Drivers and Barriers to Sustainable Viticulture: Evidence from Organic and Biodynamic Winemakers in Champagne

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ABSTRACT

This thesis aims to identify drivers and barriers of environmental sustainability in the Champagne wine region of France. Although France is one of the leading countries in sustainable, namely, organic viticulture, Champagne region is underexplored in academic literature, particularly in regard to small-scale wine producers. It is especially significant, since 90% of the vineyard land is owned by small and medium-sized enterprises, many of whom practice sustainable viticulture. Given the prevalence of small producers in the region, their environmental impact is significant, and their perspectives and experience are key for understanding sustainable developments in viticulture within the region. Thus, the following research question is formulated: *What are the drivers and barriers to sustainability in the Champagne wine region among small-scale organic and biodynamic producers?* To adress this question this thesis employes qualiative research, focusing on four case-studies of wineries committed to organic and bidynamic approaches. The data was collected through semi-structured interviews with winemakers and analysed through thematic analysis. For the purpose of arranging the interviews with wine producers, a fieldtrip to Champagne was conducted. The findings are presented both as separate case studies and as a cross-case analysis of recurring themes related to the sustainable viticulure. The analysis confirmed the relevance of existing models of environmental sustainability, namely those catagorising drivers and barriers as internal, external and strategic factors. However, an additional category of institutional barriers was revealed, associated with challeges imposed by regulatory frameworks and regional administrative bodies. These findings provide both academic and practical insights into an underrepresented group of Champagne winemakers, revealing important implications for policymakers and future research.

KEYWORDS: sustainability in viticulture, drivers and barriers to sustainability, environmental certifications, wine producers, Champagne.

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1. Introduction

Viticulture is a key agricultural sector globally, with an estimated market value of $333 billion (Zappelini et al., 2025). Being an intensive form of agriculture, viticulture has a significant environmental impact, ranking among the highest within the broader context of the agricultural industry (Masson et al., 2021). Conventional viticultural practices, such as the use of herbicides and synthetic pesticides to manage pests and diseases, are prevalent in 89% of vineyard areas globally (Masson et al., 2021). Other challenges caused by conventional viticulture are associated with water use, emissions and chemical waste, pollution and harmful influences on local areas (Gabzdylova et al., 2009). Growing consumers' awareness regarding health and environmental risks, caused by conventional winemaking, contributed to the increasing popularity of more sustainable approaches to viticulture.

One of the most widely adopted approach – organic viticulture – refers to farming practices that prioritise the protection of natural resources and biodiversity by minimising the use of chemically synthesised products and genetically modified organisms. The global area under organic viticulture has been expanding over the past decade at an average annual rate of 13%, resulting in 6.2% of all vineyards being organically certified (International Organisation of Vine and Wine (OIV), 2021). France, being one of the leading countries for the organic wine production, accounts for 24% of the world's organic vineyard area, with 14% of its domestic vineyards now certified organic (International Organisation of Vine and Wine (OIV), 2019).

Another sustainable approach to viticulture is biodynamic farming. Frequently considered an extension of organic approach, biodynamic viticulture goes beyond organic principles, prohibiting the use of synthetic chemicals, instead relying on naturally made substances (Demeter International, n.d.). There is a close relationship between organic and biodynamic viticulture; namely, biodynamic producers are required to meet organic certification standards before transitioning to biodynamic approach (Baiano, 2021). Globally, more than 600 wine producers are certified as biodynamic, with approximately half located in France. This accounts for almost 4,700 hectares, making France the leading country in biodynamic viticulture (Castellini et al., 2017).

Sustainability in viticulture has increasingly gained attention among researchers. Many studies examine sustainability in the wine sphere through the prism of factors that drive or hinder sustainable development in the sector. Prior research has often focused on specific country case studies, for example, Gabzdylova et al. (2009) and Dodds et al. (2014) explored sustainability dynamics in the context of New Zealand wine industry. Other case studies

emphasise smaller wine regions, treating, for instance, the role of eco-certifications in sustainable development in small wine producing area in Italy (Ceccacci et al., 2024). Apart from the socio-economic factors, some research also explores qualitative aspects of sustainably produced wines (Delmas et al., 2016) or chemical composition differences between conventional and sustainable wines (Moyano et al., 2009).

Despite these contributions, no previous research has investigated the wine producing region of Champagne in regard to sustainable viticulture, particularly in the context of organic and biodynamic approaches. This is notable, since France is one of the leading countries in organic viticulture globally. The region of Champagne, in particular, is an interesting case, as small and medium winemakers (SME's) own approximately 90% of the land under vineyards, making them key contributors to sustainability progress (Comité de Champagne, n.d.). Still, existing research tends to overlook these smaller producers, resulting in their underrepresentation in the academic literature. Given their prevalence and impact on the environment, it is of key importance to investigate their specific motivations and challenges in the transition to sustainable practices. To address this gap, the following research question was formulated:

What are the drivers and barriers to sustainability in the Champagne wine region among small-scale organic and biodynamic producers?

Specifically focusing on the experiences of organic and biodynamic producers of Champagne, this study provides empirical data that contributes to understanding of sustainability drivers and barriers in the unique context of Champagne. Moreover, this research proposes an extended categorisation of environmental sustainability constraints, thereby contributing to a more comprehensive and adaptable model applicable to various wine regions.

Apart from scientific contribution, this study offers practical insights for the wine industry. The exploration of drivers and barriers to sustainability provides insights into how local policies and incentive programs can be structured to support winemakers in their sustainable efforts. Moreover, by highlighting motivations and challenges of small-scale wine producers, this study contributes to increased visibility of the underrepresented producers within the broader context of sustainable viticulture.

Given that the aim of this study is to investigate perspectives on drivers and barriers of sustainability within a group of small-scale winemakers, qualitative research was employed to collect in-depth data on their experiences, motivations and challenges. Thus, the primary set

of data was obtained through semi-structured interviews conducted with organic and biodynamic winemakers in the Champagne region. These interviews formed the basis for four case studies, which allowed for cross-case synthesis of the findings and led to identification of sustainability drivers and barriers specific to the context of the region.

The remainder of the thesis is structured as follows. Chapter 2 provides an overview of the development of academic research on sustainable viticulture. It outlines the main approaches, such as organic and biodynamic viticulture and explores the role of eco-certifications in sustainable winemaking. This chapter also introduces the theoretical framework for this study, focusing on existing models of sustainability drivers and barriers, which are later compared to the findings of this study. Next, Chapter 3 describes the methodology, focusing on the reasons for adoption a qualitative approach, explaining the process of case study selection and data collection through semi-structured interviews and strategies employed for data analysis. Chapter 4 presents the results of the analysis in the form of four case studies, highlighting specific drivers and barriers to sustainability that were identified in the interviews with wine producers. Finally, Chapter 5 discusses the findings in relation to existing literature, reflects on the limitations of the research and outlines societal implications of the conducted study.

2. Theoretical framework

This chapter provides theoretical background on sustainability developments and issues in viticulture. Building on existing research on drivers and barriers of sustainability, as well as environmental certification schemes, this study's theoretical foundation is formed, with a particular emphasis on the role of small-scale producers in sustainable development in the Champagne region.

2.1 Sustainable development in agriculture

Sustainability has become a central issue in debates concerning environmental challenges. One of the first attempts to define sustainability was made by the United Nations, referring to sustainability as to "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 1987, Chapter 2, Section 1). In line with this definition, more recent sustainability-driven initiatives were established world-wide. The 2030 Agenda for Sustainable Development, emphasising 17 Sustainable Development Goals (SDGs) and the Paris Agreement on Climate Change provide a global framework for sustainable development. These strategies go hand in hand with the three-pillar conception of sustainability (Purvis, 2018) that integrates efforts made in environmental, economic and social dimensions. The European Union (EU) tackles these areas by implementing nation-wide programs. European Green Deal – an initiative to reach carbon neutrality by 2050 demonstrates Europe's commitment to eliminate environmental and climate pressures (European Commission, n.d.). Additionally, the 8th Environment Action Programme (EAP) provides actionable objectives that ensure reduction of greenhouse gas emissions, transition to a circular economy, preservation and restoration of biodiversity, as well as zero-pollution efforts (European Environment Agency, n.d.). Environmental issues are also addressed by the Common Agricultural Policy 2023-2027 (CAP) that promotes greener farming practices and finances eco-schemes, incentivising organic farming and other sustainable approaches to agriculture. In particular, one of the most common sustainable approaches - organic farming - is regulated by the Regulation (EU) 2018/848 that outlines the rules on organic production and labelling of organic products.

