

Review

Collaborative Approach for Achieving Ambitious Sustainability Goals: The Prosecco Sustainability Project

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Abstract: Despite attention to sustainability growing in the last decade in the wine sector, the rate of association with wine sustainability programs still appears to be limited. This is mainly related to the uncertainty about the economic benefits related to the implementation of sustainable best practices. In this regard, some studies highlighted that the presence of professionals capable of managing the requirements promoted by the standards generally leads to a positive perception of their impact on the economic performances of companies. Therefore, to encourage participation in sustainability programs, the adoption of a collaborative approach to share the skills and knowledge necessary to manage the transition from a conventional organization to a sustainable one seems to be a functional strategy. This paper presents the Prosecco Sustainability Project as a case study to investigate how a structured set of activities must be deployed through a participatory/collaborative approach to significantly improve the level of sustainability of a wide and heterogeneous community of grape and wine producers. The case study highlights that the collaboration between different actors and the guidance from a coordinating figure capable of fostering dialogue and cooperation among the various stakeholders represent key elements to the large-scale deployment of a sustainable management system.

Keywords: sustainability; wine; certification; territory; Prosecco; competitiveness



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1. Introduction

In recent decades, attention to sustainability has essentially increased in all productive sectors, including the global wine system. The transition of the wine sector towards a sustainable production model is a need that can no longer be postponed. The evidence of climate change is, in fact, highlighted by rising temperatures, water scarcity, soil instability, wildfires, soil erosion and desertification, with consequent loss of crop productivity and ecosystems and important impacts on socioeconomic activities.

Studies on future trends in the wine-growing sector confirm that rising temperatures will shorten the phenological phases and will lead to a higher risk of water deficit, even with unchanged annual rainfall, due to higher transpiration. This phenomenon is already influencing the final quality of products and may question the suitability of certain regions especially for the cultivation of some more sensitive varieties [1,2]. This could lead to the disappearance of quality viticulture in historically suited areas, with important economic losses for local wine producers. For this reason, it is crucial to rapidly adopt less impactful practices that can help mitigate climate change processes, while working towards climate change adaptation.

The emergent awareness of the risks associated with climate change has led to an increase in consumer sensitivity to environmental and social issues. In a recent study

carried out at the University of Oxford as part of the United Nations (UN) Development Program [3], the opinion of a sample of 1.22 million people from 50 UN member countries on climate change was analyzed. It is shown that 64% of the population considers climate change as a global emergency. This can be regarded as a clear sign of increasing ecological awareness. Moreover, within this 64%, more than half (59%) state that they believe it is essential to urgently try everything necessary, on a global level, to slow down the emergency. This survey is particularly interesting for the wine sector if the results are analyzed in more detail. The percentage of respondents coming from the main wine markets who believe it is opportune to act immediately is very high. Italy, the UK, Australia, Spain, Canada, France, Germany and the USA are in fact countries where more than 70% of the population is attentive to climate change and believes that it is fundamental to adopt all the needed strategies to mitigate the effects of global warming.

The better level of knowledge developed thus far is inducing consumers to be oriented towards products made with less impacting processes. This is true for wine consumers as well: several studies have highlighted the presence of a segment of consumers interested in wines produced with more sustainable production processes [4–10]. This is especially evident in some markets, such as those in Northern Europe, where sensitivity to environmental and social issues is greater than in other areas. Access to these markets, which are regulated by monopolies, cannot be possible without having obtained a recognized sustainability certification. Therefore, being organic is not enough to be competitive. In fact, markets increasingly require companies to make not only an environmental but also a social commitment [11].

The adoption of more sustainable practices is also encouraged by local communities. People living near viticultural areas call for a more sustainable approach to viticulture, including reduced pesticide use and greater protection of land and biodiversity [12], especially in areas of high agricultural intensity and rural tourist vocation. Indeed, it is well known that in areas where viticulture is intensive, negative impacts on air, water and soil quality are possible, which also negatively affect the health of workers and people living near the vineyards. In this regard, the adoption of innovations and best practices to reduce the impact on the environment and society is crucial [13].

Considering this context, there is increasing pressure from institutions and national governments that are developing various programs to encourage the transition to more sustainable production models. In addition to the Agenda 2030 with its Sustainable Development Goals promoted by the UN, at the European level, a package of policy initiatives named the European Green Deal was developed, which aims to lead a transition process to a “greener” Europe, with the ultimate goal of reaching climate neutrality by 2050. In order to achieve these goals, the Common Agricultural Policy (CAP) has also undergone a renewal process. Indeed, the new 2023–2027 program has introduced a series of payments aimed at encouraging conversion to a more sustainable agricultural system [14].

