. By examining network structures, standards and certification systems, and implementation processes, I illuminate the complex dynamics of environmental governance through multi-stakeholder coordination. In particular, I devote attention to power relations and institutional arrangements that shape how these initiatives function in practice. Through this examination of MSI governance, I provide insights into how the emergence of innovations into the regime-level of horticultural food system can enable or constrain sustainable transformation in their value chains. By analyzing the collective action mechanisms involved, I offer a foundation for understanding how the diverse stakeholders navigate competing interests and priorities while working towards environmental improvements.

6.1 Standards, Certifications, and their Limitations

The governance of environmental practices in Huelva's berry sector is founded on private standards and certification systems. While these mechanisms aim to ensure compliance with sustainability requirements and facilitate market access, examining their functionality reveals significant limitations in their ability to foster significant structural transformations in production practices. In engaging with how certification systems operate, their structural constraints, and implementation challenges and opportunities I provide crucial context for the emergence of alternative governance approaches.

6.1.1 Current Certification Landscape

Private market standards continue to play a crucial role in differentiating production and increasing competitiveness, despite advances in legislative frameworks (EI7, Pos. 145; EI8, Pos. 60; EI9, Pos. 52). These standards primarily serve to communicate information about product sustainability and environmental-social impacts from producers to retailers, and inform purchasing decisions in supermarkets' commercial departments (EI5, Pos. 117; EI1, Pos. 272, EI4, Pos. 54). Certification for production is achieved through audits of social and

environmental practices on farms, by companies who are authorized to carry out these procedures by the certification agency (EI3, Pos. 149). Such certification systems are primarily concerned with the reduction of inputs, and have achieved global reach, with one certification agency expert noting implementation by more than 200,000 producers worldwide (EI3, Pos. 19; EI3, Pos. 76). The certification landscape in Huelva's berry sector comprises three distinct types: a) government-established standards, such as for integrated production management, which often lack recognition from downstream value chain partners (EI7, Pos. 75; EI9, Pos. 38; EI10, Pos. 101), b) standards for good practice in production recognized by retailers but without explicit product differentiation or significant value addition (EI9, Pos. 37; EI0, Pos. 82), and c) premium certifications like organic management that generate price premiums, maintain consumer visibility, and often operate under public management (EI1, Pos. 346).

Huelva has established itself as a global leader in the certification of its fruit, with producers[10] viewing these credentials as crucial for market differentiation and competitiveness (EI7, Pos. 15; EI14, Pos. 133). Consultants guide producers through implementation and certification processes (EI7, Pos. 9), ensuring compliance with baseline requirements demanded by retailers (EI1, Pos. 54; EI4, Para, 54; EI5, Pos. 81). The standards effectively verify agreed-upon practices between producers and retailers, streamlining verification processes that would be impossible for retailers to conduct individually with each supplier (EI4, Pos. 46). However, producers increasingly view additional certifications beyond the baseline not as a means for consumer recognition or price premiums, but rather as a necessary market entry mechanism for doing business with retailers. They feel that it is like a kind of 'tax' that has to be dealt with yearly (EI10, Pos. 91). This dynamic is intensifying as heightened public awareness of environmental risks drives retailers to demand additional certifications and compliance measures from producers (EI14, Pos. 145). While certification systems have become firmly embedded in the berry sector's governance structure, their function has evolved from a tool for market differentiation to a basic requirement for market access. This shift reveals characteristics that can potentially limit their capacity to drive meaningful environmental improvements.

6.1.2 Structural Limitations in Implementation

The implementation of certification systems reveals several fundamental challenges that limit their effectiveness in driving environmental improvements. A prevalent concern across stakeholders is the phenomenon of audit fatigue, stemming from the proliferation of certification requirements and their associated bureaucratic demands (EI7, Pos. 53; EI10, Pos. 103; EI3, Pos. 28). While it is acknowledged that auditing systems help in establishing the

[10] In the discussion of the empirical results of my research, I refer to my interview partners who were commercial and technical managers within cooperatives as producers, as the function of the cooperatives is to represent the interests of the producers.

integrity of the supply chain (EI3, Pos. 28), this benefit must be weighed with the costs in time and labor for complying with exhaustive requirements. One consultant explained:

> *"…They say: 'Well, another? [redacted], I don't want more.' Because they have more than five or six every single year. So they're very tired about the certificate. They think is like a… a tax, you know? Yeah, something that they have to do every year. Otherwise they cannot sell to the European supermarkets." -EI7, Pos. 53*

In emphasizing this point, another stakeholder explained that producers then have to dedicate more time to the administrative processes of certification than this is realistically contributing to improved environmental practices (EI3, Pos. 149). While the standardization of certifications in the sector has helped to set a certain level of practices, it becomes counterproductive where this system devolves into a proliferation of various different standards, each with their own set of demands (EI6, Pos. 85).

Actors acknowledge that despite the standardization in guidelines of these market-based value chain governance mechanisms, audits and controls are subjected to human error and influence (EI5, Pos. 81; EI6, Pos. 93). In particular, NGOs express concerns that auditors may look away when certain non-compliances are detected, and are complicit in enabling potentially detrimental practices (EI14, Pos. 167; EI6, Pos. 93). This is mirrored by retailers' attitude that auditors are challenged with making nuanced decisions in determining compliance, and that other motivations can factor into this choice, leading to an inaccurate representation of practices (EI15, Pos. 157). In general, however, the network of actors in Huelva's berry sector express expectations of a high-level of integrity of professionals, implying that these instances are generally few and far between (EI9, Pos. 46). The certifications are only effective to the extent where they are implemented correctly. Generally where there is demand in the value chain for the product, the supply chain will provide this product, regardless of whether or not it is certified (EI6, Pos. 89). Furthermore, a perspective shared by an environmental specialist indicated that certification of one farm in one country does not necessarily mean the same thing as when a farm is certified with the same standard in another country due to differences in public regulations (EI6, Pos. 89). A general trend appears to be that although something is labeled, this does not necessarily mean that it is better, or that the practices reflect what the assumption of the label is (EI13, Pos. 178; EI8, Pos. 86).

An additional limitation presents itself in the red tape inherent in certification systems. For retailers and other value chain actors conducting due diligence in establishing the chain of custody, it becomes difficult to ascertain which standards and certifications apply to specific farms due to issues in information systems and codes. Typically, producers must provide their certifications to their cooperatives, which then have identification codes enabling importers, exporters, and retailers to track supplier certificates (EI5, Pos. 81; EI14, Pos. 117). A consultant

explained that traceability is a critical area needing improvement - the supply chain steps must be traceable to show that farms themselves are certified, not just cooperatives or company headquarters (EI14, Pos. 114). While sophisticated quality control systems enable tracing fruit to specific plots (FN2, Pos. 38), information on individual farms' environmental practices cannot be similarly communicated through the market-based certification system. The bureaucratic burden of certification systems, combined with challenges in audit quantity, integrity and traceability reveals fundamental limitations in their capacity to effectively drive environmental improvements, rendering a closer examination of the challenges of implementation and opportunities for effectiveness necessary.

6.1.3 Opportunities for Effective Environmental Governance

Certifications enable a streamlined communication along the value chain on actions taken to improve environmental performance in production (EI3, Pos. 157; EI4, Pos. 54). This added value further cements the wide-adopted governance mechanisms in Spain's fresh fruit and vegetable value chains (EI8, Pos. 60). While it has been established that certifications have been effective in fostering an overall improvement in the environmental impacts of production (EI5, Pos. 85), these improvements have largely been related to responsible input management, rather than in furthering the development of innovations in alternatives to agronomic practices (EI3, Pos. 19). A common thread that emerged from the discourse was that opportunities for growth and learning need to be promoted in production, and that incremental changes require support mechanisms beyond certification (EI8, Pos. 86).

A promising opportunity lies in the collaborative development of standards. For example, one of the most commonly implemented standards in the fresh fruit & vegetable industry is developed jointly by representatives from retail and producers. The standards are hence written as the product of a collaborative discussion (EI15, Pos. 202). However, both certification agencies and retailers agree that additional resources are needed for the meaningful implementation of the targets set (EI8, Pos. 86; EI4, Pos. 159). When asked what resources producers need to make the demanded improvements in efficiency, a specialist from a certification agency stated that:

> *"Well first of all they need the advice, they need technology. Yeah, I think those are the two keys and. I think this comes through support — through external support we… We can expect that some farmers do that on their own, but if we want to have a real impact and have this in a scalable way that everybody does, that we need to provide them with resources to have access to this information and have access to technology. And that is one of the points that we found more challenging when developing the standards because we are talking here about the south of Spain, OK, they might have certain access to technology, but we write the standards for the whole world." -EI3, Pos. 84*

The specialist emphasized that understanding local context is critical in fostering scalable impact, enabling best practices to be adopted in a manner specific to each context. While standards are acknowledged as a ‘necessary tool’, they are not believed to be ‘the solution’ (EI14, Pos. 153). The collaboration of retailers in supporting standardized certification systems for environmental governance in their supply chains thus potentially further entrenches existing power dynamics, which is only partially addressed by the collaborative nature of standard development. These limitations in certification systems’ ability to facilitate knowledge transfer and capacity building have led to the emergence of alternative governance mechanisms. Multi-stakeholder initiatives have evolved to fill this gap, providing platforms for collective learning and implementation support that extend beyond the compliance-focused approach of traditional certification systems.

