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Analyzing firms' dynamic capabilities to identify the actions for a sustainable future of the Italian wine sector

Giulio Paolo Agnusdei[1], Mauro Amoruso[2], Leonardo Agnusdei[3], Pier Paolo Miglietta[4]

[1] Department of Psychology and Health Sciences, Pegaso University, Naples, Italy
[2] Department of Architecture and Industrial Design, University of Campania "L. Vanvitelli", Caserta, Italy
[3] Department of Engineering, Pegaso University, Naples, Italy
[4] Department of Biological and environmental Sciences and Technologies, University of Salento, Lecce, Italy

Abstract. The UN Agenda 2030 for Sustainable Development, a global plan for a better future, requires actions. This study investigates how Italian wineries are adapting to these challenges through sustainability-oriented innovation by examining the role of dynamic capabilities. Specifically, the research analyses three dimensions of dynamic capabilities: sensing (understanding changes in the environment, including those related to sustainability), seizing (taking action to address these changes through innovative solutions) and reconfiguring (adapting internal processes and resources to support sustainability-oriented innovation). A survey of Italian wineries assessed the perceived importance of specific actions related to these dynamic capabilities. The results indicate high average scores across all three dimensions, as measured by a positivity index: sensing (0.80), seizing (0.82), and reconfiguring (0.83). Wineries prioritized information gathering through sustainability programs (sensing), investing in research and development, adopting advanced process technologies, and strategically marketing sustainable products (seizing), and upgrading existing processes and technologies (reconfiguring). Furthermore, using beta regression, the study reveals that participation in sustainable programs and supply chain integration significantly enhance positive responses, highlighting the importance of collaborative networks and partnerships in facilitating adaptation and sustainability-oriented innovations.

1. Introduction

Organizations' capabilities are broadly categorized into two groups: operational and dynamic. Operational capabilities focus on maintaining current operations, encompassing aspects like activity scale, business ventures and customer segments. These are the routines and processes that sustain day-to-day activities. In contrast, dynamic capabilities represent a firm's ability to adapt to rapidly changing business environments. Specifically, operational capabilities denote the capacity to efficiently integrate, build and reconfigure both external and internal competencies. This allows firms to transform and renew their operational capabilities, achieving sustainable competitive advantage in dynamic markets. Unlike operational capabilities, dynamic capabilities are significantly more difficult to imitate and are context specific. Dynamic capabilities are deliberately cultivated through three core activities: sensing (understanding changes), seizing (taking actions) and reconfiguring (adapting internal processes) [1].

Wine production is fundamental to Italian agriculture, representing a traditional product and a staple of the national diet. Italy ranks third globally in vineyard area, possessing 9% of the world's total, following Spain and France. Viticulture is widespread across all Italian regions, extending through diverse altitudinal zones, including mountainous terrains. Approximately 650,000 hectares are dedicated to wine-producing vineyards, with a regional distribution of 46% in Southern Italy and the Islands, 38% in Northern Italy and 16% in Central Italy. Italy's annual wine production averages 45 million hectoliters; alternates with France as the world's leading wine producer, each accounting for approximately 18% of global production. Regional production shares indicate that Northern Italy contributes over 51%, followed by Southern Italy and the Islands at 39%, and Central Italy at 10%. Nearly 46,000 wineries characterize Italy's wine sector. Production is concentrated: a few large firms produce 80% of wines, while many small farms contribute to the remaining 20% [2].

However, the Italian wine sector, with its diverse structure and regional variations, faces sustainability challenges including the need to reduce environmental impact, adapt to climate change and ensure the long-term viability of small farms, which are also addressed by the 2030 Agenda for Sustainable Development. The 2030 Agenda for Sustainable Development addresses immense global challenges, including poverty, inequality, climate change and environmental degradation, which threaten the well-being of billions and the planet itself. To combat these issues, the Sustainable Development Goals have been established, representing an unprecedented commitment by world leaders to collective action. This agenda aims to foster global development through integrated and indivisible goals, emphasizing "win-win" cooperation, respect for national sovereignty and adherence to international law, ensuring a sustainable future for present and future generations [The 2030 Agenda for Sustainable Development].

Dynamic capabilities theory provides a robust framework for analyzing the adaptation of the Italian wine sector, an industry that constitutes a significant portion of the nation's agricultural heritage and confronts evolving market pressures, including sustainability demands. These pressures, including the increasing need for sustainability-oriented innovation, necessitate that Italian wineries develop and utilize dynamic capabilities to adapt and remain competitive. The increasing salience of global sustainability underscores the importance of the UN 2030 Agenda as a guiding framework for understanding these transformations. Therefore, this study explicitly examines how Italian wineries leverage dynamic capabilities to address emerging sustainability challenges through sustainability-oriented innovation, with the aim of identifying actionable strategies for securing a sustainable future for the sector.