The importance of applying the principles of sustainability (environmental, social and economic) in wine production, regarded as a social responsibility, has led to the proliferation of a large number of initiatives concerning sustainability indicators, self-assessment procedures, production protocols and third-party certification schemes all over the world. These initiatives, driven by ad hoc producers’ communities, producers’ organizations or institutions and mainly cooperating with research centers, have been developed to improve and certify the compliance of wine production with sustainability principles [14–18]. This global trend started with the pioneering California sustainable winegrowing program and continued with the promotion of similar programs in different countries, such as Australia, New Zealand, South Africa, the USA, Chile, France, Spain, Italy and others. In fact, today, although there is still no international sustainability standard for the wine sector, almost every wine-producing country has developed one or more standards to certify compliance with good sustainability practices: for example, Terra Vitis in France, Napa Green vineyard and winery in Napa Valley, Sustainable Winegrowing New Zealand and Sustainable Winegrowing Australia [18]. In addition, in 2021, the Sustainable

Wine Roundtable, a coalition involving producers, distributors, retailers, logistics partners and researchers was founded, with the ultimate goal of creating a global sustainability reference standard for the wine sector.

However, the increasing attention to sustainability has not yet translated into the widespread adoption of wine sustainability standards, whose rate of adoption is still insufficient and needs to increase [19]. Although firms are interested in sustainability and believe that it is important to adopt sustainable good practices, they have not yet fully integrated these into their business models [20,21]. In Italy, for example, among approximately 9000 wine bottling companies, less than 400 have obtained a sustainability certification.

This is mainly related to the high level of technical complexity required to implement such protocols and the uncertainty regarding the existence of economic benefits that exceed the costs necessary to implement good sustainability practices. In fact, there is a widespread idea among wineries that adopting sustainable good practices does not provide any advantages in terms of economic benefits. In this regard, many owners consider that the investments required to implement a sustainable certification exceed the economic benefits [22] and consider extra costs and capital investment as impediments to sustainable standards adoption [20,23]. To date, the literature does not yet provide a clear picture of the economic benefits for wine companies related to the adoption of sustainable best practices [15,16,24–28]. However, some studies, highlight that the presence of specific skills that support the implementation of best practices within the company, with the aim of reducing business impacts, positively influences the effect of their adoption on cost and profitability [15,16]. Therefore, initiatives that promote the sharing of information and expertise in order to identify common solutions to problems shared by companies in specific areas certainly can play a key role in encouraging the participation of wineries in sustainability programs. Of particular interest to companies may be all those solutions that allow them to reduce costs and have an environmental benefit at the same time, such as reducing the use of pesticides and other inputs, but also the valorization of by-products such as sarments, pomace, lees or water. In this regard, sectoral bodies, such as producer or professional associations as well as consortia, must play a key role in identifying strategies that will enable the industry to cope with the obstacles arising from future environmental, social and economic changes [29]. For this reason, to overcome the constraints that hinder companies' ability to adopt sustainable behaviors, it is necessary to facilitate individual companies' access to useful skills and tools through collaborative actions, with the aim of identifying site-specific solutions best suited to the context [30]. Such collaborative actions can be easily guided/mediated by the existing integration bodies among the operators. From this perspective, policies that support collaborative projects rather than financial support for individual actions are potentially more effective.

Adopting a collaborative approach is certainly not without issues, especially with the difficulties that may arise in bringing together different types of professionals. For this reason, this study aims to present an ongoing case of implementation of a participatory/collaborative approach developed by an interbranch organization in order to show which kind of organization and resources are necessary to start a territorial process toward production processes consistent with the principles of sustainable development based on a community of socially responsible companies. Given the need and urgency to integrate social responsibility along the productive system, our results can provide valuable support for entities or communities that want to bring together diverse expertise to achieve ambitious sustainability goals.

2. Materials and Methods

The aim of this study is to show, through a case study, how a structured set of activities has to be deployed through a participatory/collaborative approach to significantly improve the level of sustainability of a wide and heterogeneous community of grape and wine producers.

To achieve this goal, we have chosen to adopt a single case study method [31], presenting the activity developed as part of the Prosecco Sustainability Project named “PRO.S.E.C.CO DOC”, the Italian acronym of “Program of Sustainability and Control of the Competitiveness of the Prosecco DOC Wine Supply Chain”.

The project was promoted by the Consorzio di Tutela del Prosecco DOC (from here on Consorzio)—the interbranch organization in charge of governing the production of the PDO Prosecco wine in Northeast Italy—with the aim to develop and test the approach needed to achieve sustainability along the production system through the implementation of a collaborative program involving centers of research with professionals from different fields and a group of wineries with different dimensions and levels of integration, capable of representing the heterogeneity of the Prosecco DOC production system

The Prosecco Sustainability Project is an interesting case study because it allows us to observe concretely how cooperation among different stakeholders can be fostered to achieve a common goal. It is considered by the authors also a relevant case study because it involves a large and complex community of producers. Other similar initiatives were developed in Italy (e.g., PDO *Vino Nobile di Montepulciano* and PDO *Rosso di Montepulciano* compliance with Equalitas Designation of Origin for Sustainability standard) or in other countries (evaluation of PDO *Ucles* carbon footprint in the Castilla y la Mancha region) but the Prosecco Sustainability Project differs because it involves a broader community that involves very different types of companies in terms of dimensions and level of integration.