6.2 Architecture and Networks of Multi-stakeholer Initiatives

The effectiveness of multi-stakeholder initiatives hinges on how different actors interact, make decisions, and share power within the network. In this section, I analyze how stakeholders who are both actively or indirectly involved with the MSI of the Swiss supermarket retailer construct and navigate their roles within the MSI framework. The initiative emerged as a response to the limitations of certification systems, particularly in facilitating capacity building and knowledge transfer between value chain actors. Understanding the network’s composition, organizational structure, and relationships to parallel platforms and programs reveals how MSIs attempt to bridge diverse stakeholder interests while complementing existing governance mechanisms.

6.2.1 Network Composition and Motivations of Actors

What is immediately clear across the interviews with stakeholders, is that each actor in the value chain carries out their operations in the interest of their financial success and viability (EI10, Pos. 82; EI9, Pos. 41). However, their operational viability rests in the precarious position between the internal decision-making of the firm, and the external factors which constrain these decisions, whether they be political, social, or environmental factors. Hence, actors must balance this interaction of internal and external forces when effectively taking action in their operations. The necessity of collaboration was made immediately clear by an NGO representative, who established that short-term individual actions may certainly lead to faster outcomes. However, where these actions take place in a void, they possess little capacity to generate meaningful impact. Instead, collaboration between actors creates the possibility for more effective and efficient joint problem-solving (EI2, Pos. 167). In such a collaborative dynamic, the roles of stakeholders evolve beyond their operational functions within the value chain to include collaboration and sharing of experiences in possibilities and challenges in operations.

Formally, in the MSI of the Swiss supermarket retailer, there is a set group of actors who are involved in the orchestration and implementation of the project. This includes the retailer, a group of seven suppliers (these range from large cooperatives to smaller organic production companies), a global certification company for agricultural practices, an environmental auditing company, and two trading companies (Medienstelle MGB 2019). Beginning at the end of the berry value chain, retailers construed their purpose within the MSI as initiators for developing projects to jointly address the environmental and social challenges faced by value chains of specific products – in the case of Huelva, the berries. One representative from the commercial department of a retailer explained that from a technical perspective, these challenges could be dealt with by simply deciding to source from elsewhere, allowing the retailer to also clear their reputation. However, this would not structurally solve the challenges in the long-term. Hence, retailers perceive incentives for collaboration with their suppliers and other advisors in both the functional roles of the supply chain, and experts in advisory roles of the environmental and social risks (EI4, Pos. 66; EI15; Pos. 64).

At the other end of the value chain, the producers primarily understood their participation in the MSI as fundamental to enacting the standards that supermarkets establish. By so doing, producers perceived the benefit to nature in fulfilling environmental governance demands, as well as meeting the demands of end consumers (EI10, Pos. 67). Tasks such as technical and quality controls, certification management, and commercial negotiations are positioned within the cooperatives. The cooperatives hence have the function of advising and controlling[11] the operations of berry cultivation in the *fincas* (EI10, Pos. 4). In turn, producers carry out the operational tasks of meeting environmental and social measures in their management of horticultural inputs and labor (EI8, Pos. 106).

These environmental and social measures are then checked annually by the environmental auditing company of the MSI, whom I did not have the opportunity to interview (EI15, Pos. 163). A global certification agency that operates tangentially to the MSI conceptualized the role of certification within such programs as providing the framework for the agreed upon targets and measures to track progress (EI3, Pos. 163). Positioned similarly at this juncture between producers and retailers are the traders. The trader understood their function in the value chain as such that they are responsible for ensuring that the demands of the retailer are met, and that these can be verified through establishing a thorough traceability of certificates (EI1, Pos. 321). Most interestingly, when asked about the role of importers in the multi-stakeholder initiative, a representative from a producer cooperative expressed that they are a "key piece in the project" (EI10, Pos. 71). This statement evoked the sense that the trader has a critical function in orchestrating the effective operations of the supply chain. The criticality

[11] Controlling, in the sense of quality controls.

of the involvement of traders in MSIs was also emphasized by a Spanish NGO (EI5, Pos. 105). However, the producer cooperative did not perceive the sense in the involvement of too many actors in the MSI, alluding to the management, the technical department, and the commercial department of a cooperative (EI10, Pos. 69). In discussing further along this line of whether other actors need to be more closely involved in the MSI and given a platform to represent their interests, it was explained that:

> *"Man, it is easier to reach an agreement between the two of us than between three of us. And if there are more parties, you understand? Of course, because each one has its own point of view of work. So, it is important that in a project like this there are many interested parties and that everybody contributes. Okay, yes, but in reaching an agreement and even in the mere fact of meeting to talk about this issue. I think it is a bit complicated, okay. In the end, I as a producer and you as a trader, not a marketer, as a consumer, not as the one who buys from me. At the end we agree on the type of work product and at the end how much the issue costs. Is that ok? I think that the main difficulty may be that of… that every question has it's different point of view." -EI10, Pos. 77*

By explaining the difficulties in balancing an inclusion of interests, and efficiency in achieving results, it was made clear that the structure and membership of the MSI needs to be tailored to specific targets. Hence, the goals of the MSI should neither become too broad nor too specific, and require consistent deliberation to refine and adjust their direction.

6.2.2 Organizational Structure

Beyond individual participation, the effectiveness of the multi-stakeholder initiative depends on how the interactions between these actors are structured and facilitated. The organization of decision-making processes essentially shapes how collective action materializes in practice within the MSI. In all fifteen interviews which I conducted with the experts, the most prevalent theme which consistently emerged was the importance of collective action across the value chain (EI2, Pos. 41; EI3, Pos. 28; EI4, Pos. 142; EI5, Pos. 93; EI6, Pos. 11; EI7, Pos. 15).[12] Indeed, the purpose of the MSI is to foster collective action and establish opportunities for capacity building (EI3, Pos. 161), which necessitates a dual directionality of communication in opportunities and challenges faced individually and jointly by participants. Similarly, an agricultural specialist from a Spanish NGO reflected that the MSI offers a critical opportunity for enhancing this management through a coordination of expertise from various perspectives. Furthermore, it was suggested that doing so would make sense of the complexity of the environmental challenges at hand (EI5, Pos. 93). A critical point was also made by the sustainability department of the retailer, that oversight of the initiative is crucial in establishing whether the project is achieving its environmental and social targets (EI15, Pos. 40). For this to be effective, a system of project management and coordination needs to be established to

[12] This is a condensed selection of the data which evoked this trend.

facilitate knowledge sharing and monitor resource management (EI2, Pos. 63). Beyond this project-level coordination however, a broader orchestration of the challenges in the sector as a whole needs to take place, as expressed by a researcher from the national government of Spain (EI13, Pos.141). For such coordination to be possible, not only are the financial and time resources necessary, but also an acceptance of the relevance of the mission on a political and social level (E13, Pos. 141).

A fundamental question was raised by the commercial department of the retailer, of how the culmination of a multi-stakeholder initiative can be established- at what point can the participants consider the goals attained, and the program completed (EI4, Pos. 134)? In elaborating further, it was suggested that progress in environmental and social performance is not fixed, but rather a continuous process of improvement (EI4, Pos. 142). This was in turn reflected in the emphasis of evolving external political, economic, and social influence on action to address environmental challenges. Hence, collective decision making in the sector must adapt to expand beyond the boundaries of the MSI. The MSI may act as a facilitator for this adaptation, given its goals, structure, and participants.

6.2.3 Parallel Platforms and Complementarity

The MSI operates within a broader institutional context where multiple platforms address environmental governance in berry production, albeit in different capacities. An examination of how these initiatives and platforms interact and complement each other offers insights into opportunities and challenges in coordinating collective action across Huelva's berry sector. One suggestion made by an NGO based in Switzerland was that the existing efforts need to be 'convened' to magnify the opportunity for impact (EI2, Pos. 163). This harmonized logically with what was repeated by many actors: one retailer from one country is, at the end of the day, a relatively small player within the entire value chain of the berries grown in Huelva, and has relatively little leverage (EI3, Pos. 28). However, the impression that these programs are establishing their "own private shows" was expressed by one berry sector consultant, demonstrating that there is a perception of competitiveness between initiatives with similar targets (EI9, Pos. 48). By contrast, a coordinator of one industry initiative focused on water management expressed a desire to collaborate with other projects in order to effectively manage resources in jointly addressing common challenges in the sector (EI14, Pos. 246). The coordinator explained further, however, that this collaboration is difficult to facilitate due to bureaucracy and grid-lock of decision-making within the schematic of the project's management (EI14, Pos. 248). Examples nonetheless exist of where this kind of collective action was previously possible in the sector, with a Spanish NGO representative explaining that initiatives which reflected engagement for common goals were successful in establishing advocacy networks for environmental practices (EI5, Pos. 93). Therefore it is critical that MSIs evolve to consolidate sector interests, as expressed by the project coordinator:

"And in my opinion this will be it will be key to see if it works out or not in the future because if it doesn't- there will be a big risk to transmit the impression locally that these programs are just another international project, another one, because these local producers, I tell you and you may have heard, they are a bit fed up with international demands and requirements." -EI14, Pos. 254

In another vein, the coordinator explained that a collaboration with other platforms for stakeholders such as producer organizations could facilitate a broader exchange of perspectives, setting a precedent for collective action in the sector (EI14, Pos. 240).