As a niche of agriculture, wine sector tends to focus more on the environmental dimension of sustainability due to its significant ecological footprint (Alessandri et al., 2024). Although it receives less attention than more industrialised chemical or manufacturing sectors, the wine industry poses several environmental challenges (Dodds et al., 2013).

Gabzdylova et al. (2009) recognizes five major groups of environmental issues: the use of water and land, greenhouse gas emissions, organic and chemical waste, and the impacts of chemical spraying, noise and genetic modification on local communities. To tackle some of these issues regulatory frameworks have been developed to encourage more sustainable practices. For instance, there is a dedicated section to viticulture in the European regulation 2018/848 on organic produce, that outlines specific requirements for organic viticulture. Among the rules are an exclusive use of organically grown grapes and yeasts for wine production; the use of sorbic acid and desulphurisation processes is prohibited and overall sulphites levels must be lower than those permitted in conventional wines, depending on the residual sugar content (EU Regulation 2018/848).

Drawing on the EU-level frameworks, individual member-states implement organic standards through national and regional authoritative bodies. The two key issues, important for understanding environmental sustainability in the context of viticulture, are available eco-certification schemes on global and national level, as well as the nuances of sustainable winemaking. Consequently, next section addresses these points by introducing currently existing environmental certification bodies; and discusses the regulations behind organic and biodynamic approaches to viticulture.

2.2 Organic viticulture: national certifications

Since the focus of the study is the French region of Champagne, it is necessary to discuss the national context of sustainable development. In this regard, France ranks comparatively high in international environmental sustainability ratings. According to the Sustainable Governance Indicators (SGI), France holds the eights position due to its relatively low CO2 emissions and recognised efforts in biodiversity preservation. Nevertheless, France faces significant challenges, including a higher-than-average temperature increase of 1.9°C compared to the global average of 1.15°C, reflecting the broader impacts of climate change (France Report, SGI, 2024).

As part of the national program, French organic production is certified by L'Agence Biologique (AB), whose rules completely correspond to the Regulation (EU) 2018/848. The AB logo can be displayed on wine labels to demonstrate producer's compliance with European organic regulations. AB certification focuses more on the product, not only guaranteeing the organic nature of the wine and its ingredients, but also strictly tracking the composition and production inputs (L'Agence Bioloqique, n.d.).

In contrast, Haute Valeur Environnementale (HVE) (High Environmental Value) places emphasis on the ongoing processes on farms and vineyards, encouraging more environmentally friendly farming practices within four areas: biodiversity conservation, plant protection, management of fertiliser use and management of water (Comité de Champagne, n.d.). This certification does not require a fully organic conversion, offering three levels of participation, although only achievement of Level 3 allows producers to use the official HVE label on their products (L'Association Nationale pour le Développement de la Certification Haute Valeur Environnementale, n.d.). For an overview of certifications, refer to Table 1.

2.3 Biodynamic viticulture

Sometimes described as a radical evolution of organic agriculture, the biodynamic movement is closely connected to the environmental sustainability principles (Castellini et al., 2017). Indeed, as Santoni et al. (2022) demonstrate, biodynamics and organic agriculture share most of the regulations, with latter, however, imposing extra obligations, as biodynamics does not allow certain practices commonly found in conventional winemaking. For instance, the use of GMO's, additives such as sorbic acid, Polyvinylpolypyrrolidone (PVPP), diammonium phosphate, and animal-derived fining agents are strictly forbidden by certificating bodies (Santoni et al., 2022).

In its essence, biodynamic agriculture refers to "holistic, ecological and ethical" approach to farming, dating back to 1924 (Demeter International, 2025, para.1). Founded by Rudolf Steiner as a response to increasing use of chemicals in agriculture, biodynamic movement was based on anthroposophy theory, which emphasises the interconnectedness of all life and encourages farming practices to be tuned to natural rhythms (Castellini et al., 2017). By connecting humans, plants, animals and soil, biodynamic movement strives to turn farms into living organisms, where each element nurtures the other (Demeter International, 2025). Certain practices, for example the use of special natural herbal and mineral preparations, are made to increase the quality and fertility of the soil and combat diseases (Demeter International, 2025). Additionally, the farm operations are regulated by a specialised calendar that aligns with lunar and planetary cycles, meaning that certain activities, like planting or harvesting, can only be arranged on certain days (Castellini et al., 2017). Considering these unique practices, it is understandable why some view biodynamic farming more as a spiritual belief than a scientifically grounded approach to sustainable agriculture (Castellini et al., 2017). Still, the number of biodynamic farms is growing,

reaching nearly 8,000 globally in 2024, 1,439 of which are vineyards across 30 countries (Demeter International, 2025). In France alone, there are 1,081 farms, with 709 dedicated to viticulture (Demeter France, 2024).

Demeter International is a global federation supporting biodynamic agriculture through a network of national member organisation across 63 countries (Demeter International, 2025). Each member of Demeter International Association is responsible for the control of the application of biodynamic guidelines outlined by Demeter locally. Together, biodynamic farmers adhere to the core principles of the biodynamic approach, which include regeneration, human-nature integration, fostering of thriving environments, ethical inclusion of animals, social and ecological responsibility (Demeter International, 2025).

A similar philosophy is shared among the members of a smaller-scale organisation - Biodyvin (Syndicat International des Vignerons en Culture Bio-Dynamique). Founded in France, this union of biodynamic winemakers nowadays spans across several European countries, including Germany, Greece, Italy, Moldova and Portugal (Biodyvin, n.d). Their commitment to biodynamic principles is expressed through a slogan: “nothing added, nothing taken out, nothing changed”, highlighting a careful approach to the winemaking (Biodyvin, n.d., para. 7).

It is necessary to note that being organic is a minimum requirement to start transitioning to biodynamic farming (Castellini et al., 2017). As a result, all biodynamic wines carry a double certification (Baiano, 2021): one confirming their organic status, and another issued by an international body such as Demeter or Biodyvin. For an overview of certifications, refer to Table 1.

Table 1: Overview of Environmental Certifications

Name of certificating scheme	Main Characteristics	Scope
Organic Agriculture (AB)	A certification scheme compliant with EU regulations on organic agriculture	National certification (France)
HVE (High Environmental Value)	A certificating scheme focusing on farming practices with three optional levels of participation.	National certification (France)
Demeter	A certificating scheme for biodynamic farming, including but not limited to viticulture.	International certification, globally recognised label
Biodyvin	A certificating scheme for biodynamic viticulture.	Transnational certification, mainly focused on European wine-producing countries

2.4 Drivers of sustainability in wine production

One of the theoretical frameworks approaching sustainability is related to the identification and analysis of driving and hindering factors behind sustainable transition. This section delves deeper into the drivers specific to the wine industry. The overview of these factors is presented in Table 2. Various studies have explored drivers of sustainability, highlighting its importance within the sector (Gabzdylova et al., 2009; Dodds et al., 2013; Ceccacci et al., 2024).

Sustainability drivers are typically characterised into internal and external factors, as well as strategic considerations – depending on the circumstances (Dodds et al., 2013; Ceccacci, 2024). Among the determining internal factors emphasis is placed on the environmental concerns (Gabzdylova et al., 2009; Ceccacci et al., 2024), as well as ethical choices of the producers and general behavioural factors (Ceccacci et al., 2024). Other significant influences are altruistic reasons and personal convictions (Hauck et al., 2021) together with personal satisfaction with the profession of a winemaker (Gabzdylova et al., 2009). It is pointed out that internal motivations can be more influential than external factors (Ceccacci, 2024), however, there is no reason to downplay the importance of external issues, such as climate change (Blackmore and Goodwin, 2009), the need to comply with regulations

(Gabzdylova et al., 2009; Pomarici et al., 2015), export procedures and constraints imposed by major retailers (Pomarici et al., 2015).