2. Material and Methods

2.1. Data

To assess factors influencing the adoption of sustainable practices in the Italian wine industry, a survey was conducted to identify the challenges and opportunities encountered by wineries. Data were collected from 64 Italian wineries using a qualitative questionnaire with quantitative rating scales. Respondents rated 51 questions on a scale from 1 (least important) to 10 (most important). The survey comprised four sections: the first section explored how wineries prioritize the economic, environmental and social dimensions of sustainability; the second section studied the various innovations for sustainability; the third section assessed dynamic capabilities (sensing, seizing and reconfiguring); and the fourth section gathered contextual data, including, participation in sustainability programs and supply chain integration. The questionnaire is presented in Appendix A for more details.

2.2. Methods

2.2.1. Positivity Index

To quantify the degree of positive responses obtained from the survey, a positivity index was constructed. This index aimed to capture favorable assessments from the respondents' subjective evaluations of each question. For each question, the index was calculated by first summing the scores from the relevant survey items, specifically those relating to sustainability practices, innovation, and dynamic capabilities. This total score was then divided by the maximum possible score for that dimension. This index served as the basis for descriptive statistical analysis and as the dependent variable in the subsequent regression analysis.

2.2.2. Beta Regression

Beta regression is a statistical technique used to model dependent variables that are confined to the open interval (0, 1) and assumed to follow a beta distribution. This method is particularly valuable for modelling proportions and rates, which naturally fall within these bounds. In beta regression, the response variable, denoted as y, is assumed to be beta-distributed with a mean μ and a precision parameter ϕ. The mean μ is constrained to the interval (0, 1), while ϕ is unrestricted. A higher ϕ value indicates a beta distribution with lower variance, meaning the data points are clustered closer to the mean; hence, ϕ is termed the precision parameter [Beta Regression in R]. The motivation for using beta regression is its ability to address the limitations of traditional linear regression when applied to beta-distributed data. Beta-distributed variables often exhibit heteroscedasticity, a condition where the variance is not constant, showing greater dispersion near the mean and reduced dispersion in the tails. This violates the homoscedasticity assumption of linear regression. Furthermore, beta regression offers a more direct interpretation of the mean response compared to generalized linear regression frameworks, which often require transformations that obscure the mean's meaning. Finally, beta regression effectively accommodates the skewed distributions commonly associated with data confined to the (0, 1) interval [3-4].

In this study, the total positivity index, representing wineries' positive assessments, served as the dependent variable. Membership in sustainability programs and the degree of supply chain integration were used as independent variables. This analysis aimed to determine if wineries with sustainability program participation and supply chain integration showed higher positivity indices, indicating a greater commitment to sustainable actions and adaptive capabilities.

3. Results

3.1. Selected wineries

A preliminary review of 64 questionnaires indicated that only 34 contained complete responses. Consequently, these 34 questionnaires were selected for the analysis. Figure 1 presents a map of Italy, highlighting the geographical distribution of the wineries included in the analysis.

Figure 1. Distribution of involved wineries

Figure 2 presents a histogram illustrating the detailed distribution of importance ratings obtained from the responses to the 51 questions included in the questionnaire. This figure provides a comprehensive overview of the perceived importance of various questions, as reported by the wineries, and serves as a foundation for further analysis. The x-axis labelled "Importance Degrees," represents the range of values, while the y-axis, labelled "Percent," indicates the frequency of responses within each range. The most responses appear to cluster towards the higher end of the importance degrees (with over 30% of the 1,734 responses rated 10, and 90% rated 7 or higher), with a decreasing frequency as the importance degree decreases.