The authors of this paper were directly involved in the activities of the Prosecco Sustainability Project as members of the operational group. For this reason, the case study is developed thanks to the direct experience of the authors and the analysis of the output, such as reports, guidelines, tools and other documents resulting from the work of the operational group. The involvement of the authors at different levels in the project made it possible to gather information related both to organizational aspects, such as critical issues in the coordination of all the figures involved in the project, and to more operational aspects, particularly concerning the study and implementation of useful tools to facilitate the transition to more sustainable production models. On the other hand, the analysis of reports, guidelines and tools produced under the project was aimed at gathering detailed information on the studies conducted to evaluate the level of sustainability of Prosecco DOC appellation, the proposed solutions and strategies to mitigate environmental and social impact and to ensure economic sustainability and their validation after involving test wine companies.

3. Results

3.1. The Context

The Prosecco DOC is a famous PDO sparkling wine produced in north-east Italy, more specifically in defined areas of the Veneto and Friuli Venezia Giulia regions. The territory is characterized by 24,450 hectares under vines and involves approximately 11,550 winegrowers and 360 bottlers, so viticulture contributes significantly to the economy of the territory. The PDO Prosecco production system has a rather articulated structure, involving companies of very different sizes and with different levels of integration along the supply chain. Indeed, within the appellation, there are both well-structured, technologically advanced and market-oriented companies and smaller and mainly grape-oriented companies that, on the other hand, have few resources. Very important is the presence of a large number of wine cooperatives, of which thousands of vine growers, within the appellation, are supplier members, producing grapes in large quantities or doing this work even if only on a part-time basis.

The PDO Prosecco area is characterized by significant environmental and landscape quality elements but also by widespread urbanization. Given the proximity between agricultural production and urban areas, greater attention to environmental quality protection by grape producers is needed. The community in this area is particularly sensitive to issues related to environmental sustainability, in particular to the use of pesticides, and is therefore

demanding the adoption of more sustainable vineyard management methods. In addition, the PDO Prosecco area contains different sites of tourist interest, such as many UNESCO sites. In this regard, more attention is needed to protect the integrity of the land, preserving its biodiversity, which translates into the adoption of innovative and technological vine growing methods that are more environmentally friendly.

For this reason, in 2019, the Consorzio launched the Prosecco Sustainability Project, a virtuous initiative that aims to significantly increase the level of sustainability of the PDO Prosecco territory. In fact, thanks to this project, the Consorzio wants to find and test strategies and develop tools that enable vine growers and wineries to approach and implement social responsibility, facilitating the conversion towards more sustainable production systems. For the Consorzio, it is important to achieve concrete results, not only to improve the sustainability performance of the territory and its vineyards and wineries but also to obtain sustainability certifications, avoiding greenwashing and guaranteeing market recognition.

In Italy, different regional and national initiatives have been developed to ensure and certify compliance with good sustainability practices. Among these, Equalitas[®], a sustainable standard promoted by Federdoc, and VIVA standard, supported by the Ministry of Ecological Transition, are now internationally recognized. Furthermore, a new sustainable wine standard was introduced in 2022 by the Ministry of Agricultural Policies, proving, once again, the importance of sustainability in the wine sector. For this project, the Equalitas standard (<https://www.equalitas.it/en/> (accessed on 20 March 2022)), named SOPD—Sustainability of the Wine Production Chain: Organisations, Products, Designations of Origin—has been chosen as the sustainability benchmark. This is an Italian standard that now has around 280 certified companies, almost all of them from Italy, but also five from Spain and two from Sweden. In fact, the Equalitas certification can also be applied for by non-Italian companies, partly due to the recognition in 2023 of the logo as a European certification trademark. The SOPD standard provides an integrated approach to sustainability, based on three pillars, environmental, social and economic. It defines best practices through objective requirements and verifiable indicators that the different actors of the wine sector must adopt and measure. In addition, the SOPD standard envisages three application modules of certifications, making it possible to extend the adoption of sustainability principles on multiple levels:

- Sustainable Organization (SO), which makes it possible to certify that an organization has met a set of requirements related to sustainability for the activities under its control;
- Sustainable Product (SP), which makes it possible to certify that the production process of a particular wine has been conducted in compliance with a set of requirements related to sustainability;
- Designation of Origin for Sustainability (DfS), which makes it possible to certify that the Consortia, involving at least 60% of the claimed area of PDO vineyard, met a set of requirements related to sustainability.