Additionally, certain strategic factors are considered complimentary in encouraging sustainable transformations. In a case study examining the drivers of environmental sustainability in New Zealand wine industry, Dodds et al. (2013) concluded that strategic drivers were among the least influential, with internal drivers being the most significant, followed by external drivers. However, factors such as competitive advantage, differentiation, marketing benefits, public image, brand reputation, quality of product and cost savings were identified not as the most significant drivers, but rather as consequences of adoption sustainable approaches in the wine business (Dodds et al., 2013).

In terms of microbiological quality of wines, it has been argued that organic wines contain lower levels of sulphites and pesticide residues compared to conventionally produced examples (Alonso González et al., 2022) with some studies indicating that these differences may influence overall wine quality (Čuš et al., 2010; Alonso González et al., 2022). Given that European consumers are particularly concerned about pesticides residues among other food safety concerns (EFSA, 2022), it is of key importance for wine producers to strive for lower pesticides levels, which can be achieved with the adoption of sustainable vineyard practices.

Additionally, organically certified wines are perceived by consumers to show superior quality to the non-certified samples (Delmas et al., 2016). It is reflected in a study on Californian wines conducted by Delmas et al. (2016) that approached the research by analysing expert wine reviews of 74,148 samples. Having positive effects on wine ratings, adoption of wine eco-certification can also incentivize wine producers to transition towards more environmentally friendly practices, acting as a driver of sustainability.

Table 2: Overview of Sustainability Drivers Identified in Existing Literature

Drivers of sustainability identified in literature	**Type**	**Source**
Environmental concerns	Internal	Gabzdylova et al., 2009, Ceccacci et al., 2024
Personal satisfaction with the profession	Internal	Gabzdylova et al., 2009
Product quality	Strategic Factors	Gabzdylova et al., 2009, Dodds et al., 2013

Compliance with regulations	External	Gabzdylova et al., 2009, Pomarici et al., 2015
Ethical choices	Internal	Ceccacci et al., 2024
Behavioural factors	Internal	Ceccacci et al., 2024
Altruistic reasons	Internal	Hauck et al., 2021
Personal conviction	Internal	Hauck et al., 2021
Core requirements for export	External	Pomarici et al., 2015
Pressure from large retailers	External	Pomarici et al., 2015
Competitive advantage	Strategic Factors	Dodds et al., 2013
differentiation	Strategic Factors	Dodds et al., 2013
Marketing benefits	Strategic Factors	Dodds et al., 2013
Brand reputation	Strategic Factors	Dodds et al., 2013
Public image	Strategic Factors	Dodds et al., 2013
Cost savings	Strategic Factors	Dodds et al., 2013
Climate change	External	Blackmore and Goodwin, 2009
Consumers awareness of carbon footprint, food miles and traceability	External	Dodds et al., 2013
Social responsibility	External	Dodds et al., 2013
Protection of agricultural land	Internal	Dodds et al., 2013

2.5 Barriers to sustainability in wine production

Despite the above established sustainability drivers, existing frameworks highlight the importance of considering issues that can hinder sustainability efforts in the wine sector. The overview of these factors is presented in Table 3. Dodds et al. (2013) classified several internal factors as barriers to adopting sustainable practices: absence of effective leadership, as well as lack of specific knowledge and skills. In a case study related to New Zealand wine industry, it has been highlighted that external issues associated with high upfront costs to become a certified member of a sustainable wine organisation discourage some producers from adhering to sustainable guidelines (Dodds et al., 2013). Additionally, the issues of limited commitment to sustainability from other actors within the supply chain (Signori et al., 2017) and bureaucratic obstacles to certification (Ceccacci et al., 2024) are found to be another set of external barriers.

Due to inconsistent and limited evidence on wine quality as a determining factor for sustainable changes, it is important, in author's opinion, to introduce context-specific studies that may help to clarify the role of wine quality in stimulating sustainable transitions. For instance, by employing chemical and sensory analysis Moyano et al. (2009) compared aromatic profiles of Spanish sherry wine made from conventionally grown grapes versus organic grapes. This study concluded that although wines made from conventionally and organically grown grapes shared similar aromatic profile, ecological wines had reduced aromatic intensity. Since sensory attributes of wine, such as aromas, are directly associated with the quality of wine (Moyano et al., 2009), this finding can be perceived by some winemakers as a sign of wine quality degradation, discouraging their efforts in transitioning to more environmentally sustainable approaches.

Table 3: Overview of Sustainability Barriers Identified in Existing Literature

Barriers to sustainability identified in literature	**Type**	**Source**
Absence of knowledge	Internal	Dodds et al., 2013
Absence of effective leadership	Internal	Dodds et al., 2013
Lack of sustainability orientations from other actors of the supply chain	External	Signori et al., 2017
Obstacles associated with bureaucratic procedures in the certification process	External	Ceccacci et al., 2024
Unsuitable weather conditions	External	Hauck et al., 2021

2.6 Small-scale wineries and sustainable transition

Another set of factors, influencing sustainability progress in the wine sector, relates to the size of wine producing companies. Regarding the correlation of the firm size and the levels of employing environmentally conscious practices, some conflicting evidence needs to be examined. On the one hand, larger wineries are considered to be more likely to integrate environmentally sustainable practices due to strategic motives, such as market positioning (Spielmann, 2017). Other studies, however, do not find firm size to be a determining factor in practicing sustainability (Muscio et al., 2013), suggesting that the sustainability concept itself may be interpreted differently, depending on the company (Szolnoki, 2013), highlighting a subjective nature of the sustainability adoption.

The ambiguity is particularly relevant due to the wine industry structure. As discussed by Dodds et al. (2013), a significant proportion of wine-producing companies worldwide are considered small and medium-sized enterprises (SMEs). Within the European Union, SMEs account for 99% of all businesses (European Commission, n.d.). While the specific definition of an SME may differ per region, in the EU a medium-sized enterprise refers to a company that employs fewer than 250 people, a small enterprise has fewer than 50, and a micro-enterprise has fewer than 10 (EU Recommendation 2003/361). This classification is particularly evident in regions like Champagne, where the majority of the vineyards are owned by small-scale grape growers – *vignerons* (Charters and Menival, 2008).

Given the prevalence of SMEs in the wine sector, particularly among organic and biodynamic producers, further research is needed to examine the motivations and obstacles smaller wine enterprises face when choosing environmentally sustainable approach to viticulture. Champagne, a region with a high concentration of small winemakers, who are committed to environmental values, serves as a relevant case study to explore sustainability-related decisions in practice. Thus, this study focuses on understanding the key drivers and barriers influencing the adoption of environmentally sustainable viticulture practices among small-scale organic and biodynamic producers in the Champagne region.

2.7 Champagne: background information

According to the Comité de Champagne[1] (n.d.), there are approximately 16,300 small-scale farmers, who collectively own 90% of the land under vines, in contrast to the 10% owned by larger Champagne Houses. The two principal to this research types of champagne producers are Négociant manipulant (NM) and Récoltant manipulant (RM). NM corresponds to wine companies (Champagne Houses) that buy grapes from the farmers and produce their own wine, while RM, otherwise known as 'grower producer', makes champagne exclusively from their own grapes (Stevenson, 2005). This producer structure highlights an ongoing dual dynamic in which growers not only cultivate grapes for sale to the Champagne Houses but also vinify and market their own wines.

In terms of environmental sustainability efforts, the region of Champagne is thought to be the pioneer of sustainable development, as it was the first wine region in the world to assess its carbon footprint in 2002/200 (Comité de Champagne, n.d.). Winemakers of the region increasingly demonstrate their commitment to sustainability in several areas: biodiversity, circular economy, water and carbon footprint (Comité de Champagne, n.d.).

These communal efforts were translated into an ambitious goal – by 2030 all the winemakers should commit to one of the certifications: Organic Agriculture (AB), Haute Valeur Environnementale or Sustainable Viticulture in Champagne, a regional sustainability framework, designed with consideration to Champagne-specific conditions. Currently, approximately 60% of the viticultural land is certified by one of the offered schemes (Comité de Champagne, n.d.).

Having outlined theoretical perspectives on sustainable viticulture, emphasising drivers and barriers to sustainability, next chapter introduces the methodological approach adopted to this study. Namely, it presents the research design, as well as procedures undertaken for data collection and analysis.

3. Methodology

This chapter deals with the methodological approaches applied to this study in order to answer the following research question: *What are the drivers and barriers to environmental sustainability in the Champagne region of France?* In particular, this study focuses on small-scale organic and biodynamic Champagne producers.