Interest in this direction was also expressed by a regional government agricultural researcher who explained that the knowledge-sharing work that their office facilitates would be amplified by the inclusion of the producer organizations (EI11, Pos. 345). However, as was explained to me by one consultant, efforts to expand the frameworks of the producer organization to encompass environmental and social pressures are limited by tradeoffs between reaching "low-hanging fruit, and dedicating resources to addressing the most pressing issues" (EI9, Pos. 36). Instead, the function of the producer organization is understood as representing the interests of the sector to government bodies (EI7, Pos. 15). Along these lines, cooperatives feel that the government should be participating in these initiatives, as the limitations on the use of common-pool natural resources is determined by legislations (EI10, Pos. 73). Thus, this cycle upwards in recognition of power of influence within the value chain, and in a broader sense within the agricultural system, indicates that participation in collective action is not limited solely to the boundaries of the multi-stakeholder initiative. For this reason, a closer examination of power is necessary to conceptualize the dynamics of diffusion and infusion of environmental governance in the context of sector-wide sustainability initiatives.

6.3 Manifestations of Power in Horticultural Value Chain Governance

While the multi-stakeholder initiative creates new spaces for collaboration and knowledge sharing, its operation remains fundamentally shaped by existing power relations in the value chain. Understanding how these power dynamics manifest reveals the initiative's capacity to facilitate change within established market structures. The positionality of the supermarket is established by one fundamental point: supermarkets decide where to procure their products from, in which quantity, and at which price point (EI1, Pos. 36; EI7, Pos. 139). Producers, on the other hand, must ensure compliance with standards communicated to them from the supermarket via internet platforms and other formalized requirements (EI1, Pos. 102). Hence, in establishing their demands for a matrix of criteria such as quality standards in freshness, flavor, appearance, taste, and size to name but a few, in addition to sustainability standards in agricultural input use, supermarkets are effectively steering the operations of producers (EI9, Pos. 21; EI10, Pos. 76). Furthermore, the supermarket establishes the lists of criteria and

protocols which must be enacted, and the work is carried out by the rest of the value chain actors (EI10, Pos. 67, EI4, Pos. 205). However, this becomes particularly challenging where each international supermarket actor has its own demands on sustainability criteria that are given to producers, and these demands need to be unified (EI10, Pos. 106).

This power dynamic extends to both foreign and domestic markets. In one packhouse that I toured on a field visit, entire lines of the operations were dedicated to a large Spanish supermarket retailer, with specific requirements on packaging materials, sizes of boxes, and quality criteria that had to be met by the cooperative (FN3, Pos. 9). NGOs acknowledge that where there is involvement of food retailers, that "these voices dictate where things are going" (EI2, Pos. 171). Furthermore, they express the position that it is the responsibility of supermarkets to contribute to solutions to these environmental problems, as they are viewed to have profited from bad practices (EI2, Pos. 187). This cohered to other statements, sharing that the retailers face the most media attention and have the most outwards exposure to scrutiny and are pressured to comply with consumer demands and regulatory mechanisms (EI8, Pos. 74). In turn, the external pressure from markets is crucial in generating an impetus for change in environmental practices in production (EI13, Pos. 240). However, a quality expert for a trading company emphasized that it is the consumers who have a determining function in pushing an agenda for sustainability in the product that they purchase from the supermarket (EI1, Pos. 163). Nonetheless, it was acknowledged that one of the primary decisive factors for consumer purchasing decision is price, before sustainability criteria (EI1, Pos. 199). However, the markets which establish these prices exist due to one core fact: the retailer has a market for the product, because the consumer has a demand for it (EI11, Pos. 335; EI15, Pos. 9).

Interestingly, a word that reoccurred throughout interviews with stakeholders was "pioneer" (EI3, Pos. 89; EI4, Pos. 13; EI7, Pos. 191; EI14, Pos. 133). This consistently demonstrated an admiration for leading players in the value chain that take action beyond their established practices. One consultant explained that in initiating their own program for sustainability in their berries procured from Spain, the retailer went beyond the standard in the industry and set an example for what is possible (EI7, Pos. 135). A cooperative additionally expressed this admiration for the "pioneering spirit" and a high value for the Swiss supermarkets as business partners. When I asked why this was, the commercial department executive from the cooperative explained to me that the Swiss consumers have more money, and hence more willingness to buy higher quality products, and this in turn finances and drives innovation (FN2, Pos. 16). The sustainability representative from the retailer corroborated this point in explaining that the advantage for Switzerland as an importing country is in being able to demand more performance in terms of quality and sustainability through offering compensation of a higher price (EI15, Pos. 64). In this manner, the supermarket functions in setting an impetus for environmental practices among upstream value chain partners.

However, the capacity of one supermarket from one country to leverage much change is limited, as was expressed by the Swiss NGO, who advises supermarkets on their sustainability policies (EI2, Pos. 171).

Despite aims of collective governance, examining how decisions are made, resources are allocated, and priorities are set demonstrates how pre-existing dynamics between actors continue to influence environmental governance outcomes.

6.4 Concepts at the Regime Level of Analysis

The themes that emerge in discussing environmental certification of production and the orchestration of multi-stakeholder initiatives with stakeholders in the value chain of Huelva's berries are concentrated on aspects of governance, in particular that of power. In this discussion on governance in the berry sector, it became evident that producers are confronted with a complex set of certifications and demands that must be met in order to enter markets defined by European supermarket retailers, further entrenching aspects of hierarchical power in the value chain. Bain (2010) discusses the involvement of large-scale producer and trader organizations to restructure aspects of power in these certification systems through a consolidation of sector interests. During my interviews, stakeholders nonetheless described limitations in these standards. Specifically, they explained that certifications for environmental and social practices in production vary in their visibility to downstream value chain actors, and the additional value that they generate for producers. Additionally, the process of certifying production appears to do little to effectively facilitate innovation uptake and a structural transformation in production systems (Ponte and Chenys 2013; Ransom, Bain and Higgins 2013). Thus, stakeholders are involved in MSIs that build further on the environmental governance offered by certifications (Konefal 2015; Beermann, Freund and Fuentelsaz 2022). Within the MSI, differences become apparent in how stakeholders perceive their involvement and impact in facilitating sustainability transitions. While aspects of power concentration with supermarkets is a consistently reemerging trend, the impact of the reinforcement of these power dynamics on the efficacy of the supermarket-led MSI in generating a sustainable transition across the sector is partly under-conceptualized (Clapp and Fuchs 2009; Krishnan, De Marchi and Ponte 2023).

Additionally, given the complexity of transactions in the berry value chain and high levels of coordination and subordination between growers and traders, the role of traders in MSIs necessitates a closer assessment (González-Ramírez et al. 2020). In particular, the role of importers as facilitators of governance and the middleman between producers and retailers is critically under-analyzed, as is also found by Grabs and Caredenuto (2021). These power dynamics between producers, traders, and retailers in MSI governance reflect broader sociopolitical and economic structures that shape environmental governance in global value

chains (Gibbon 2003). While retailers can drive environmental improvements through their market position, their ability to effect change is itself constrained by landscape-level factors. Understanding how these broader contextual elements influence governance outcomes requires examining the political, social, and economic dynamics that shape both opportunities and limitations for environmental improvement in Huelva's berry sector.

7. Political and Socioeconomic Landscape Pressures

A core point emerged from the assessment of the regime-level of interaction of actors engaging in sustainable innovations in the Spanish-Swiss strawberry value chain: the transformation potential of environmental innovations through the orchestration of multi-stakeholder governance is fundamentally shaped by broader market, institutional, and socio-political forces. In Huelva, conversations with stakeholders show that the complex interactions between regional agricultural policies, international market pressures, and local implementation challenges create both opportunities and barriers for sustainable development in the horticultural sector. By providing an examination of how these landscape-level pressures influence environmental governance and innovation adoption, I present critical insights into the capabilities and restrictions faced by the multi-stakeholder initiative for sustainable berries from the region. I do so through the analysis of stakeholder perspectives which engage with key dimensions of the landscape context. The discourse from the expert interviews revealed significant tensions between economic pressures and ambitions for sustainability in Spain's strawberry capitol. These tensions were primarily characterized by the foundation of a trend of economic development intersecting with intensive resource use in an environmentally critical context. In tandem, governments are pressured to respond through policies to subsidize production, or enable the provisioning of further resources for production. Simultaneously, the rising environmental challenges from intensive production generate public attention through the media, NGOs, and subsequently, international consumers from export markets. As a result, supermarkets initiate multi-stakeholder initiatives to counter both environmental and social risks in their supply chains, as well as reputational and regulatory risks to their own business operations which arise from increased consumer awareness. Parallel to this, consumers' willingness to pay for imported produce is affected by impressions of product value and impact. Subsequently, retailers consider sourcing elsewhere in order to be able to continue to fulfill demands for quality fruit at a reasonable price that also meets standards for environmentally sustainable practices. Lastly, producers experience an enhanced pressure on price margins due to rising threats of foreign competition, and increased production costs for attaining certifications and adopting agronomic innovations in their operations. Hence, the cyclical nature of prices, competition, and environmental impacts is made apparent. By examining these landscape-level pressures characterizing this cycle, I illuminate how broader contextual forces enable or constrain environmental innovation and governance in Huelva's berry sector.