To achieve its objective, the project, on one hand, aims to support wineries to be compliant with the Sustainable Organization and the Sustainable Product module and, on the other hand, aims to support the Prosecco production system as a whole to be compliant with the Designation of Origin for Sustainability module. Given the different nature of the companies and their different availability of skills and resources, the Prosecco Sustainability Project is especially useful in supporting those smaller and less structured companies, which represent the majority of the companies in the appellation in terms of numbers, supporting them in the adoption of more sustainable and accountable behavior. Moreover, it can also be useful in facilitating more structured companies, which can still benefit from the project to improve their sustainability level, although they could have adequate resources.

In this regard, taking advantage of resources funded under the European Innovation Partnership (EIP) for agricultural productivity and sustainability, according to Art. 35 of the Regulation (EU) No. 1305/2013, an operational group was established, coordinated by the

Consortium and involving several actors. The EIP allows actors to be brought together with complementary knowledge (practical, entrepreneurial, scientific, etc.) working together in a project to develop solutions/opportunities, making them ready to implement and disseminate the outcomes broadly in practice [32]. The operational group established under the Prosecco Sustainability Project consists of the Consorzio, a research center, training experts and a group of wineries with different dimensions and levels of integration, capable of representing the heterogeneity of the Prosecco DOC production system, one of which, the Cantina di Conegliano e Vittorio Veneto, was designated as the project coordinator. In addition, given the multidisciplinary nature of sustainability and, therefore, of the Project, the operational group involves different external partners such as management systems experts, agronomists, oenologists, environmental engineers, software engineers, analysts and programmers, economists, labor consultants and others (Table 1).

Table 1. Actors involved in Prosecco Sustainability Project development.

	Internal Members		External Partners
Wineries	Cantina di Conegliano e Vittorio Veneto: cooperative winery (project coordinator)	Software	AGER: Enogis software supplier
	Le Carline: small family winery		APRA: collecting data system developer
	Le Rive: small family winery		
	Santa Margherita: very large family winery		
	Villa Sandi: large family winery		SATA: life cycle assessment experts
Interbranch organization	Consorzio di Tutela del Prosecco DOC: interbranch organization responsible for PDO Prosecco production	Calculators	Qualiware: carbon and water footprint calculators supplier
Training body	Impresa Verde: accredited training body	Sustainability management system	Michele Granzotto: consultant
Research Center	CIRVE: Interdepartmental Centre for Research in Viticulture and Enology of Padua University		FDC Project consulting: consulting company

3.2. Project Activities Organization

The Prosecco Sustainability Project contemplates five main steps (Figure 1):

1. Organization of a coordination working table among the members of the operational group to establish a work plan for the drafting of organization manuals and guidelines addressing the implementation of a system for sustainable management at the company level and the application of good practices according to the Equalitas[®] SOPD standard in the selected wineries;
2. Design of the coordination system, which lays the foundation for the future development of the IT platform for the sustainability management system, and an initial survey of indicators (baseline), in order to verify the state of the art;
3. Development of strategies that facilitate and support the implementation of the good sustainability practices defined by the Equalitas standard within the designation area. This activity included three sub-steps:
 - (a) Analysis of the state of the art of the selected wineries in order to identify possible critical issues in the implementation of the requirements of the standard;
 - (b) The drafting of guidelines containing guidance for developing strategies and tools that allow for the meeting of sustainability requirements, optimized for the characteristics of specific appellation territory;

- (c) For the five participating wineries: the registration of vineyard management operations on the specifically developed digital platform and the calculation of the organizations' carbon and water footprint, as well as one of their Prosecco wines. This phase was functional to the development of digital tools.
4. Training activity to inform stakeholders about the tools developed and made available by the Prosecco Sustainability Project with the aim of engaging an increasing number of companies.
 5. Project reexamination to identify and develop the most suitable path to transfer the model to the whole Prosecco productive system.