3.1 Research design

Providing a thorough strategy for data collection, data measurement and analysis, research design is essential to conducting the study. For this investigation qualitative research method was used, as it allows to examine participants' interpretations of the phenomena in question (Bryman, 2016). By focusing on human experiences and interpretations, qualitative methods rely on qualitative data, rather than numerical, essentially providing framework to analyse "words", rather than "numbers" (Bryman, 2016, p.375). Considering that the objects of this research are organic and biodynamic winemakers of Champagne, qualitative approach is well-suited to examine their specific views, opinions and experiences. For this reason, the research adopted multiple-case study design that allows cross examination of data. The evidence from multiple case studies is often considered more thorough and trustworthy (Yin, 2009). Moreover, the sample of case studies for this research consists of cases similar in characteristics, as well as opposing, allowing for exploration of the sustainability drivers and barriers from different perspectives.

3.2 Data sampling

The process of data sampling took place on three levels: (1) the selection of a particular wine region, (2) identification of wineries that would qualify for case studies and (3) the choice of interview participants. First, the geographical locality – a specific wine region – was chosen. The reason for choosing Champagne lies in its distinctive structure: more than 16.000 small scale grower producers work alongside almost 400 big Champagne Houses (Comité de Champagne, n.d.). The relationship dynamics between SME's and powerful houses is unique to the region, making it a perfect context to explore barriers and drivers to sustainability.

Utilising an a priori sampling approach, where the criteria for selecting participants were established at the beginning of the research, the second level of sampling involved identifying appropriate wineries to serve as case studies (Bryman, 2016). A set of criteria was

developed to select wineries that would help to answer the research question. First criterion refers to geographical position of winemakers: eligible wineries had to be located in the Champagne region. Next, wineries should fulfil a requirement in terms of sustainable certifications: producers should be at least certified via organic viticulture scheme. Additionally, for the purpose of the study wineries could also be biodynamic and carry a label of Demeter or Biodyvin or be in conversion to biodynamic viticulture. Taking into consideration the above-outlined criteria, the list of eligible wine producers was compiled in consultation with several sources. These included a reference book of all Champagne producers with information on their production activities and sustainable certifications (Gault&Millau. 2024), and official websites of Demeter and Biodyvin bodies that provide documentation on wineries they certified. Based on this information, an initial list of 35 wine producers that practice organic and biodynamic viticulture in Champagne was developed for further consideration – this list can be viewed in Appendix C.

For the final level of sampling – sampling of semi-structured interviews participants – a criterion related to participant's role at the winery must be fulfilled. Potential interviewees were required to be actively involved in the winery's viticultural and business processes, holding positions of a winery manager, or, ideally, a winemaker. Following the sequential approach to sampling (Bryman, 2016), an initial sample of winemakers was formed. These were two participants who agreed to interviews in advance and confirmed their attendance via email. Sequential approach allowed to expand contacts that were suited for the research, as the study progressed. Further, using a snowball sampling technique (Bryman, 2016), more interviews were scheduled through the network of winemakers with whom the interviews had been already conducted over the course of the fieldtrip. An additional interview was conducted online with a Champagne expert, whom the researcher met during professional wine trade fair. However, it was excluded from the final list of case-studies, as its contents did not correspond to the purpose of this research. Furthermore, an informal interview with a property owner of a non-certified winery in Epernay took place during a wine tasting event but was excluded from further research due to unfulfilling eligibility requirements. Lastly, an interview with an in-house wine expert of a Champagne House in Reims was arranged, the outcome, however, was unsuccessful, as the expert lacked sufficient knowledge, and the information provided was irrelevant for this study. Overall, 7 interviews were conducted, four of which formed a basis for four case-studies of this research. For information on interviews' participants, refer to Appendix D. All interviewees were initially contacted either via email or by phone, and all the interviews took place in person at the respective winery premise.

Additionally, most winemakers arranged a complimentary winery tour, allowing for deeper exploration of their processes and sustainability related practices.

3.3 Data collection

To collect data, a seven-day field trip to the Champagne region was undertaken from 06/04/2025 to 13/06/2025. During this period primary data was gathered through formal semi-structured interviews with organic and biodynamic producers, informal meetings with wine producers and participant observation. All participants gave oral or written consent to participate in the study. Interviews lasted from 40 minutes to 1 hour 20 minutes.

Additionally, the web sites of the wineries were consulted to verify and expand on experiences with sustainable approaches mentioned during the interviews with the winemakers. This formed a part of the triangulation process, which helped to ensure reliability and validity of the research by cross-checking interview data with publicly available information about the wineries, ensuring consistency in analysis (Bryman, 2016).

The researcher also attended a professional wine trade fair, enabling participant observation. By observing winemakers' interactions in a professional setting, it was possible to gain insights into how sustainability is discussed within the wine industry. The ways producers communicated their sustainable efforts and the discussions about eco-certifications were the focus of the participant observation. Informal conversations and observations provided valuable context, complimenting the triangulation of findings from interviews and websites.

The following table (Table 4) offers an overview of case studies that were formed. Based on the above outlined criteria, the sample of case studies that represented organic and biodynamic Champagne producers consists of 4 winemakers, all situated within Champagne wine region.

Table 4: Overview of Case-studies

	Name of the winery	**Location**	**Type of certification**
Case №1	Champagne de Sousa	12 place Léon Bourgeois 51190 Avize, France	Organic viticulture, biodynamic viticulture (Demeter)
Case №2	Champagne Pascal Agrapart	57, Avenue Jean Jaurès 51190 Avize, France	Not officially certified but consistently practice organic and biodynamic approaches to viticulture.
Case №3	Champagne Augustin	2 Route de Germaine 51560 Avenay Val d'Or, France	Organic viticulture, biodynamic viticulture (Demeter)
Case №4	Champagne André Heucq	9 Rue Eugène Moussé, 51700 Cuisles, France	Organic viticulture, biodynamic viticulture in conversion (due to receive Biodyvin certificate in 2025)

All four producers included in the study approach sustainability from organic or biodynamic perspectives. Two of them (Champagne de Sousa and Champagne Augustin) hold a biodynamic label issued by Demeter. One of the winemakers (Champagne André Heucq) is due to receive a biodynamic certification Biodyvin in 2025, indicating the near completion of their transition from organic to biodynamic viticulture. The fourth producer (Champagne Pascal Agrapart), although not certified via any sustainable schemes, was included due to offering valuable insights on the reasons why small Champagne producers do not pursue environmental certifications, despite employing sustainable methods. Their perspective revealed a set of barriers to sustainability not previously mentioned by certified winemakers.

To gather appropriate data from semi-structured interviews, an interview guide was compiled, with questions divided into 7 thematic categories. For a visual representation of the interview guide, refer to Table 5.

Table 5: Interview Guide: Main Themes

	Theme	**Type of questions**
1	Introduction	Questions regarding interviewee's background and journey into winemaking
2	Sustainable practices	Questions regarding sustainable practices adopted at the winery
3	Motivation for adopting sustainable practices	Questions regarding reasons that drove conversion to sustainable approaches
4	Outcomes of adopting sustainable practices	Questions regarding positive or negative consequences of sustainable approach to winemaking
5	Challenges	Questions on challenges and barriers encountered when practicing sustainable winemaking
6	Collaborations	Questions regarding collaborative work with other actors that practice sustainability in the wine industry
7	On certifications	Questions regarding reasons for becoming certified by a specific certificating body; consequences
8	On traditional Champagne method	Questions on how producers balance traditional winemaking methods with sustainable approaches

First, an introduction about the researcher and topic of study was provided to all interviewees, as well as questions about their background and role at the winery were asked. Second, the adoption of sustainable practices was investigated, together with the reasons why winemakers decided to transition from conventional winemaking to more sustainable alternatives. Following, barriers to sustainable conversion were explored together with overall experiences of the winemakers.

To gain a clearer understanding of the practices adopted at each winery, the topic of certifications was raised, focusing on the reasons for selecting specific certificating bodies and the implications of adopting these labels. To investigate further the drivers and barriers to sustainable viticulture, the interviews also included questions about collaboration with other organic producers, associations or administrative bodies. Lastly, interviewees were asked to share their views on how traditional champagne-making methods can be combined with modern sustainable approaches.