7.1 Regional Development and Agricultural Policy

In this section, I investigate the dynamics characterizing the economic context of berry production in Huelva, and the political framework within which the agricultural economy of Andalusia interacts. By disseminating the exchange between economic performance with the formal and informal institutions that shape the economic context of the region, I set a framework for understanding the emergence of a chain of reactions between local and global actors. These reactions occur in response to the intensive resource use and environmental impacts of berry cultivation, and foster the emergence of environmental governance in the value chain.

7.1.1 Andalusian Agricultural Economy

In describing the centrality of the strawberry sector for the economic prosperity of the region, actors in Spain referred to the development of towns in the region which experienced expansion and growth as a result of the economic success of the berry industry (EI6, Pos. 17). It was communicated to me that a significant share of employment was either the direct or indirect result of berry cultivation, with primarily locals working in packhouses, foreign migrant laborers working in the fields, and companies specialized in agricultural services developing parallel to production (EI7, Pos. 29). The criticality of the continuation and the prosperity of the agricultural sector was emphasized by a researcher from the regional government, who expressed that the berries are the financial fuel to the regional economy (EI11, Pos. 76). Additionally, a consultant specialized in social and environmental certifications for producers explained that the costs of the work for picking the fruit make up nearly 80% of the total costs of production. They described further that there technologies for picking are as of yet insufficient or ineffective in reducing the costs of labor, due to the physical qualities of the fruit (EI7, Pos. 33).

Notably, the financial success of the sector is not just locally important, but internationally as well. The industry provides employment opportunities for foreign laborers, who often can secure a higher income than in their domestic countries through field work in Huelva's berry tunnels, as was explained to me by the coordinator of a forum for ethical social and environmental practices in production (EI8, Pos. 44). While the employment of migrant foreign labor is a crucial element in establishing the competitiveness of the berry sector, it is coupled with significant instances of practices that establish poor working conditions and compensation (EI9, Pos. 40; EI15, Pos. 169). Through the process of my field work it became starkly apparent that social sustainability and environmental sustainability were two sides of the same coin and one could not be considered fully independent of the other. Labor, while not the core focus of the stakeholder interviews, became a recurring theme in discussing the financial aspects of addressing the environmental challenges faced by the sector. Fundamentally, labor is the foundation of production, and it is this labor that all actors in the

chain who contribute to value generation wish to have compensated. As implementing environmental sustainability measures is coupled with additional labor, it was widely understood and accepted that these efforts also need to be financially compensated (EI7, Pos. 107; EI15, Pos. 34).

Critically, a representative of a Spanish NGO pointed out to me that the adoption of these environmental practices presents a 'win-win' for the industry, as not only does this result in a reduction of pressures on ecological systems, it also establishes the long-term viability of the sector (EI5, Pos. 53). Through securing this mutually profitable approach, both the ecological and economical importance of the region can be recognized, as was also suggested by a specialist on efficient irrigation infrastructure from an advocacy agency (EI6, Pos. 17). However, it was also suggested that the opposing forces of managing supply and demand represents a duality that is fundamental to the agricultural economy, referring not only to the supply and demand of the product, in this case the berries, but that of the agricultural inputs necessary for production (EI14, Pos. 184). The agricultural economy of Andalusia is dependent on natural resources that are managed and regulated by government policies (EI13, Pos. 60). Yet, the regional government is perceived to be beholden to the interests of the lobby of the berry sector given its economic relevance, as was suggested by a researcher from the national ministry for the environment (EI13, Pos. 33).

As the natural resources for agricultural production are critically at risk, approaches diverge in governing the management their availability and use. From the perspective of the producer organization, the path forward in addressing limited availability of water, is in constructing waterways and establishing further infrastructure of hydrological engineering to increase the supply (EI7, Pos. 67). This would confirm the impression expressed by a sustainability expert of the retailer that the goal of the region is to further expand production and increase economic growth (EI15, Pos. 191). Another consultant reiterated this statement, conveying that through financing infrastructure to improve the availability of water, the sector would be pushed to scale further, rather than experience a relief on the intensive use of resources (EI14, Pos. 140). Hence, a fundamental disconnect between responses to limitations of collective natural resources arises, representing a balance between economic interests and environmental impacts. As this dilemma cannot be resolved by the market, the role of deliberation and decision-making transcends to regional and national governments.

7.1.2 Regional-National Policy Tensions

Perceptions of the functionality of the national government and opinions on their roles in steering the economic activity of the berry sector varied across stakeholders. While one consultant expressed a positive impression that the government "wants to help" (EI9, Pos. 30), another expert from a Spanish NGO explained the ineffectiveness of public governance, as the government often fails to enforce legislations, specifically regarding legal use of water (EI5, Pos. 41). The interest areas and operations of the levels of government are concerned with distinct, yet interconnected areas. As was explained to me from a government official for a national research institute, the national government and the subsidiary confederations of the river basins, are responsible for the allotment of water use rights to producers (EI13, Pos. 33; EI5, Pos. 67). Land rights that allow producers to grow their crops on specific plots, however, are managed by the regional government of Andalusia (EI65, Pos. 105). Hence, it becomes evident that the competencies of these agencies are highly fragmented (EI13, Pos. 33). A local project manager explained that this represents a critical issue, and that more coordination between the levels of government is necessary to establish effective solutions (EI14, Pos. 308). This was confirmed by the National Park researcher who stated:

> *So if the whole thing is… it gets complicated. Then you have the town halls, the municipalities. Yeah. They are also in charge of competences. Is, is fragmented and each of them have a different aim to achieve and normally they work in isolation so there is no coordination and this coordination, this lack of coordination and this lack of application of actual legislation that has to be fulfilled didn't work out. (EI13, Pos. 38)*

Furthermore, other experts explained that this coordination is difficult to orchestrate due to differences in the agendas and interests of political parties, with differences in which party controls which level of government (EI6, Pos. 11; EI13, Para 160; EI14, Pos. 174). There appeared to be a general trend towards stronger government involvement, with an actor from one NGO explaining that legislation is becoming more restrictive to address environmental concerns, and existing measures are being more actively enforced (EI5, Pos. 67). However, a fundamental point was made that government officials often try to frame the issue as a 'this or that' choice between nature and the economy, stating that this is completely false, as the economy, in fact society as a whole, is structured entirely on the basis of a functional and healthy environment (EI13, Pos. 82).

Hence, what emerges from this discussion on the role of governments with diverse stakeholders, is the necessity to found policy decisions in a recognition for environmental pressures and not allow political decision-making to be compromised by economic self-interest (EI14, Pos. 174). The immediacy of finding a functional political solution was made clear by the local project coordinator who stated that:

"Well, I think the solution in the end in can only come from a governance point of view. Yeah, if there is all these movements on, yeah, market-driven initiatives, certifications. No, come together able to influence the governance decisions. So for example, the hydrological plans and the plans from the government to restore the Doñana. I think in the end if there is a legal obligation from the government for doing something this this will. This is the what will finally happen. I think this… the final solution well. I think it's a combined as always, but in the end they need to come to governments to influence the government's decision." -EI14, Pos. 306

A representative from a cooperative also agreed that the government places a critical role in enabling resource use and providing funding through subsidies (EI10, Pos.73).

One such movement towards a political solution are the plans of the national government to provide financial incentive to producers near the Northern Crown of the Doñana to move their production elsewhere to reduce ecological pressure on the National Park resulting from intensive resource use (EI7, Pos. 139; EI13, Pos. 66). Both actors in Switzerland and in Spain expressed skepticism, however, as to the success of this policy measure (EI2, Pos. 45; EI13, Pos. 196). Nonetheless, they agree that this legislation package will be a puzzle piece of the larger picture of a political solution for the dilemma between environmental conservation and the continued prosperity of the strawberry sector. In this manner, steps are being made to address both financial support for operations of the berry industry to modernize and improve access and use of natural resources, while also addressing environmental pressures caused by the intensive resource use of the industry.

7.2 The Context of Socio-Environmental Pressures

Public awareness in response to the environmental repercussions of intensive and partly illegal resource use in berry cultivation in Huelva has grown in tandem to emergent government actions. This results in two directions of consumer, and more broadly, social responses. Firstly, consumers are demanding information on the environmental and social sustainability of the products from retailers, and secondly, their impressions and value of Huelva's berries are altered, affecting their willingness to buy. These responses are critically shaped by information shared by the media. The resulting positions adopted by consumers hence generate pressure on the value chain to address environmental and social concerns, leading actors to initiate MSIs for capacity building.

7.2.1 Global Public Awareness of Local Environmental Challenges

In the downstream operations of the value chain, the shared impression from actors is the rising attention paid to the sustainability criteria of food products by consumer in making purchasing decisions (EI1, Pos. 350; EI4, Pos. 209). Particularly in the case of the Spanish strawberries, my interview partners shared that seemingly every consumer has developed some opinion on whether it is good or bad to buy the imported berries out of season (EI8, Pos.