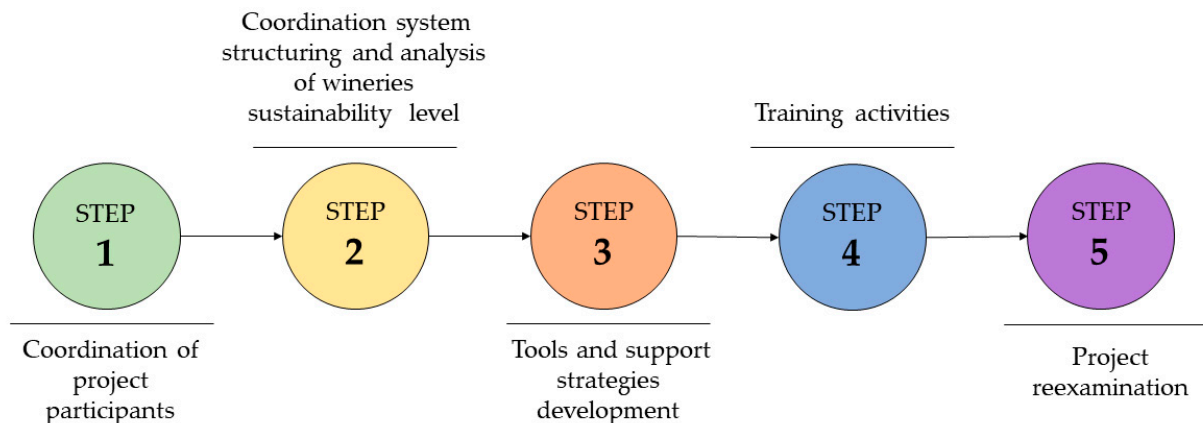


Figure 1. Prosecco Sustainability Project steps.

3.3. Activities

The Prosecco Sustainability Project has made it possible to develop a number of tools and strategies, many of which are still a work in progress, that will increase the level of sustainability of the Prosecco DOC area, allowing both structured wineries to obtain the Sustainable Organization certification and the PDO Prosecco production system as a whole to obtain the Equalitas Designation of Origin for Sustainability certification. This was made possible by continuous cooperative work among members of the operations group.

3.3.1. Environment

One of the main objectives of improving the environmental sustainability of the PDO area, facilitating wineries to be compliant with the Sustainable Organization standard defined by the operational group, is to reduce the impact of vineyard management and wine production activities. After the development of a viticultural protocol that identifies the minimum good practices that must be adopted in the vineyard for a management approach congruent with the principles for the preservation of the territory, the operational group is working to define strategies to reduce plant protection products (for example, substituting synthetic pesticides with alternative products and biostimulants, but looking at the matter with a holistic approach) to increase biodiversity and to protect soil health.

To enable the Consorzio to monitor the management of the PDO vineyards, the use of a specific vineyard management register, named Enogis, has been encouraged among winegrowers. This instrument helps winegrowers collect all relevant data concerning the management of the vineyard, for example, spray schedule, type of plant production products used, irrigation, waste management and energy consumption. All this information, in addition to being useful to meet a legal requirement, is useful to evaluate the impact in terms of water use and greenhouse gas emissions. For this reason, Enogis feeds the carbon and water footprint calculators, specific tools developed thanks to this project, to measure the impact in terms of water and CO₂ of a company, a product, or the entire appellation. The measurement of these indices is compulsory both for structured wineries to obtain the Sustainability Organization certification and for the PDO Prosecco production system

as a whole to obtain the Equalitas Designation of Origin for Sustainability certification. Data collected through Enogis and the footprints calculators will all converge to the Consorzio as soon as the implementation of the Sustainability Management System Platform (SMSP) is completed. This platform will allow the Consorzio to acquire and process the production system information related to sustainability matters (for example, quantifying the pesticides used and treatments performed or the amount of energy consumed and evaluating the impact on the territory) (Figure 2). Thanks to the centralization of data and the possibility of analyzing specific indices, such as the amount of plant production products or quantity of water used for irrigation, the Consorzio will be able to analyze Prosecco PDO environmental performances and have knowledge that allows it to identify strategies or policies that can help reduce the impact of grape and wine production on the environment.