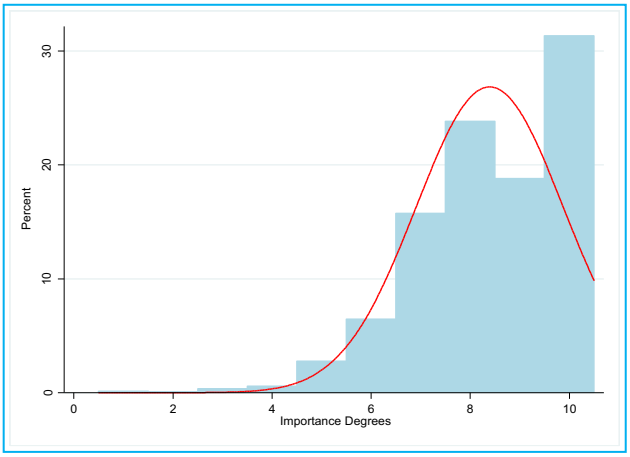

Figure 2. Distribution of responses

3.2. Perceived importance of sustainability in winery operations

Based on the results presented in Figure 3, the perceived importance of sustainability in winery operations is high across economic, environmental and social dimensions. The environmental dimension registered the highest index at 0.89, receiving 304 out of a possible 340 (assuming all 34 respondents assign a rating of 10 to the question) points, highlighting the significance of reducing production impacts, protecting the landscape and safeguarding biodiversity in the wine industry. Following closely, the economic dimension achieved an index of 0.87, with a total of 297 out of 340 points, indicating that respondents highly valued factors such as energy efficiency, product differentiation, and packaging. Lastly, the social dimension also demonstrated strong importance with an index of 0.86, accumulating 295 out of 340 possible points, underscoring the importance of preserving local characteristics, ensuring adequate working conditions, and achieving higher product safety. These results illustrate that there is a strong agreement among respondents regarding the crucial role of sustainability in the wine industry, with environmental aspects being perceived as slightly more important than economic and social factors.

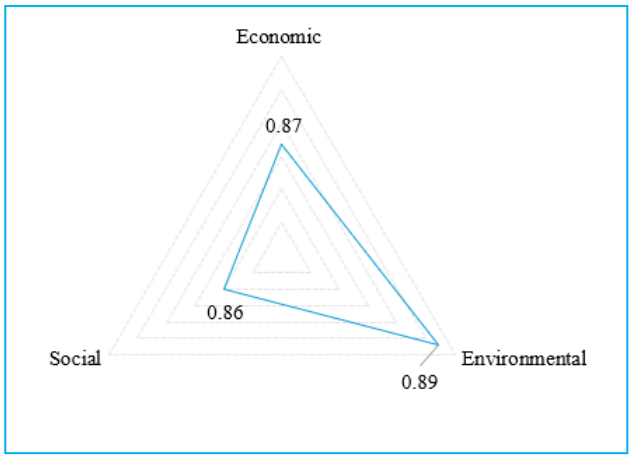

Figure 3. Perceived importance of sustainability dimensions in winery operations

3.3. Perceived importance of innovations for sustainability in winery operations

Based on the survey results presented in Figure 4, the perceived importance of sustainability-oriented innovations in winery operations is high across economic (0.82), environmental (0.87) and social (0.85) dimensions. The environmental dimension appears to be considered particularly important, likely focusing on innovations that reduce production impacts, protect the landscape and safeguard biodiversity. Economic sustainability innovations, such as those related to energy efficiency, product differentiation and packaging, also show a strong level of perceived importance. Finally, social sustainability innovations, addressing aspects like preserving local characteristics, ensuring adequate working conditions and achieving higher product safety, are also valued within the winery sector. Especially, within

economic innovations for sustainability, the option receiving the highest number of positive responses was efficient use of water and energy. A significant majority also voted positively for reduction of waste, soil and vineyard management, and the use of lighter bottles. For the environmental sustainability dimension, the innovations with the highest levels of perceived importance, gathering the most positive responses, were reducing chemicals and phytosanitary, reduction of greenhouse gas emissions and reduction in plastic use. Following closely, adoption of (integrated-organic-biodynamic) agricultural control and management plans, reduction of water footprint and reduced impact on fauna were also considered highly important by many respondents. Finally, within social innovations, the options with the most positive responses included enhancing origin typicity, reducing pesticides and regulating contracts and training, with reducing wine additives also receiving considerable support.

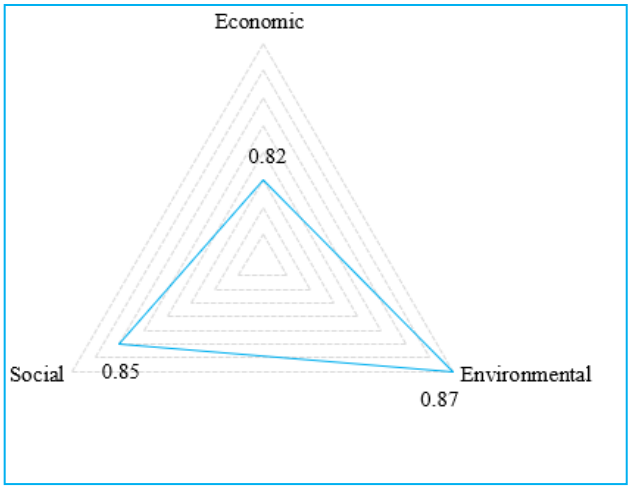

Figure 4. Perceived importance of sustainability-oriented innovations in winery operations

3.4. Perceived importance of dynamic capabilities in winery operations

Figure 5 illustrates the perceived importance of dynamic capabilities in winery operations, as evaluated by survey respondents. The figure reveals that all three dimensions, sensing (0.80), seizing (0.82) and reconfiguring (0.83), are considered important, with reconfiguring perceived as slightly more important than the other two.