66; EI2, Pos. 75). When asked why they felt this was, a representative from an NGO based in Switzerland explained to me that no other fruit has as emotional a response from consumers as the strawberries. They explored this further, stating that consumers care more about issues that are visible to them. For the berries grown in Huelva in proximity to the Doñana, this is very much the case (EI2, Pos. 33). A specialist in irrigation management raised the same point, explaining further that:

> *We have areas with like Malaga and Granada with avocados and mangoes, that there is a big problem on the water. In Almeria, you know they don't have water either. They, it's true, they are using this this salt plants and all of this, but I don't have the perception that there is a pressure on these crops or areas in Spain, compared with the one that we are receiving in, you know, strawberries. Everybody knows about the strawberries in Huelva. […] Why everybody knows about the problem of the strawberries? So there is a lot of pressure. -EI6, Pos. 72*

Thus, the conversations with these stakeholders indicate that the attention paid to Huelva's strawberry sector is not necessarily a congruent reflection of the severity of the environmental risks which it generates, though these risks are nonetheless to be taken seriously.

However, the pressure that originates with the consumer as a result of the information that they do have access to largely indirectly affects producers, and primarily directly pressures retailers to take action. One actor from the retail sector explained that although one option to respond to these risks could be to move sourcing to an area with less public attention to environmental risks, that this makes little sense in the long-term, as it only would result in moving the issues to a new location (EI4, Pos. 66). Both a project coordinator and a retail sector sustainability specialist explained that the primary motivation in initiating, or participating in a multi-stakeholder initiative in Huelva was to mitigate these risks to the retailer's reputation (EI14, Pos. 49; EI15, Pos. 44). A commercial department representative from the retailer stated that consumers have become more objective in their purchasing decisions, and that they have been sensibilized by the media that critically and objectively analyzes the situation (EI4, Pos. 83). A pivotal moment during my field work is reflected aptly in an excerpt from my field notes:

> *A particular moment happened when I asked about the concerns of consumers in the European market about the impacts on the Donana from strawberry cultivation. Here, [redacted] repeated emphatically: "A ellos, les digo: 'No me conoces. No me conoces. No me conoces.'* [13] *I could really sense the emotion behind this statement- the frustration at having demands and pressures from people who have little to no idea what is actually being done in production. This felt like a critical moment in my research for me, because it clearly showed the importance of the emotional, cultural, and*

[13] In English: "To them I say: 'You don't know me. You don't know me. You don't know me.'"

interpersonal values and beliefs that are the foundation for the interaction of all of the actors in the system. -FN2, Pos. 14

Stakeholders repeatedly reflected that while the attention to sustainability criteria from consumers is important, that consumers frequently have neither the expertise to fully grasp the complex dynamics of the context of production and the value chain, nor do they have access to the necessary information to do so (EI1, Pos. 350; EI4, Pos. 83; EI10, Pos. 84). In particular, a representative from a producer cooperative expressed the impression that consumers fail to understand what the costs of production are (EI10, Pos. 84). A researcher from the regional agricultural institute explored this further stating that the information about the aspects of production that are communicated to consumers is a critical issue that needs to be resolved (EI11, Pos. 241). In turn, retailers attempt to monitor the information which consumers have access to in order to understand and respond to their resulting evolving demands (EI4, Pos. 74). However, the risk of false impressions gained by consumers about the products and the reflection of these impressions in the patterns of their demand was made apparent by a specialist who stated:

"And in the other hand- because it always happens- in Germany, when the crop and the season starts and they start selling their berries, there are always: "Bad News About Spain" because the German berries are two, two Euros more expensive. So the German consumer needs to think: "I'm going to pay two more Euros for our berries, because they are German, and by the way, the people that is producing this is not exploited." Because you're in Germany, you know? And nobody is telling them: "Maybe you are not right.'" -EI8, Pos. 66

Therefore the information which is shared to consumers can only be as effective as the perceptions and opinions which it generates, presenting a complex dilemma to the value chain in understanding the mechanisms that bridge the value chain to the consumer.

7.2.2 The Instrumentality of NGO and Media Attention

Two actors operate in facilitating the information exchange between producers and consumers- the media and non-governmental organizations (NGOs) tasked with addressing environmental and social issues. NGOs are tasked with advocating for the conservation of nature, and facilitating practices that reduce environmental pressures (EI2, Pos. 111; EI4, Pos. 146). NGOs collaborate directly with MSIs to establish practices in berry cultivation that fulfill their environmental and social goals (EI4, Pos. 145). One the other hand, the role of the media became a recurring theme in discussing the public scrutiny of Spanish strawberries with stakeholders. The public interest and attention of the media was understood to be a result of the proximity of production to the Doñana National Park (EI4, Pos. 58; EI6, Pos. 11; EI11, Pos. 297; EI13, Pos. 73). However, a critical issue that arose is that the media often makes a complicated issue much simpler than it is in actuality. This oversimplification distracts from the

complexity of different actors all having a different impact on the same system, as was explained by two industry consultant, alluding to the demands placed on natural resources by other crops such as almonds, oranges, and rice, or other industries such as mining and tourisms (EI6, Pos. 148; EI, Pos. 29). The potential of the media to also have a positive impact on the issue beyond raising alarm, was also discussed by stakeholders, who suggested that information could be communicated to the public on the results of initiatives for improvements in the sector by these platforms (EI6, Pos. 64). Additionally, another actor emphatically explained to me, that the involvement of the media is in fact a good thing, in that it generates awareness and impetus for change. Hence, the freedom of the press needs to be protected (EI8, Pos. 66). These discussions on the role of the media indicated the necessity for a nuanced and factual communication of information to the public.

In following the path of the chain of reactions of stakeholders in response to critical environmental resource use from within to beyond the direct operations of the value chain, I highlight the importance of the media in outcomes in consumer demands. Moreover, this path illustrates the dynamics by which systematic economic and social pressures for environmental governance in production emerge.

7.3 Market Structure and Economic Pressures

The cause for international awareness of the environmental impacts of the Spanish strawberries is likely a result of not only the Doñana National Park, but also the export orientation of the sector and globalized nature of the value chain. For this reason, producers and other value chain actors are exposed to the attention of consumers, both near and far. A closer examination of the dynamics of the global competition of markets for producing berries allows for insights into the impact of arising pressures of price on operations in Huelva's berry sector and their environmental impact.

7.3.1 National-International Market Interface

Although the domestic Spanish market represent a crucial segment for producers, the majority of income is generated by the demand for berries from foreign markets (EI10, Pos. 84; FN2, Pos. 16; FN3, Pos. 12). Huelva distinguishes itself as a market leader in the production of berries that meet a variety of demands from Europe's powerful supermarket retailers. The red fruit is produced with certified practices compliant with demands for environmental and social performance baselines from international retailers, and are available for a prolonged season (EI5, Pos. 23). Producers are generally motivated to adopt standards in order to attract business from this segment, and in turn, retailers value the favorable business relationship (EI6, Pos. 108). However, the sector is exposed to pressures from foreign competitors in production, such as Morocco. Although stakeholders approached the topic of sourcing from Morocco from different perspectives, a common theme of a desire to avoid a move of

supermarket berry procurement further south of the Straits of Gibraltar was apparent throughout the interviews (EI5, Pos. 23; EI6, Pos. 89; EI7, Pos. 49). From the perspective of the retailer, a commercially smart decision would perhaps be to move sourcing to a country with lower exposure to risks, and a lower price point for the product (EI4, Pos. 66; EI15, Pos. 232). However, the commercial department representative from the supermarket explained that this an unfavorable choice, as it fails to systematically address the issue at hand (EI4, Pos. 66). A representative from a Swiss NGO expressed the necessity to support the business of responsible producers. If responsible producers become unprofitable and disappear, sourcing will have to be relocated elsewhere, where ethics and responsibility in production operations is less certain (EI3, Pos. 58). In this sense, Spain enjoys a competitive edge in being able to offer retailers greater confidence in the quality, safety, and sustainability of their products, beyond the ease of logistics in mainland Europe (EI8, Pos. 34).

Nonetheless, situations arise where the retailers, faced with a lack of availability in the market, source from countries that are not perceived to uphold the same standards regarding labor and natural resource use (EI6, Pos. 89). One specialist remarked that the supermarket retailers desire to buy “Spanish fruit with Moroccan prices” (EI9, Pos. 14). Another researcher expressed the sense that this is critically unfair to Spanish producers, as they are mandated to comply with the regulations of the European Union as well as private demands from retailers, whereas non-European producers do not face these same pressures (EI11, Pos. 97). Another consultant expanded on this point in expressing that the competitive setting of Mediterranean berry producers is made further challenging for the Spanish actors, due to their compliance with European legislation (EI7, Pos. 49). As a result of this pressure, large specialized companies have begun to relocate their production to Morocco, as was related the following anecdote:

> *“You know, I know one importer that was participating in our events that one year, one year told me “[Redacted], I would love to keep coming here because it's really useful, we really learn a lot but we are stopping buying in Spain.” And I say: “Why?” “Because we are going to buy in Morocco:” and I said: “But you are here because the working conditions…” and they said: “It is for us much cheaper and we have realized that the impact of the working conditions in Morocco are not known in Europe. So for us, paying more- because we know that in Spain the working conditions are not like the ones in Morocco- doesn't make any change, you know. So they move, they moved to Morocco because of this reason, you know? And I said, OK, this is a big alarm, you know.” -EI8 Pos. 62*

Hence, competition in the globalized market for fresh red fruit creates a context emulating patterns of the ‘race to the bottom’, in which producers seek lower operation costs, while sacrificing environmental and social practices. This trend in a relocation to countries with lower

costs of production reflects the centrality of pressures on price to the business operations of value chain actors.