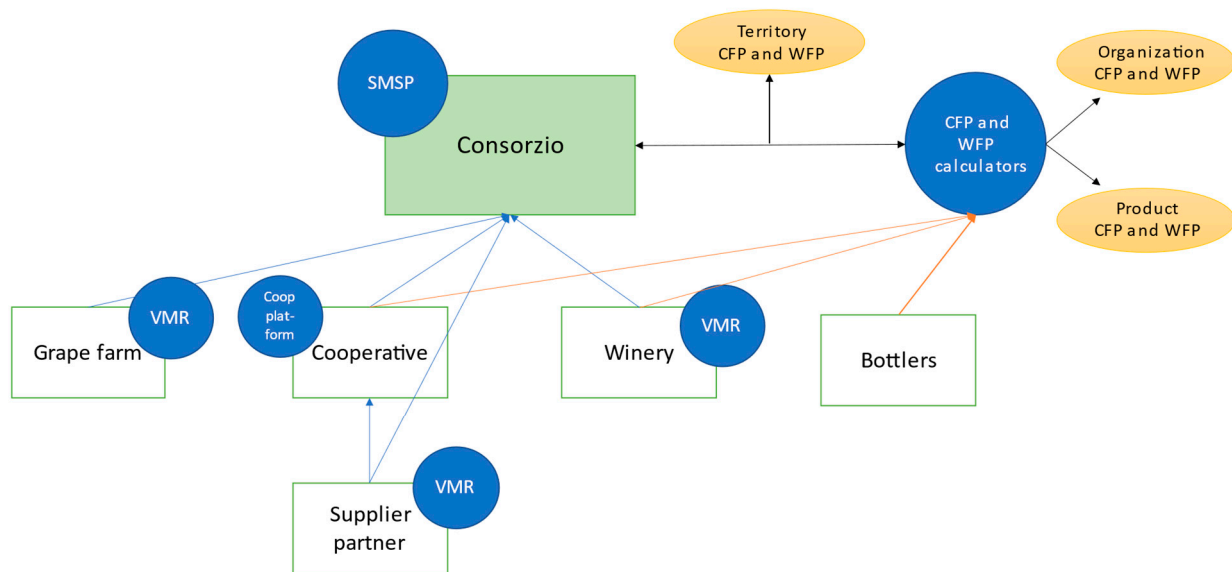


Figure 2. Data collecting and processing tools and data inputs and outputs. The figure explains the link between tools. Vineyard Management Register (VMR) data from grape farms, wineries and suppliers (the latter directly or through cooperative platform) will be transferred to the Sustainability Management System Platform (SMSP) controlled by Consorzio. Data from cooperatives, wineries and bottlers (from Vineyard Management Register and other data) and data collected from the Sustainability Management System Platform (SMSP) will be transferred to carbon footprint and water footprint calculators that are able to calculate the PDO territory carbon and water footprint for the companies, organization or product for the Prosecco production system as a whole.

In addition, to help wineries comply with the Sustainable Organization standard, a model for energy consumption monitoring was developed for wineries to improve energy use efficiency and reduce energy waste and consumption.

To facilitate the PDO Prosecco production system as a whole to be compliant with the Equalitas Designation of Origin for Sustainability standard, the operational group is working on the following activities to improve the environmental sustainability of the entire appellation. PDO territory zoning has been conducted, not only taking into account pedological aspects but also considering the level of climate change sensitivity, identifying areas with different risk classes in terms of heat and thermal stress. This initiative will allow the Consorzio to monitor the areas with higher risk, defining for each of them specific strategies to mitigate the impacts or adapt to climate change. The operational group is also working on precision viticulture to develop a meteorological and decision support system (DSS) platform based on a system of meteorological stations and sensors located in strategic vineyards. This instrument will be useful, on the Consorzio side, to monitor weather and water in the appellation and, on the farm side, to improve the application of plant

protection treatments and to optimize irrigation and water use efficiency. The operational group has also started bee biomonitoring for environmental pollution assessment. It is known that bees can be considered environmental sentinels because they provide insight into the state of the environment and the chemical contamination present in a place, given their susceptibility to pollution. In this regard, the activity consists of the evaluation of bee mortality and the analysis of residues in beehives in, thus far, three different areas of the PDO. The beehive data will be analyzed in relation to the type and quantity of plant protection products used in the neighboring vineyards to identify the origin of the eventual pollutants and their possible correlation with bee health status. This activity enables the Consorzio to identify the quantity and type of plant protection products that are more dangerous for the bees and the environment, defining strategies to remove the use of these products, replacing them with less dangerous ones or using alternative strategies. Finally, an analysis of biodiversity on a territorial scale is being performed, through the calculation and evaluation of biodiversity indices defined by the Biodiversity Friend (BF) standard on homogeneous areas identified within reference vineyards.

3.3.2. Social Responsibility

The operational group is also developing training tools for human resource growth and management to help wineries meet the requirements defined by the Equalitas SOPD standard within the Sustainable Organization module; for example, training courses about soil nutrition and management, canopy management and irrigation management were encouraged among wineries and vineyards staff. For the same reason, the group is also working on the extension of a common code of ethics for the whole productive system to ensure the protection and respect of workers' rights.

Furthermore, considering that the production area of Prosecco DOC includes many urbanized areas, the operational group is working on a series of tools that can facilitate and encourage dialogue with local communities and other key stakeholders. This aspect is very important to enable the PDO production system to be compliant with the Equalitas Designation of Origin for Sustainability module because it makes it possible to identify issues in which to invest as a priority and the time and resources needed in order to address the needs of specific stakeholders within the area. For example, the operational group has promoted the dialogue between a priest of a local church, as a representative of the community, and the territory interbranch organizations (among which, the Consorzio), as representatives of the producers, to discuss perceived problems by the local populations and find, collectively, the possible solutions meeting the needs of both producers and residents. Furthermore, subsequent to a case study, the Consorzio will develop a system (also thanks to the support of a digital tool connected to the Consorzio Sustainability Management System Platform) to manage whistleblowing reports from both workers and communities.