All interviews were transcribed with the help of the transcription function in ATLAS.ti software and analysed within the same platform. This process involved creating

codes that corresponded to relevant categories and recurring themes. The following section outlines the approach taken to analyse the data in more detail.

3.4 Data analysis

In order to analyse the collected data effectively, key concepts such as environmentally sustainable viticulture, drivers and barriers to sustainability were operationalised. This process involved defining observable indicators that guided data analysis and interpretation, ensuring consistency with theoretical frameworks. For the visual representation, refer to Table 6.

Table 6: Operationalisation of Key Concepts

Concept	Definition	Indicators in data
Environmentally sustainable viticulture	Environmentally responsible viticulture that focuses on grape cultivation and wine production that minimises environmental impacts, reducing synthetic chemical use and promoting biodiversity.	Examples of environmentally friendly practices adopted throughout all stages of viticultural processes; official eco-certifications
Drivers of sustainability	Factors that motivate wine producers to transition to environmentally sustainable viticulture.	Personal motivations of winemakers, product quality, differentiation, market demands, benefits of environmental certifications, climate-related issues
Barriers to sustainability	Challenges and obstacles, hindering the adoption of environmentally sustainable approaches to viticulture.	Lack of knowledge, disadvantages of eco-certifications, institutional pressure, financial risks

The analysis of the data collected through semi-structured interviews is based on thematic analysis. This systematic approach enables coding of first-hand data and its further categorisation into themes relevant for answering the research question. Thematic analysis includes several stages, such as initial coding of one element of transcript at a time; then organising initial codes in themes and finally developing original explanations or concepts from these themes that directly address the research question (Bryman, 2016). Consequently, 27 codes emerged from first stage coding in ATLAS.ti, then operationalised into two key

categories: drivers and barriers for sustainable viticulture. 21 codes referred to the drivers, while 6 codes were categorised under barriers.

The following section provides the results derived from the comprehensive thematic analysis of the collected data. The findings are presented in two parts: first section is organised in the form of individual case studies and the second section contains a cross-case synthesis that highlights recurring and contrasting themes in the context of drivers and barriers to sustainability. Together, the individual case-studies and cross-case synthesis contribute to an exploration of a nuanced context of sustainable viticulture in Champagne.

4. Results

This chapter presents empirical findings of the study based on cross examination of four case-studies of organic and biodynamic wine producers in the Champagne region of France. The purpose of this research is to examine the main factors that drive the adoption of environmentally sustainable practices among small organic and biodynamic Champagne producers, as well as examine the key factors that hinder the transition to sustainable operations. This chapter presents findings from each case study individually, followed by a section on cross-case synthesis that identifies recurring and contrasting themes. For reference on the case-studies see Table 3 in the chapter on methodology.

4.1 Case study (1) – Champagne de Sousa

Located in Avize in Côte des Blancs subregion of Champagne, Champagne de Sousa is a family wine producer with a team of no more than 15 people managing all operations. De Sousa's commitment to sustainable principles is reflected in holding two green certifications: organic agriculture received in 2010 and biodynamic obtained in 2013. De Sousa's was one of the first organic producers in Côte des Blancs, nowadays cultivating around 15 ha of vines and producing approximately 70, 000 bottles of Champagne annually, all in accordance with biodynamic principles (Champagne de Sousa, n.d.).

4.1.1 Drivers

Among the main sustainability drivers that were discussed by Charlotte, were health concerns, attributed to the use of chemical substances in the vineyards. The motivation to implement more sustainable practices was a consequence of personal experience of de Sousa family. Severe allergies and cancer that a family member who worked in the vineyards had, were believed to be linked to the use of chemical sprays, before they shifted to organic viticulture. The health-related motivations were later reinforced by Charlotte in a more general way, noting that residues of chemicals and microplastic stay in water, possibly causing serious health conditions, such as cancer. It can be said that health-related motivations played a significant role in de Sousa's transition to more sustainable practices, encouraging them to seek solutions within nature.

As Charlotte explained, many challenges faced in the vineyards, such as excessive rainfall or diseases outbreaks, are natural in origin, and therefore solutions should also be natural, rather than chemical based. This idea, that solutions to many vineyard and winery

issues can be found in the nature, is further reflected in the explanation by Charlotte, why they specifically chose the biodynamic approach to sustainability. Charlotte explained their motivation by being attracted to the idea that the vineyard can be "protected with natural things", adhering to the philosophical side of the biodynamic principles to viticulture. This reason in favour of biodynamic farming can be seen as philosophical in nature, highlighting low-intervention and nature-attuned principles of biodynamic viticulture.

Furthermore, organic methods of cultivating and producing Champagne are believed to influence the quality of wine. With this in mind, Charlotte elaborated on why they chose to transition from conventional viticulture to organic. Having studied at a wine school, de Sousa's initiator of organic transition, met many organic wine producers and positively evaluated the quality of their environmentally friendly wines. Since then, de Sousa family started experimenting with organic approaches, looking for the best methods to produce organic Champagne. The quest for a better wine quality was also driven by personal qualities of the winemaker, who was described as a perfectionist, committed to continuously improving their wines.

4.1.2 Barriers

Several barriers to sustainable viticulture were identified following Case study 1. Charlotte emphasised the importance of the regional context, which is characterised by the imbalance between grape supply and demand. As Charlotte stated, "there is more demand [for grapes] than offer". Given the specific relationship dynamics in the region – where small-scale growers sell their grapes to the bigger Champagne Houses – there is no incentives for growers to adopt sustainable practices. As noted, growers are rarely rewarded for their green efforts, making transition to sustainable operations less appealing. Consequently, financial security offered by conventional viticulture, discourages farmers attempts for change, reflecting a broader lack of motivation that hinders the region's progress towards sustainability.

Certain features of biodynamic approach also influence the processes in the winery, posing some challenges. One of such difficulties, as highlighted by Charlotte, is constantly adapting to changing weather conditions. Because the nature of biodynamic preparations is highly specific – each substance targeting a certain issue – they require frequent application. In rainy years, such as 2024, daily spraying of the vineyards is often necessary. While the preparations are proven to be effective, their application methods are not, as they must be

applied separately and are not usually mixed. Charlotte described this as inefficient and highlighted the need for further research on how to combine these preparations and make spraying more efficient.

4.2 Case study (2) – Champagne Augustin

Champagne Augustin, a fifth-generation wine producer, is primarily situated in Avenay-Val-d'Or in the Montage de Reims subregion with several other sites spread across neighbouring locations. Highly dedicated to sustainability, Augustin turned to biodynamic approach in 2013, obtaining certifications in both organic and biodynamic agriculture. This family enterprise takes biodynamic principles further, developing a so-called cœurviculture[1]- an approach to winemaking, where attention to "the promptings of nature" is vitally important for Champagne production (Champagne Augustin, n.d., para. 6).

4.2.1 Drivers

During the interview, Maxence, the winemaker, revealed several sustainability drivers that were key in Champagne Augustin's sustainable journey. Augustin's adherence to the philosophy of biodynamics and dedication to cœurviculture, encouraged the formulation of their unique understanding of how natural elements are interconnected. For instance, four elements of the universe (earth, water, air, fire) correspond to four parts of the vine plant (roots, leaves, flowers, fruits) that need attention and care, in accordance with the lunar calendar. This ideological principle led Champagne Augustin to prioritise health of the soil, being "the first element of Champagne" that connects vine roots and earth. The winemaker also emphasised soil protection as their long-term goal to preserve the land for future generations.

Another factor that can be interpreted as a driver for sustainable conversion is improvement in grape quality, compared to conventional winemaking. Maxence pointed out that since their conversion to biodynamic farming, the taste of grapes became more consistent, with key characteristics as sugar or acidity becoming more well-balanced. These qualities are essential in biodynamic winemaking, where the addition of sugar or chemical regulation of acidity levels in wines is prohibited. To maintain low-intervention winemaking

[1] Cœurviculture – winemaking with a heart (Champagne Augustin, n.d., para. 6).

and to allow natural grape characteristics to express fully, the quality of the grapes should be optimal at the time of harvest.