7.3.2 Value Distribution Patterns

A sentiment shared by the actors interviewed in Spain was that the economic and environmental issues faced by the berry sector pivot on the axis of markets. These markets, however, give rise to immense pressures on price to producers, setting tight margins for profit (EI3, Pos. 189; EI5, Pos. 243; EI8, Pos. 60; EI9, Pos. 13; EI11, Pos. 331) (see figure 10 on page 96). Additionally, a certification specialist recognized that sometimes the market constructs prices that offer producers compensation below the cost of production. Instead producers need to compensated fairly, so that they don't disappear, as their existence in the European Union is fundamental to ensuring sustainable practices in the value chain (EI3, Pos. 58). Both a Swiss trader and a Spanish NGO expressed that in fostering a willingness to pay for domestic products, domestic producer associations indirectly contribute to a lower willingness to pay for foreign berries, exacerbating pressures on the profit margins of Spanish producers and constraining their financial ability to invest in agronomic innovations to address environmental risks in their operations (EI1, Pos. 284; EI8, Pos. 60). However, these practices to ensure responsible environmental and social management in production generate costs for producers, which need to be financially compensated, either by retailers, or by consumers (EI5, Pos. 157; E11, Pos. 333). A conversation with a quality manager from a producer cooperative strongly evoked this fundamental frustration with markets:

> ***EI10:*** *I think that if there is something in common at the end it is to make a product that is interesting, right? Because both the one who sells it and the one who consumes it, yes, that the product is interesting, that it tastes good, that it has a good view, that, that, that, in short, that it is free of residues, no? Within the margins set by the limits. Yes, that's the idea, isn't it? That's the idea. Yes, that's it. That's what they have in common. At least in the end. What divides us is that I think this is worth one euro. And you say no, that one euro is very expensive. That is to say, I sell this for one euro. And the consumer buys it for three. Yes, maybe I have production costs and I can't sell it for less than the production costs, plus my profits. And maybe the consumer says that I buy it at too high a price from the consumer, from the producer to the consumer, okay.*
>
> ***INT:*** *Do you think the consumer understands this?*
>
> ***EI10:*** *I don't think so. I don't think so, no. There is something that the consumer doesn't understand that I do. Sometimes they don't even believe it. Yes, that I have this. That I have a production cost, one euro, to tell you something. That's right. And then you have to buy it three or four times more. No, that is not understandable. It is not. You know that the free market Europe is free and the market is free. Everyone sells as they demand, supply, supply, demand. No, nobody can control the subject. And I think that is where there is more division of opinion, no? Yes, yes, because you, as a consumer, you would like to consume the cheapest.*

And me, if I sell as a producer, I would like to sell the most expensive. Do you understand me?

***INT:** And the certificates or labels with the information? If it is a blueberry with good water use?*

***EI10:** It is very important that at the end the consumer knows the whole issue that has a certain labeled certificate so that he understands the origin, how does it go? As you do not understand. This is so important.*

***INT:** And with [redacted: certificate] for example, it is not visible to the consumer.*

***EI10:** The consumer? No. No. He doesn't know what it's about. He doesn't know. Yes. I have the feeling that the final consumer of the fruit does not understand that. -EI10, Pos. 82-88*

This conversation reflected an essential dilemma faced by producers of meeting consumer demands, while being able to generate supply with the required criteria and a profitable price. A consultant additionally stated that production costs aren't fixed by the law, indicating a structural difficulty in balancing the pressures of supply and demand in the market (EI9, Pos. 44).

Figure 9. Strawberries (Fresón de Palos) sold at a local supermarket in Huelva for €1.95 for 500 grams. Huelva, Spain.

Source: Own image.

A compelling solution to the challenges faced by the berry sector was presented by the researcher for the national environmental ministry: they suggested that the overall production area could be decreased through enabling producers to achieve the same level of profitability at a lower volume of production by means of a higher price point paid to producers (EI13, Pos. 188). This could be achieved through two channels- either a) consumers must become willing to pay more for Spanish strawberries, or b) governments need to subsidize production with

environmental incentives. If there is less on offer, then producers can get higher prices, which is additional incentive why producers don't want the illegal operations around, beyond just the harm to the reputation of the sector (EI8, Pos. 52). I encountered the reality of the expansive production during a field visit to a finca in Lepe in mid-May, near the end of Spain's berry season, and the beginning of Switzerland's. Rows of strawberry plants were laden with ripe berries, that, to me, appeared to be perfect, and tasted so as well. However, the quality manager of the cooperative explained to me that operations to maintain and manage these crops had been ended, as the market no longer enabled the producer's to achieve a profitable price for these operations. Incidentally, domestic demand was also not sufficient to incentivize continuing the crop management, and instead, the plants would be removed and the soil exposed to the sun (FN3, Pos. 12). Thus, the lack of harmony between the seasonality of production and the seasonality of demand emulates a critical challenge for sustainable resource use in berry cultivation.

With this closer analysis of the effect of global competition and the establishment of tight profit margins for producers by international markets, I have illustrated the dynamics characterizing the broader context that determines the playing fields of actors in implementing environmental practices in production.

7.4 Concepts at the Landscape Level of Analysis

By zooming out to assess the impacts of the economic, political, and social institutions that shape the operations of Huelva's berry sector both directly and indirectly, I establish a clearer picture of the landscape level that defines actors and the directions of their operations. Furthermore, the landscape level determines the uptake of innovations by these actors to foster a sustainable transition in the sector. Adopting this level of analysis allowed me come to a better understanding of the pivotal interaction between the market and the political institutions that shape its development. Additionally, this perspective has facilitated a grounded understanding of the impacts of information sharing across system actors. Specifically, it brings to light how information and its interpretations steer incentives and decision-making in innovation adoption for environmental governance in the value chain. These insights reflect elements of the socio-political drivers of environmental upgrading in value chains (De Marchi 2024; Lanari et al. 2024), and more broadly, the influence of corporate environmental food regime in the literature (Campbell 2009; McMichael 2021).

Fundamentally, the function of political institutions in the management of environmental risks associated with intensive cultivation is divided between a reinforcing pathway of economic productivity, and pathways of environmental conservation and governance of common-pool resource allocations (Lanari et al. 2024). While the intentions of the legislations and policies of these pathways logically should coincide to establish a sustainable use of

natural resources, they are characterized by an entrenched strategic mismatch, leading to outcomes of disincentives for an environmental transition in production (Campbell 2009). A critical suggestion arose from the interview process – the establishment of a stable scale of production in Huelva's berry sector presents opportunities to responsibly manage resource use of production inputs. However, the dialogues with stakeholders indicate that such a state of the sector can only be facilitated through a harmonization of both market and political instruments. Thus, it becomes apparent that the solutions to the environmental challenges of intensive horticultural production lie not entirely in market-based initiatives for environmental governance in the value chain, but also in supportive policies at the landscape level.

8. Towards a Sustainably Intensive Strawberry Value Chain

In my research, I set out to discover the potentials and challenges of multi-stakeholder initiatives in supporting the adoption of agronomic innovations to mitigate the environmental impacts of the Spanish-Swiss strawberry value chain. Subsequently, I sought an understanding how power relationships between value chain actors within the MSI influence the initiative's capacity to drive the adoption of environmental agronomic innovations. Furthermore, I also investigated how existing market-based and governmental requirements shape value chain actors' motivations for implementing environmental risk management practices in the value chain, within the framework of the MSI. I grounded my analysis in institutional and governance theory, using the Multi-Level Perspective framework to make sense of the complexity of sustainability transitions. In my research, I focused on key concepts including governance in horticultural global value chains, environmental upgrading, and sustainable intensification through agronomic innovations in berry cultivation.

The case study of a Swiss retailer's MSI in Huelva, Spain, which brings together producer organizations, importers, and certification agencies presented the case study which I used to investigate the questions which I put forth. Using a critical constructivist epistemology, I collected data through semi-structured expert interviews across Switzerland and Spain, including site visits to production facilities in Sevilla, Huelva, Moguer, Palos de Frontera, and Lepe. Using the MLP framework in my empirical research enabled me to analyze the interplay between niche innovations, regime-level changes, and landscape pressures in the berry sector. I analyzed the data using constructivist grounded theory, which revealed three distinct levels of transition dynamics at the niche, regime, and landscape levels. At the level of niches, discussions with stakeholders on environmental risks and innovations in production gave insights into the processes by which environmental upgrading takes place in the berry sector. At the level of regimes, conversations were focused on certifications for environmental governance, and the emergence of MSIs in the wake of the ineffectiveness of these certifications to secure necessary capacity building and knowledge sharing platforms for innovation uptake in production. At the landscape level, the dialogue with actors across the value chain and the wider system enabled me to understand the broader economic, political and social institutions and trends that give shape to the development of sustainable transitions within Huelva's berry sector.