3.3.3. Economic Aspects

In order to have a holistic approach to sustainability, it is also important to consider the economic aspects of the Prosecco DOC production system. In fact, the Equalitas standard defines a set of requirements that identify a series of good economic practices that the Consorzio and wineries must comply with. For example, to be compliant with the Designation of Origin for Sustainability module, the Consorzio must work on the assessment of the profitability of the companies in the PDO area, considering the different types, sizes and productive structures or with the evaluation of the economic value generated and distributed by the PDO companies. The analysis of the performance of the wine supply chain, through the monitoring of production factors, is in fact essential to ensure a balance in the companies' profitability, better productivity and greater competitiveness in markets.

To facilitate compliance with the Sustainable Organization module of the SOPD standard for structured wineries, the operational group is working to promote the adoption, among wineries, of a management control or an annual accounting system that also allows

the identification, assessment and reporting of the financial costs concerning sustainability. For this reason, the group also worked to facilitate the use of tools that allow companies, which are not obligated, to have ordinary accounting. In addition to an analysis of the PDO economic current scenario, the operational group is working on systems that will enable an analysis of the PDO's medium/long-term evolution, considering changes in the market, which will allow companies to identify possible opportunities and threats to maintaining their competitiveness. Additionally, in this case, to enable wineries to meet the requirements of the Sustainable Organization module of the SOPD standard, the operational group is also working on applying the principles of lean production, already used in other industries, to reduce waste and costs in the wine sector. A manual is being developed that suggests how to identify waste in the production process, implement waste-eliminating practices, rethink the production flow and provide a checklist to support the staff in these operations.

In light of the new Directive (EU) 2022/2464 on non-financial reporting, it is clear how important it is to communicate the environmental, social and economic adoption of shared and recognized standards. This is required also by both the Sustainable Organization and Designation of Origin for Sustainability modules of the SOPD standard, and for this reason, the operational group has created guidelines to support companies and the Consorzio in redacting sustainability reports in accordance with the Global Reporting Initiative (GRI) standards. These guidelines should be updated, taking into account the European Sustainability Reporting Standards (ESRS) developed by the European Financial Reporting Advisory Group (EFRAG). In addition, the group has created three matching matrices between the requirements of the Equalitas[®] SOPD standard and the GRI standards; these matrices will be the starting point to develop an IT tool capable of facilitating the acquisition of useful information and drawing up, semiautomatically, a sustainability report in accordance with the GRI standards to simplify the work of companies and support them in the reporting process.

All tools created are part of a broader sustainability management system developed by the operational group both to facilitate structured wineries to obtain the Equalitas Sustainable Organization certification and the PDO Prosecco production system as a whole to obtain the Equalitas Designation of Origin for Sustainability certification. These manuals contain guidelines and case studies that can help the wineries and the Consorzio to manage operational activities (best practices in vineyard and cellar, socioeconomic and communication best practices, environmental sustainability indices) to define a sustainability policy, to manage roles and responsibilities of activities included in the management system and to carry out internal audits and a sustainability system review, identifying corrective actions and improvement objectives.

To manage this complex system and allow compliance with the Equalitas Designation of Origin for Sustainability module of the entire PDO Prosecco production system, a platform for the integrated management of sustainability (SMSP) is being developed in the appellation, which is controlled by the Consorzio and linked to other digital tools, as mentioned above. This tool will allow the collection and centralization of data at the Consorzio level, giving the possibility to carry out an analytical control of costs, collecting not only data related to environmental and social performances but also economic data.

Finally, to promote the use and adoption of all developed tools and strategies useful for wineries to improve their sustainability level, ongoing assistance and training for companies are provided. The Consorzio has identified a person responsible for sustainability project activities who also coordinates educational tools and events and provides support to companies. Meanwhile, many open meetings have been organized and continuous updates on the project are uploaded to an ad hoc website.

3.4. Planned Development

The operational group is currently re-examining the project and planning to integrate social responsibility in all its aspects, while defining short-, mid- and long-term objectives

and activities. Examples of future activities that should be developed pertain to identifying areas of intervention to reduce carbon and water footprint along the supply chain and productive system, carbon farming potential, identification and implementation of circular economy systems and new strategies for the reduction in chemical pesticide uses, also thanks to the optimization of efficiency in the distribution of plant protection products by sprayers and the spatiotemporal monitoring of phytoplasma vectors associated with Flavescence dorée, a critical issue in PDO territory. In addition to helping producers cope with climate change, an assessment of the impact of climate change on vine biology and physiology will be conducted and strategies to improve water management related to point source pollution reduction and washwater management should be defined. Additionally, activities related to the socioeconomic dimension will be developed, including the identification of strategies for the production and revenue risk management along the supply chain, a study of social integration at the farm enterprise level and the identification of corporate social responsibility indicators applicable to the agricultural sector to monitor the social responsibility performance of companies.