During the conversation with the winemaker, the topic of biodynamic certifications also emerged, highlighting the differences in how wine producers in Champagne perceive certifications' importance. In this context, Maxence stressed that for them getting certified was a matter of personal convictions, rather than a simple formality. Obtaining the biodynamic label reflects the commitment of the producer, giving them "more control" over winemaking. Aligned with the winemaker's values, the certification can serve as a motivator to follow strict environmental standards, providing a structured framework for practicing and developing biodynamic viticulture.

During the analysis of this case study, no sustainability barriers were identified, as the winemaker reflected very positively on their biodynamic journey.

4.3 Case study (3) – Champagne André Heucq

Situated in a small village of Cuisles in the Marne Valley, Champagne André Heucq is a family-run estate, managed by Heucq family. They closely follow organic farming principles with certification dating back to 2018. Heucq also practice biodynamic approach to winemaking and are due to receive the Biodyvin label in 2025. By employing eco-friendly practices, such as using renewable energy and natural climate control systems, Heucq family strives to preserve the environment and protect biodiversity of the region (Champagne André Heucq, n.d.).

4.3.1 Drivers

During the interview with the winemaker (Fanny) several sustainability drivers were discussed, including those related to climate change. According to Fanny, the biodynamic approach can be considered as a solution to mitigate the wine industry's contribution to climate change. The winemaker argued that by adhering to conventional viticulture that uses chemical fertilisers and pesticides, winemakers are unintentionally "nourishing the climate changes", sustaining a vicious cycle of combating environmental issues while simultaneously contributing to them. In relation to the use of chemical substances in the vineyards, Fanny also mentioned their influence on the health of family members involved in winemaking. Several relatives had suffered from severe skin conditions, allergies and cancer before the winery transitioned to organic viticulture. The death of a close family member from cancer

prompted Heucq family to reconsider their approach to winemaking, encouraging them to shift first to organic and then to biodynamic viticulture.

Another significant factor influencing the decision-making behind sustainable transition is certification. Fanny stressed the importance of organic label as it demonstrates the producer's commitments and gives credibility to their name. As the winemaker pointed out, the certification serves as a proof to clients and distributors that they "really do what they are saying". Furthermore, becoming a certified biodynamic producer offers more networking opportunities, granting access to a community of other biodynamic producers and exclusive trade fairs for establishing new client relations. By legitimising winemaker's commitment to environmentally friendly practices, certification offers several benefits, including market access, credibility and integration into professional networks, further reinforcing producer's efforts in sustainability.

Personal preferences of the wine producer may also play a role in favour of adopting sustainable viticulture practices. Fanny noted that their path to organic winemaking started with a tasting of various champagnes, where organic samples stood out. Describing organic champagnes as having "more deepness, more flavour, more energy", Fanny highlighted a distinct experience of drinking organic champagne compared to conventionally produced ones. This experience inspired the winemaker to experiment with organic methods.

4.3.2 Barriers

Regarding the factors that hinder development of sustainable viticulture in Champagne, Fanny mentioned that some conventional winemakers oppose the transition to biodynamic approach, arguing that this could destroy the vineyards and spread diseases to neighbouring farms. Consequently, some deliberately sprayed prohibited chemicals on Heucq's vineyards, when they were due for inspection by a biodynamic committee, attempting to sabotage their certification process. Such lack of specialised knowledge and collective support contribute to the tensions between conventional and biodynamic producers, hindering the progress of sustainable development in the region of Champagne.

According to Fanny, another major constraint is presented by the activity of Comité de Champagne. The regulations imposed by the Committee were designed to primarily accommodate the needs and practices of the bigger Champagne houses, as part because they are members of this organisation. As a result, the rules do not reflect the issues smaller-scale winemakers face, making their fulfilment unfeasible or counterproductive for them. This

leads to power imbalance between Champagne Houses and smaller vignerons, ultimately delaying the overall progress of the region in sustainability efforts.

4.4 Case study (4) – Champagne Pascal Agrapart

Champagne Pascal Agrapart can be considered an exception among the case studies: the domain is neither organically, nor biodynamically certified, despite generally adhering to sustainable viticulture principles. This family winery has a distinct approach to sustainability in comparison to those previously examined. Their experience and perspective on organic viticulture offer valuable insights into why some winemakers do not pursue official certifications, despite practicing sustainable methods. Following the evidence from the interview, this section only discusses barriers associated with transition to sustainable winemaking.

4.4.1 Barriers

Chloe highlighted limiting effects of obtaining a sustainable certification, whether organic or biodynamic. According to the respondent, certificating bodies impose rules that are not always feasible to follow, while their estate prefers to have "their own experience". For instance, some vintages were high in rainfall, increasing the risk of fungal diseases. Instead of following organic or biodynamic protocols of spraying a mixture of sulphur and copper over the vineyards daily, they opted for a single application of a chemical treatment. Chloe expressed their doubt that organic methods of fighting off humidity-related diseases is necessarily less harmful to the environment than a single use of conventional chemical substance. This perspective demonstrates how strict rules of certificating companies can discourage wine producers from pursuing official sustainable labels. Additionally, the lack of knowledge regarding different sustainable approaches may further hinder the adoption of standardised sustainable viticulture.

Chloe also addressed the issue of sustainability barriers from the perspective of reputation. Highlighting that within the Champagne region, it is far less important to have an official label than to have a reputation of a sustainable winemaker, interviewee undermined the significance of obtaining an environmental certification. While this may make sense within a community of champagne makers, for broader audience, such a perspective can create transparency and credibility issues, causing confusion about the actual practices employed by producers. The reliance on informal reputation can discourage winemakers in

adopting standardised, measurable efforts offered by certificating bodies, impeding the transition to more environmentally sustainable viticulture.

4.5 Synthesis of the findings

Following the above presented findings on drivers and barriers to sustainable viticulture in the context of organic and biodynamic producers in Champagne, these factors can be classified according to established frameworks. Drawing on typologies offered by Gabzdylova et al. (2009), Dodds et al (2013), Pomarici et al. (2015) and Ceccacci et al. (2024) that consider drivers and barriers of sustainability in terms of internal, external and strategic categories, the following drivers were observed. For a visual representation of the factors driving sustainability, refer to Table 7.

The majority of identified sustainability drivers stemmed from internal motivations of the winemakers. Health concerns due to the use of harmful chemical solutions in conventional viticulture, as well as concerns regarding soil degradation caused by the same substances were observed as internal factors encouraging sustainable transition. The research also revealed that personal preferences of wine producers along with their philosophical convictions that align with biodynamic principles may result in adopting more environmentally friendly practices in viticulture. According to some, organically and biodynamically grown vines result in a better fruit quality, which drives sustainable transition in wineries.

A somewhat ambiguous factor concerning an internal decision of applying for an eco-certifications was observed. Some producers (e.g. Champagne Augustin) characterised the process of getting a certification and working under an ecological label as a positive experience that encouraged them to engage more in sustainability. Others (e.g. Champagne Pascal Agrapart), however, pointed out its limiting effects, as it does not allow use of many chemical substances that otherwise can help combatting vineyard diseases.

Furthermore, environmental certification can also be considered from a strategic perspective. As discussed by some respondents, an eco-label helps to differentiate their product, showing producer's commitment to sustainability. Another strategic factor related to wine quality. Grapes that were grown in environmentally friendly ways produce better quality wines, as the research revealed.

Among the external influences, the findings suggest that climate change and its consequences related to rising temperatures and unpredictable weather conditions are a factor that drives some producers to transition to sustainable viticulture.

Table 7: Sustainability Drivers Identified in Current Research

Group of drivers	Examples	Case
Internal	Health concerns	Champagne de Sousa
Internal	Philosophical convictions	Champagne de Sousa
Strategic	Wine quality	Champagne de Sousa
Internal	Soil health, soil protection	Champagne Augustin
Internal	Grape quality	Champagne Augustin
Internal	Certification	Champagne Augustin
External	Climate change	Champagne André Heucq
Strategic	Certification	Champagne André Heucq
Internal	Personal preferences	Champagne André Heucq

Barriers to sustainability can also be divided into internal, external and strategic categories. However, the study revealed an additional group of constraints – institutional (Table 8). They refer to the barriers that are associated with regulatory frameworks and administrative bodies that implement regulations potentially hindering the progress of sustainable development in the region (Olesson et al., 2023). Among such barriers are regulations implemented by the Comité de Champagne that are considered more effective for bigger champagne houses, causing issues for small-scale winemakers. On a more general level, the imbalance between grape supply and demand, along with the dependent relationship where small growers sell fruit to bigger houses, creates little incentive for farmers to adopt environmentally friendly practices. Lack of recognition for sustainability efforts creates a barrier to sustainable viticulture in the region.