8.1 Potentials and Challenges of the Multi-stakeholder Initiative

The multi-stakeholder initiative facilitates the uptake of technologies and infrastructure that increase efficiency in production and are intended to reduce environmental risks. However, this approach reveals fundamental limitations in addressing systemic challenges in intensive production and encouraging an agroecological transformation. Firstly, while efficiency

improvements reduce resource use, they are poised to lead to expanded production given reduced input costs, potentially undermining the environmental benefits of their uptake. Secondly, market institutions incentivize intensive production expansion to maintain economic growth, creating a paradoxical relationship between innovation uptake and environmental protection. The MSI's effectiveness is further constrained by limited engagement with political institutions. While government ministries possess relevant expertise and collaborate with producers, their involvement in MSIs remains minimal. When supermarkets launch individual MSIs, they can create lighthouse effects that demonstrate best practices. However, this often transforms environmental governance in the value chain into competitive advantages rather than driving systemic change. While joint platforms involving multiple retailers help diffuse this competitive dynamic, they face challenges in achieving transformative change without broader institutional support. These findings suggest that effective environmental governance requires harmonizing market-based initiatives with political frameworks while addressing power imbalances within value chain relationships.

8.2 Research Implications, Limitations, and Recommendations

These results offer insights into the potential and constraints of multi-stakeholder initiatives in horticultural value chains and their synergies with the ecosystems at the heart of agri-food systems. The findings highlight how sourcing strategies, price prioritization, and quantity demands influence environmental risk management implementation. The limitations of my research lie in several areas. While I was able to analyze the nexus between Spanish producers and Swiss retailers, I did not explore crucial elements such as consumer perceptions, media influence, and financial institutions' roles in shaping production technology investments. Additionally, language restrictions and time constraints limited the scope of stakeholder interviews and site visits. Further research on the interdisciplinary and interconnected concepts and dynamics at hand in the sociopolitical and economic landscape is necessary to make sense of sustainable transitions in agricultural value chains. Potential for future projects may investigate subsidy structures at EU, national, and regional levels. Furthermore, my research indicated that examining the role of financial institutions would give insights into the technological transformation potential of the sector.

8.3 Concluding Remarks

As global agricultural systems grapple with intensifying environmental pressures, the experience of Huelva's strawberry sector illuminates both the promise and limitations of market-based environmental governance, suggesting that lasting solutions lie not in isolated initiatives, but in the careful orchestration of market mechanisms, political will, and collective action towards truly sustainable food systems.

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Appendices

Appendix A

Semi.-Structured Interview Guide (for interviews conducted in English)

Beginning of the Interview	

• Welcome & thank you for participation.
• Time management
• Informed Consent- data and information will be anonymized and kept confidential.
  ○ *Provide participant with informed consent form.*
• "May I record this interview for transcription purposes?"
  ○ *Turn on recording, thank participant for their understanding.*
• Introduction of myself, the research project, and goal of the interview
  ○ Stakeholder engagement in the strawberry value chain. Focus: innovations for sustainable intensification as environmentalrisk management	

Diving In	

1. Can you introduce yourself for the recording, and please shortly explain, what your role is at *organization*?
  ○ How long have you been at *organization?*
  ○ What are your main aims/goals/ambitions in your role?	

Block 1: The Strawberry Value Chain	
2. Please describe the strawberry value chain as you understand it. 3. What steps/ parts of the value chain are the most important in your view? ○ Which actors are involved in these steps? Some more than others? 4. What is unique about the strawberry value chain? 5. What challenges are there in the strawberry value chain that are unique to strawberries as a fresh fruit commodity?	☐
Block 2: EnvironmentalRisk Management in the Value Chain	
6. What is unique about this region for growing strawberries? (physical attributes are the core focus) 7. What are the opportunities for growing strawberries in this region? 8. What are the challenges for growing strawberries in this region? 9. What are the environmentalconsequences of growing strawberries in this region? 10. How are these consequences managed? 11. Who is responsible for managing these consequences? 12. Who benefits from these consequences being managed?	

Block 3: Multi Stakeholder Initiatives	
13. Please describe your role in the Sustainable Strawberries project of the Swiss food retailer. 14. How do you perceive/understand Multi Stakeholder Initiatives? 15. Who should be involved in a MSI? 16. What are the strengths of MSIs? 17. What are the weaknesses of MSIs? 18. Have you been involved in other MSIs?	
Block 4 Sustainable Intensification of Strawberry Cultivation: Innovations	
19. What can be done, from your perspective, to make changes in the strawberry value chain to reduce environmentalconsequences? 20. What changes have been made in the strawberry value chain to improve environmentalrisks? o *If the stakeholder is not closely involved with production, prompts may include crop rotation, intercropping, water management, anaerobic soil disinfestation, pest management, fertilizer management.* 21. What resources have been necessary for these changes to be made? 22. Who has been responsible for providing these resources? 23. How have other stakeholders contributed to these changes taking place? 24. What has been the directionality of these changes? 25. What are the opportunities presented by these innovations? 26. What are the challenges for these innovations being adopted?	
Ending questions/remarks	
1. Future Outlook: How do you see this situation developing in the future? *2. Reflection and summary of the interview.* 3. Has there been anything that we haven't addressed that you feel is critical for me to know?	
End of the Interview	
• Are you available for any follow-up questions that I may have? Do your prefer telephone or email? • Would you be interested in reading the final report or summary (interested in the final results) • Thank you for your participation and time. • *Turn off recording*	

Semi-strukturierter Interview Leitfaden- für Interviews auf Deutsch

Beginn des Interviews	

• Herzlich willkommen & vielen Dank für Ihre Teilnahme.
• Zeitmanagement
• Einwilligungserklärung: Daten und Informationen werden anonymisiert und vertraulich behandelt.
  o *Ausstellung eine Einverständniserklärung an TeilnehmerIn.*
• "Darf ich dieses Interview zu Transkriptionszwecken aufzeichnen?"
  o *Einschaltung der Aufnahme, und Bedankung an TeilnehmerIn.*
• Vorstellung meiner Person, des Forschungsprojekts und des Ziels des Interviews
  o Stakeholder-Engagement in der Erdbeer-Wertschöpfungskette. Fokus: Innovationen zur nachhaltigen Intensivierung als ökologisches Risikomanagement	

Einstieg im Interview	

27. Können Sie sich für die Aufnahme vorstellen und bitte kurz erklären, was Ihre Rolle in der *Organisation* ist?
  o Wie lange sind Sie schon bei der *Organisation*?
  o Was sind Ihre Hauptziele/Ambitionen in Ihrer Rolle?
	☐
	
	☐

Block 1: Die Erdbeer Value-Chain "Wertschöpfungskette"	
28. Bitte beschreiben Sie die Erdbeer-Wertschöpfungskette, wie Sie sie verstehen. 29. Welche Schritte/Teile der Wertschöpfungskette sind aus Ihrer Sicht die wichtigsten? o Welche Akteure sind an diesen Schritten beteiligt? Die einen mehr als die anderen? 30. Was ist das Besondere an der Erdbeer-Wertschöpfungskette? 31. Welche Herausforderungen gibt es in der Erdbeer-Wertschöpfungskette, die es nur bei Erdbeeren als Frischobstware gibt?	☐ ☐ ☐ ☐
Block 2: Ökologische Risikomanagement in der Wertschöpfungskette	

32. Was ist das Besondere an dieser Region für den Anbau von Erdbeeren? (physische Eigenschaften stehen im Vordergrund) 33. Welche Möglichkeiten gibt es für den Erdbeeranbau in dieser Region? 34. Was sind die Herausforderungen für den Erdbeeranbau in dieser Region? 35. Was sind die ökologischen Folgen des Erdbeeranbaus in dieser Region? 36. Wie werden diese Folgen bewältigt? 37. Wer ist für den Umgang mit diesen Folgen verantwortlich? 38. Wer profitiert davon, wenn diese Folgen bewältigt werden?	☐ ☐ ☐ ☐ ☐ ☐ ☐
Block 3: Multi-Stakeholder Initiativen	
39. Bitte beschreiben Sie Ihre Rolle im Projekt Nachhaltige Erdbeeren des Schweizer Lebensmitteleinzelhändlers. 40. Wie nehmen Sie Multi-Stakeholder-Initiativen wahr? 41. Wer sollte an einem MSI beteiligt sein? Welche Akteure sind stärker oder weniger beteiligt an solchen Projekten? 42. Was sind die Stärken von MSIs? 43. Was sind die Schwächen von MSIs? 44. Warst du, oder deine Organisation, schon mal an anderen MSIs beteiligt? 45. Durch welche andere Initiativen oder Instrumenten müssten solche Projekte ergänzt sein, so dass sie erfolgreich sein können?	☐ ☐ ☐ ☐ ☐ ☐
Block: Nachhaltige Intensivierung vom Erdbeeranbau: Innovationen	
46. Was kann aus Ihrer Sicht getan werden, um Veränderungen in der Erdbeer-Wertschöpfungskette vorzunehmen, um die ökologischen Folgen des Anbaus zu reduzieren? 47. Welche Veränderungen wurden in der Erdbeer-Wertschöpfungskette vorgenommen, um ökologische Risiken zu verbessern? o *Wenn der Beteiligte nicht eng in die Produktion eingebunden ist, können Aufforderungen wie Fruchtfolge, Zwischenfruchtanbau, Wassermanagement, anaerobe Bodenentwesung, Schädlingsbekämpfung und Düngemittelmanagement sein.* 48. Welche Ressourcen waren notwendig, damit diese Änderungen vorgenommen werden konnten? 49. Wer war für die Bereitstellung dieser Ressourcen verantwortlich? 50. Wie haben andere Stakeholder zu diesen Veränderungen beigetragen? 51. In welche Richtung haben sich diese Veränderungen entwickelt? 52. Welche Chancen bieten diese Innovationen? 53. Was sind die Herausforderungen bei der Einführung dieser Innovationen?	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Letzte Fragen/ Anmerkungen	
4. Zukunftsausblick: Wie sehen Sie diese Situation in der Zukunft? 5. Reflexion und Zusammenfassung des Interviews. 6. Gibt es etwas, das wir noch nicht angesprochen haben, von dem Sie glauben, dass es für mich wichtig ist, es zu wissen?	☐ ☐ ☐