4. Discussion

The Prosecco Sustainability Project, described by the paper, provides a snapshot of what steps need to be taken to implement the adoption of a participatory approach that is effective in helping a large community of producers' transition to more sustainable production models, while at the same time helping to also address the critical issues that may arise. In this regard, the importance of structuring a work plan that allows for dialogue among different stakeholders in order to identify strategies to improve environmental, social and economic performances seems clear. For this reason, it will be necessary, based on the critical issues of the sector and area, to develop tools that enable the monitoring of impacts in terms of CO₂ emissions, water consumption and biodiversity protection and also to propose strategies and tools to minimize environmental impacts, as in the case of Prosecco, especially in terms of treatment reduction. To improve the social performance of a community of companies, tools that foster dialogue with workers and the community and that aim to encourage the professional growth and welfare of workers, should be proposed. Finally, with a view to ensuring economic sustainability, tools to monitor costs and value distribution, to forecast market trends and solutions that enable the identification and reduction in economic waste should be identified. All these tools and strategies should be developed taking into account the specificities of the area and the needs of enterprises characterized by quite different production models.

The conclusion of the activities envisaged by the Prosecco Sustainability Project will allow a first step towards a growth path for the denomination aimed at achieving high levels of sustainability. At the same time, this will allow for an improvement in the reputation of the PDO area, which will enable greater consumer loyalty and improve perception by the local community, while enabling companies to increase their competitiveness in the markets.

The adoption of a collaborative approach for the Prosecco Sustainability Project, although it turned out to be effective in starting a process, was not without difficulties. The main issue was related to the coordination of a group of different professionals with different work approaches and different competencies. The project approaches different aspects of sustainability in the wine sector related to viticulture, enology, wine markets, environment, communities, pollution, waste, biodiversity, employees, etc. To address this variety of aspects, which intersect with each other, an ongoing dialogue and discussion with the different actors of the project has been required, which has not always been easy to manage. In this regard, the case study suggests that the process of transition to agriculture in line with the European objectives of the Green Deal must be coordinated, at the territorial level, by an authoritative entity that has good relations with stakeholders. The coordinator's role should be aimed at fostering dialogue among stakeholders and supporting initiatives, including through the identification of public funding sources. Indeed, collaboration among

operational group members can be effective in identifying innovative strategies. In this regard, the Common Agricultural Policy provides companies and coordinating bodies with tools that go in the direction of supporting these initiatives. The experience of the Prosecco Sustainability Project also shows how the involvement of companies from the very beginning of activities is crucial in identifying useful strategies and tools and testing their effectiveness.

5. Conclusions

Sustainability is a growing concern in the wine industry. Producers have to comply with stricter *de jure* and *de facto* constraints, descending from the regulatory framework and from the new consumer's attention to environmental and social issues. Nevertheless, to achieve advanced sustainability targets at the territorial level, that is, involving the majority of producers, is a tough task considering the fragmentation of the wine sector, in particular in the upward phase of the supply chain. Anyway, the experience presented in this paper demonstrates how the adoption of a participatory/collaborative approach may be effective in developing useful strategies and tools to improve the level of sustainability of a whole community of grape and wine producers.

The case of the Prosecco Sustainability Project provides insight into how a knowledge-sharing approach, involving different professionals and skills, may facilitate the transition of a production system as large and diverse as the Prosecco DOC area. Indeed, taking into account the different site-specific issues of the area and the heterogeneity of the companies involved, the collaboration among different actors with different points of view allowed us to find efficient and effective strategies to improve social, economic and environmental performances through the whole community.

It is important to emphasize that the activities carried out by the project make it possible to centralize, at the Consorzio level, a multitude of data that can be exploited to monitor the level of sustainability of the PDO area and guide producers toward increasingly virtuous choices. In fact, all the information collected makes it possible not only to monitor the environmental performance of the denomination but also to conduct analytical cost control, allowing the right balance between environmental and economic sustainability, with positive implications for the social dimension as well. Considering the richness of data that are going to be collected, the application of cutting-edge digitalization techniques will allow advanced approaches to data management and sharing.

With specific references to the European Union's wine-producing countries, the approach to deal with the sustainability challenges presented in this text appears of great interest in light of the new CAP objectives and the new regulation of PDO/PGI products that will be approved by the European Parliament in February 2024. On one hand, the general and specific objectives of the CAP entered in force on 1st January 2023 call for more ambitious environmental sustainability targets for all agricultural products and, on the other hand, the new PDO/PGI regulations stimulate PDO/PGI producers, coordinated by the groups officially in charge of the PDO/PGI supply management, to make their supply more and more compliant with the principles of sustainable development.

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