The results seem to indicate one internal barrier, associated with inefficiencies of biodynamic treatments application.

The data shows a set of external factors, negatively influencing sustainable transition. Lack of knowledge on organic and biodynamic practices, especially among conventional producers is one of the barriers to sustainable viticulture. Another factor is related to practicing environmentally friendly viticulture within a certificating scheme. Certification is said to restrict certain conventional viticultural practices, limiting producer's ability to choose what is best for the vineyard. Lastly, another barrier connected to certification is the undervaluation of environmental labels, as some Champagne producers place greater importance on informal reputation than on official certification.

Table 8: Sustainability Barriers Identified in Current Research

Group of barriers	**Examples**	**Case**
Institutional	Structural issues: Lack of recognition for sustainability efforts	Champagne de Sousa
Internal	Inefficiency in biodynamic treatment application	Champagne de Sousa
External	Absence of knowledge among conventional winemakers	Champagne André Heucq
Institutional	Regulatory bias toward bigger producers	Champagne André Heucq
External	Limiting effects of certification	Champagne Pascal Agrapart
External	Reputation over certification; undervaluation of environmental certification?	Champagne Pascal Agrapart

5. Conclusion and discussion

This study aimed to understand the motivating and limiting factors wine producers in Champagne region face when practicing sustainable viticultural approaches. By engaging with organic and biodynamic producers, the research focused on their experiences and perspectives, through which the key drivers and barriers to sustainability were identified and examined. The following research question guided the study: *What are the drivers and barriers to sustainable viticulture in the region of Champagne in the context of small-scale organic and biodynamic producers?* Using qualitative approach based on a multiple case study design, the research analysed the insights from four wine producers, focusing on how sustainable viticulture is approached, perceived and practised in the context of the Champagne wine region.

5.1 Overview of the key drivers and barriers to sustainability

Sustainability drivers emerged as a complex category that highlighted nuanced relationships between internal, external and strategic factors. Such drivers as wine quality and grape quality, though closely related, appeared to be distinguished by winemakers in their motivations. Nevertheless, these two factors can be combined into a broader 'quality-related reasons' category that serves as a double driver: internal, because it reflects winemaker's values of producing high quality product; and strategic, as superior quality wine can play a role of a market differentiator, enhancing reputation of a winemaker.

Philosophical motivations were also revealed as an internal driver to environmentally friendly viticulture. Closely associated with the biodynamic movement, philosophical convictions can resonate with a broader audience - including producers who may not be persuaded by scientific approaches to sustainability, but who find meaning in spiritual aspects of biodynamic practices. This way, philosophical motivations can contribute to the further spread of sustainable practices in the region among different groups of people.

Drivers related to sustainable certifications appeared across internal, external and strategic factors, demonstrating producers' personal values, external pressures related to export, and strategic benefits of product differentiation for consumers. However, the topic of eco-certifications also emerged as a barrier to sustainability.

Limits imposed by certification schemes in terms of prohibited activities during some winemaking processes appeared to create external barriers to the development of sustainable viticulture in Champagne. Additionally, eco-certifications are perceived as optional or

unnecessary by some producers, who despite practicing some organic or biodynamic methods, opt not to pursue an official label. Such an undervaluation of certifications is rooted in the belief that a strong reputation of a sustainable producer is far more important than having an official label. Thus, the need for standardised and measurable sustainability procedures is diminished, hindering the progress of the region.

5.2 Theoretical implications

The results of this study confirm the applicability of theoretical framework that suggests categorisation of sustainability drivers and barriers into internal, external and strategic. These findings are consistent with the observations of Ceccacci et al. (2024), Hauck et al. (2021), Doods et al. (2013) and Gabzdylova et al. (2009), that concluded that environmental concerns, ethical and behavioural choices, altruistic reasons, personal convictions and protection of land are among the main internal factors driving sustainability in the wine industry. Similarly, this research observed land protection as a motivating factor, which aligns with previously studied drivers, such as environmental concerns (Gabzdylova et al., 2009), altruistic reasons (Hauck et al., 2023) and preservation of agricultural land (Dodds et al., 2013). Furthermore, this research identified personal preferences as one of the factors driving sustainable viticulture, in line with the concept of behavioural factors explored by Ceccacci et al. (2024). As for the external drivers, climate change was discovered in the current research and by Blackmore and Goodwin (2009). Finally, strategic drivers to sustainable viticulture in Champagne, such as wine quality and certification reflected broader results of studies conducted by Gabzdylova et al. (2009) and Doods et al. (2013). These studies not only highlighted the importance of product quality in sustainable efforts but also emphasised the role of eco-certification that provides competitive advantage, product differentiation, brand reputation and public image.

Both external and internal barriers have been explored in the literature, including factors like lack of sustainability orientations from other actors of supply chain (Signori et al., 2017) and absence of knowledge among producers, respectively (Dodds et al., 2013). According to the results of this study, absence of knowledge can be interpreted as an external barrier too, as by lacking expertise some conventional winemakers may obstruct efforts of sustainability-oriented winemakers.

Unlike prior research, this study targeted a population of organic and biodynamic winemakers in Champagne, providing insights on sustainable viticulture in the specific

region. Following the data gathered during the fieldtrip to Champagne, this study contributes to the existing framework of sustainable drivers and barriers, by introducing the fourth category – institutional barriers. While previous literature divided these factors into three categories – internal, external and strategic, the complexity observed in Champagne indicated the need for an expanded framework that more accurately reflects region's dynamics. Thus, such factors as lack of recognition for sustainability efforts, as well as regulatory bias toward bigger wine producers were identified and categorised as institutional barriers. This finding is particularly relevant for understanding the challenges smaller wine producers face, especially in the regions, where power imbalances between winemakers and governing bodies are observed. Additionally, new external barriers were revealed, such as limiting effects of eco-certification schemes and undervaluation of environmental certification by wine producers.

Some factors related to certification also acted as drivers to sustainable efforts of winemakers. In that regard, certification can be considered a multidimensional sustainability driver, relating to both internal and strategic factors. On the one hand, it reflects producers' personal motivations to create an environmentally sustainable product, on the other, certification act as a point of differentiation on the wine market. Furthermore, such internal drivers as health concerns and philosophical reasons emerged in the data analysis.

5.3 Limitations

Despite the attempts of this study to consider accounts of the entire underrepresented group of sustainable winemakers in Champagne, several limitations should be acknowledged. As small-scale qualitative research, this study has a limited sample of respondents and case studies, which influences its generalisability.

Furthermore, practical issues, such as the limited time available to conduct the fieldtrip, impacted the scope of data collection. It is also necessary to note that respondents expressed their preference for in-person interviews, which, in turn, restricted access to potential participants and limited the data collection period to the duration of the fieldtrip in Champagne. It is also necessary to note that due to time constraints, it was not possible to establish deeper, trust-based relationships with the wine producers. This might have limited the ability to ensure that the information provided during interviews was not affected by winemakers' aim of promoting and marketing their products.

Additionally, this study does not include the perspectives of eco-certification bodies or regional administrative organs, whose input could have provided a more comprehensive understanding of sustainability in the region.

From an analytical point of view, an interesting limitation also emerged: certain indicators were of dual nature, where some drivers could also be interpreted as consequences of choosing sustainability approaches, and vice versa. Thus, the distinction between cause and effect in factors influencing sustainable viticulture may require more nuanced research instruments.

5.4 Practical implications and future research

This study has several practical implications, particularly in the areas of policymaking and producer support. By specifically identifying drivers and barriers within a group of small-scale sustainable producers, the findings can inform the development of more effective local policies and incentive programs that will encourage sustainable transition further. For example, local authorities can take into consideration institutional barriers faced by small winemakers, contributing to a more inclusive transition to sustainable viticulture. Furthermore, this study contributes to increased visibility of smaller organic and biodynamic producers in academic and policy contexts. Considering the relationship dynamic between Champagne Houses that buy a significant amount of grapes from smaller-scale winemakers, the increasing adoption of sustainable practices by small winemakers has potential to reshape the overall sustainability landscape in Champagne. Recognition of their role in the sustainability progress can become an important step towards creating more environmentally responsible future of Champagne.