Interviewabschluss	
• Stehen Sie für weitere Fragen zur Verfügung? Bevorzugen Sie Kontakt per Telefon oder E-Mail? • Sind Sie daran interessiert, den Abschlussbericht oder die Zusammenfassung zu lesen (interessiert an den Endergebnissen) • Vielen Dank für Ihre Teilnahme und Zeit. • *Aufzeichnung ausschalten*	

Appendix B

Table 2. Information on the expert interviews.

Identifier	Interview	Date	Time	Place	Interview Partner	Length	Language	Notes
EI1	1	09.04.2024	10:00	Online, in Zurich, Switzerland	Swiss Fruit Logistics Provider	00:55:55	German	
EI2	2	09.04.2024	13:15	Office, Zurich, Switzerland	Swiss-Based NGO	00:53:22	English	
EI3	3	15.04.2024	10:00	Online, in Zurich	International Certification Agency	00:43:23	English	
EI4	4	18.04.2024	10:00	Cafe, Zurich, Switzerland	Swiss Supermarket- Commercial Department	00:31:14	German	Interview was planned with a different partner, who was unavailable
EI5	5	23.04.2024	11:30	Outside park, San Lucar La Mayor, Spain	Spanish-Based NGO	00:46:37	English	
EI6	6	24.04.2024	10:00	Office, Sevilla, Spain	Spanish Government Consultant	01:00:04	English	
EI7	7	30.04.2024	12:00	Office, Huelva, Spain	Spanish Consultant/Trade Association	00:46:35	English	
EI8	8	02.05.2024	16:00	Online, in El Rocío, Spain	Spanish-Based NGO	01:21:40	English	
EI9	9	13.05.2024	18:00	Cafe, Huelva, Spain	Independent consultant	ca. 2 hours	English	Interview partner did not wish to be recorded
EI10	10	15.05.2024	11:00	Office, Lepe, Spain	Spanish Producer Cooperative	00:46:10	Spanish	First half of recording with low audio quality
EI11	11	16.05.2024	10:00	Office, Moguer, Spain	Regional Government Consultant	01:04:15	English	
EI12	12	17.05.2024	10:00	Office, Sevilla, Spain	University Professor and Adivsor to an NGO.	01:03:20	English	Audio recording faulty, could not be transcribed and included in the analysis
EI13	13	17.05.2024	13:00	Office, Sevilla, Spain	Spanish National Research Institute	00:38:53	English	
EI14	14	20.05.2024	12:00	Online, Rota, Spain	International NGO	01:06:55	English	
EI15	15	08.07.2024	15:00	Office, Zurich, Switzerland	Swiss Supermarket- Sustainability Department	00:54:37	German	

Appendix C

The full field notes contained documentation of the images and notes taken during visits to the fields where strawberries were being grown. This took place in four locations in the main strawberry growing regions in the Southwestern region of Andalusia. The field notes document the experiences, insights, and thoughts I had as a researcher in the field, and give further elaboration on their organization and other contextual factors. These notes are shared with my thesis supervisor, in order to maintain the anonymity of the contact persons.

Table 3. Field notes information.

Identifier	Date	Time	Place	Notes
FN1	07.05.2024	18:00-20:00	Northern Perimeter of El Rocio	Informal
FN2	02.05.2024	12:00-13:45	Finca, and Packhouse & Warehouse of Cooperative in Moguer	Arranged (over contacts)
FN3	15.05.2024	12:30-13:30	Finca and Packhouse of Cooperative in Lepe	Arranged (over contacts)
FN4	16.05.2024	11:45-12:15	Finca of Regional Government Research Institute	Arranged

Appendix D

Table 4. Codes and category organization for qualitative content analysis.

Code System	Frequency
Categories	
Technologies and Innovations	**88**
Phases and Types	
Innovations for Sustainability	6
Innovation Development Niches	14
Innovation Implementation Regimes	9
Pathways	
Sustainable Intensification	14
Pioneering Approach	17
Water Management Technology	19
Plant Breeding	6
Hurdles	
Resistance of Producers to New Ideas	7
Innovations-Challenges	10
Networks and Stakeholder Engagement	**175**
Community Organization	
Trust within Community	14
Grower Cooperatives	8
Unite to Strengthen Position	8
Role of Farmer's Associations	16
Influence of Supermarkets	
Supermarket Power in Supply Chain	18
Supermarket Led Initiatives	12
Supermarket Partnerships	23
Collective Action and Collaboration	
Project Management	3
Stakeholder Engagement and Coordination	13
Collective Action Across the Value Chain	47
Collectivity	9
Collaboration of Initiatives	4
ESG and Business Risk Management	**77**
Responsibility	
Due Diligence in Supply Chains	9
No-Tolerance for Illegal Operations	8
Business Risks	
Media Attention and Public Scrutiny	21
Reputation of Downstream Actors	12
Regulatory Risks	5
Food Safety	3
Measuring Risks and Reporting	
ESG Risk Monitoring Tools	6
Transparency	5
Challenges of Performance Metrics	8

Local Context	**183**
Natural Factors	
Place-Based Context	26
National Park	12
Critical Biodiversity	11
Water Scarcity	14
Economic Factors	
Economic Development	6
Specialization in Industry	16
Intensive Strawberry Production	18
Social Factors	
Labor Conditions	13
Manual Labor	6
Upstream Actors Reputation	13
Inflated Focus on Strawberries	11
Challenge of Illegal Practices	12
Political Factors	
Regional-National Political Tensions	15
Regional Politics	10
Certifications and Standards	**65**
Benefits of Private Governance	
Collaboration on Standard Adaption and Development	8
Standardizing Certification	15
Potential of Certification	13
Challenges of Private Governance	
Limitations of Certification	15
Bias of Auditors	6
Audit Fatigue	8
Institutional Frameworks	**73**
Public Institutions	
Institutional Governance	23
European Agricultural Politics	6
Subsidies and Support	13
Institutional Challenges	
Enforcement of Regulations	15
Bureaucracy and Red-Tape	5
Challenges of Formal Institutions	5
Ineffective Public Institutions	6
Supply Chain Management and Logistics	**85**
Pre-Farm Gate	
Adequate and Effective Infrastructure	11
Logistics Operations	12
Traceability	11
Post-Farm Gate	
Role of Logistics Suppliers	14
Avoid Sourcing From Outside Europe	12
Supermarket Sourcing Weaknesses	6

Top-Down Pressures	19
Sustainability Management	**174**
Economic and Environmental Goals Tradeoffs	11
Complex Systems	10
Challenges of Achieving Environmental Sustainability	11
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AI Use Disclosure and Statement of Authenticity

I hereby declare that this thesis represents my own original work. Below I disclose my use of artificial intelligence tools in accordance with departmental guidelines:

AI Tools and Applications

- Perplexity AI Pro (Sonnet 2.5/R1):
  - Employed for conceptual organization and thesis outline development
  - Generated structural suggestions and feedback for clarity and coherence
  - **Verification:** All outputs were critically analyzed, cross-checked against academic standards, and manually adapted
- Coral AI Pro:
  - Assisted in systematic literature review of agronomic techniques by facilitating source organization and key term searching.
  - **Verification:** Final paper categorization was manually validated using NVivo coding protocol
- DeepL Pro:
  - Translated Spanish-language interview transcript
  - **Verification:** Carried out a manual check of translation output and confidentiality review of original Spanish text
- Word Online:
  - Automated interview transcription (audio → text)
  - Verification: 100% manual correction of transcripts. Speaker identification and timestamp validation

Compliance Statements

- No AI system generated final content without human oversight
- All core arguments and conclusions derive from original analysis

Ethical Confirmation

- I affirm compliance with the AI Policy of the University of Zurich
- I affirm the human verification of all machine outputs
- No sensitive data was entered to cloud-based AI systems

Zurich, 31. January 2025

Isabelle Bürger

Personal Declaration

I hereby declare that the submitted thesis is the result of my own, independent work. All external sources are explicitly acknowledged in the thesis.

Zurich, 31. January 2025

Isabelle Bürger