Building upon the findings of this study, several new research opportunities emerge. While this study dealt with the perspectives and experiences of winemakers, further investigation and incorporation of perspectives of other stakeholders, such as certificating bodies, local administrative bodies or Comité de Champagne, could offer a more nuanced understanding of sustainability issues in the region. Moreover, this research can be replicated and applied to various wine producing regions to analyse differences of sustainability driving and hindering factors in other geographical contexts. Alternatively, longitudal studies may be conducted, in order to research how drivers and barriers of sustainability evolved due to environmental issues, such as climate change. Finally, this study can be expanded by utilising an additional methodological approach, for example, digital ethnography. This way, qualitative data derived from the interviews and data collected digitally can be combined to

gain deeper insights into the field and increase reliability of the study. Social media analysis or observation of online interactions between winemakers and other actors can help to further investigate sustainability dynamics within the region of Champagne.

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Appendix A

Interview Guide

Introduction

- Can you describe your journey into wine production? How long have you been in wine production? What is your role at the winery?

On sustainable practices

- How do you define sustainability in the context of Champagne production?
- What specific sustainable or biodynamic practices have you implemented in your vineyard and winemaking process?
- Have you introduced any technological innovations to improve sustainability (e.g., water management, energy efficiency, carbon footprint reduction)?
- How do you manage pests and diseases in a sustainable way, given the challenges of Champagne's climate?
- Are there any new materials or techniques being used in organic-certified cellars to improve sustainability?

On motivation for adopting sustainable practices

- What motivated you to adopt these sustainable or biodynamic practices?
- Have you noticed an increase in demand for sustainably produced Champagne? How do consumers perceive these efforts?

On outcomes of adopting sustainable practices

- How do sustainable practices impact the overall quality and style of your Champagne?
- Have you noticed improvements in soil health, grape quality, or wine complexity since adopting biodynamic practices?

On collaborations

- Do you collaborate with other producers, organizations, or research institutions to further sustainability efforts in the region? If so, can you give examples of specific collaborations or partnerships you were involved in?
- Do you also collaborate with government (regional, national, EU) actors?
- Are there institutions or actors that provide you information on certifications or sustainable practices?

On challenges of sustainable viticulture

- What are the biggest challenges of transitioning to sustainable or biodynamic production? What are the biggest financial challenges?
- How do you approach innovation while ensuring compliance with strict organic and biodynamic certification standards? Are there any challenges?

On eco-certifications

- What role does organic certification (or other sustainability certifications) play in your production process?
- Which organic or biodynamic certifications does your Champagne household, and why did you choose them (e.g., Demeter, Biodyvin)?
- Some producers follow organic or biodynamic principles without formal certification. What are your thoughts on this approach?
- Do you think there is room for improvement in current organic and biodynamic certification systems? What changes would you like to see?

On traditional Champagne method

- How do you balance traditional biodynamic principles with modern innovations?
- Do you consider biodynamic winemaking to be an innovative approach, or do you see it as a return to traditional methods?
- How does biodynamics help improve vineyard resilience compared to conventional methods?
- Do you see the future of organic/biodynamic Champagne production becoming more dependent on technology, or will it remain rooted in tradition?
- Do you see sustainability as a long-standing tradition of Champagne's winegrowing culture? How has it evolved over time?

Appendix B

Consent Request For Participating In Research

For questions about the study, contact: Alisa Kulishkina, 742250ak@student.eur.nl or alisa.kulishkina@gmail.com

DESCRIPTION

You are invited to participate in a research study about **innovation**, **sustainability and biodynamic production in Champagne region.** The purpose of the study is to understand **how sustainable and biodynamic practices influence Champagne production, including innovations, challenges, and market perceptions.** Your acceptance to participate in this study means that you accept to **be interviewed.**

In general terms:

- My questions will be related to your experiences with sustainability and biodynamic practices, the innovations you have implemented, the challenges you face, the impact on wine quality and vineyard health, and how these practices are perceived in the Champagne industry.

Unless you prefer that no recordings are made, I will make an audio recording of the interview. I will use the material from the interviews and my observation exclusively for academic work, such as further research, academic meetings and publications.

RISKS AND BENEFITS

As far as I can tell, there are no risks associated with participating in this research. I will not use your name or other identifying information in the study. Participants in the study will only be referred to with pseudonyms, and in terms of general characteristics such as occupation. You are always free not to answer any particular question, and/or stop participating at any point.

TIME INVOLVEMENT

Your participation in this study will take from 30 minutes to one hour. You may interrupt your participation at any time.

PAYMENTS

There will be no monetary compensation for your participation.

PARTICIPANTS' RIGHTS

If you have decided to accept to participate in this project, please understand your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty. You have the right to refuse to answer particular questions. If you prefer, your identity will be made known in all written data resulting from the study. Otherwise, your individual privacy will be maintained in all published and written data resulting from the study.

CONTACTS AND QUESTIONS

If you have questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, you may contact my thesis supervisor **Younghyun Kim,** Erasmus School of History, Culture and Communication via email: y.kim@eshcc.eur.nl

SIGNING THE CONSENT FORM

If you sign this consent form, your signature will be the only documentation of your identity. Thus, you do not need to sign this form. In order to minimize risks and protect your identity, you may prefer to consent orally. Your oral consent is sufficient.

I give consent to be recorded during this study:

Name Signature

Date

I prefer my identity to be revealed in all written data resulting from this study:

Name Signature

Date

Appendix C

Preliminary Sample of Champagne Producers for Interviews

	Producer	**Type of Certification**
1	Bourgeois Diaz	Demeter
2	Champagne Augustin Jean Et Fils	Demeter
3	Champagne Couche	Demeter
4	Champagne Elise Dechannes	Demeter
5	Champagne Fleury	Demeter
6	Champagne Lancelot Wanner	Demeter
7	Champagne Michel Parmantier	Demeter
8	Champagne Legrand-Latour	Demeter
9	Champagne Rodez	Demeter
10	Champagne Schreiber	Demeter
11	Champagne Poissinet Et Fils	Demeter
12	Champagne La Parcelle	Demeter
13	Champagne De Sousa	Demeter
14	Charlot-Tanneux	Demeter
15	Domaine De La Malmaison	Demeter
16	Domaine Florence Pelletier	Demeter
17	Piollot	Demeter
18	Gaiffe-Hentzien	Demeter
19	Georgeton Et Fils	Demeter
20	Gaston Collard	Demeter
21	Grethen	Demeter
22	Horiot	Demeter
23	Jullion Rigaut	Demeter
24	Leclerc Briant	Demeter
25	Lelarge-Pugeot Et Fils	Demeter
26	Ruppert Leroy	Demeter
27	Mouzon Leroux	Demeter
28	Champagne Etienne Sandrin	Demeter
29	Champagne Francis Boulard	Biodyvin
30	Champagne Franck Pascal	Biodyvin
31	Champagne Heucq	Biodyvin

32	Champagne Françoise Bedel	Biodyvin
33	Champagne Hugues Godmé	Biodyvin
34	Champagne Larmandier-Bernier	Biodyvin
35	Pascal Agrapart	Not certified

Appendix D

Overview of Respondents

	Name of the winery	Location	Respondent's information
1	Champagne de Sousa	12 place Léon Bourgeois 51190 Avize, France	Charlotte de Sousa, winemaker
2	Champagne Pascal Agrapart	57, Avenue Jean Jaurès 51190 Avize, France	Chloé Agrapart, winemaker
3	Champagne Augustin	2 Route de Germaine 51560 Avenay Val d'Or, France	Maxence Augustin, winemaker
4	Champagne André Heucq	9 Rue Eugène Moussé, 51700 Cuisles, France	Fanny Heucq, winemaker
5	Independent respondent	Berlin	Tatiana, Champagne expert
6	Champagne Elodie D.	73 Av. de Champagne, 51200 Épernay, France	Property owner/Manager
7	Champagne Pol Couronne	11 Cr Jean-Baptiste Langlet, 51100 Reims, France	In-house wine expert

Appendix E

Prompt

Prompt used for Chat GPT (declaration of use in a separate file): “Highlight parts of the text with poor readability.”