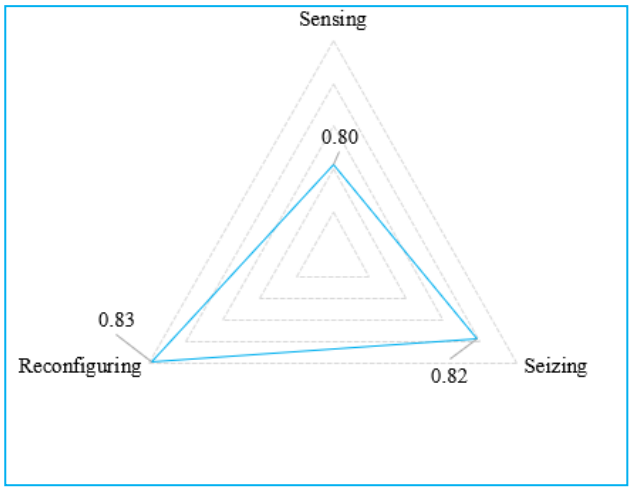

Figure 5. Perceived importance of dynamic capabilities in winery operations

Within sensing capabilities, sustainability programs for certifications received the highest importance degree, closely followed by supply chain operators and technical or commercial publications. Intra-company dialogue, environmental monitoring company reports, public research centers and universities, and private research institutes were also rated highly. Regarding seizing capabilities, experimental research and development and acquisition of equipment for better environmental performance both received the maximum importance degree. Marketing activities for new products and cooperation with public research centers and universities were also considered highly important. For reconfiguring capabilities, methods for product sales, business practices for organizing procedures and development process technology all received the highest importance degree. However, media for product promotion and pricing determination were also rated as important.

3.5. Role of sustainability programs and supply chain integration on the total positivity index

While the descriptive results highlight how wineries rate various sustainability aspects, it is also valuable to understand the factors that drive these positive perceptions. To investigate this, we examined the influence of membership in a sustainability program and supply chain integration (the highest rated in sensing capabilities dimension) on the total positivity index. The Beta regression model was specified with a logit link function and log scale link function. The analyses were conducted in Stata [Beta Regression in STATA].

Sustainability program membership was coded as a categorical variable representing the number of program memberships, ranging from 0 (no membership) to 3 (three memberships). Supply chain integration was coded as another categorical variable representing the level of integration, ranging from 1 (one level of integration) to 4 (full integration). Therefore, in the model, no program membership and one level of supply chain integration were used as the reference categories. Finally, in the model, the total positivity index is the dependent variable, while

membership in sustainability programs and supply chain integration are the independent variables. The results of the beta regression are shown in Table 2.

According to the mean model, holding one program membership was associated with a significant increase in total positivity compared to having no membership. Holding two program memberships also showed a positive association, though marginally significant compared to having no membership. Two levels of supply chain integration were significantly associated with increased total positivity.

Additionally, supply integration reduces variability in responses, as indicated by the significant negative coefficient in the dispersion (scale) model. Supply Chain Integration significantly affects the scale parameter (-1.103, $p < 0.001$), indicating that it influences the precision or variability of total perceived positivity. The constant (precision parameter ϕ) for the scale parameter is 6.450 ($p < 0.001$). The likelihood-ratio test indicates that the model is statistically significant ($\chi^2 = 16.15$, p-value = 0.0238), demonstrating that the independent variables together explain a significant portion of the variance in total positivity.

The results of residual analysis, performed to assess the model's assumptions, were presented in Appendix B. The scatter plot of residuals against fitted values (Figure 1) revealed two distinct clusters of fitted values, which is consistent with the model's use of two categorical predictors. Within each cluster, the residuals exhibited a reasonable degree of random scatter around zero. The histogram of residuals (Figure 2) showed a rough symmetrical distribution centered around zero, suggesting no systematic bias in the model's predictions.

Table 1. Beta regression results for total positivity index (n = 34)

Variables	Coefficient	p-value
Mean model		
Sustainability Membership (1)	0.738	0.001
Sustainability Membership (2)	0.647	0.093
Sustainability Membership (3)	-0.105	0.816
Supply Chain Integration (2)	0.790	0.051
Supply Chain Integration (3)	-0.067	0.900
Supply Chain Integration (4)	-0.028	0.930
Constant	1.284	0.000
Scale model		
Supply Chain Integration	-1.103	0.001
Constant (ϕ)	6.450	0.000
Model significance		
Likelihood-Ratio (χ^2)	16.15	0.0238

4. Discussion

The Italian wine industry, a vital part of the nation's agricultural heritage, is facing shifting market demands, particularly, the growing emphasis on sustainability. This study, based in dynamic capabilities theory, explored how wineries can implement innovative, sustainability-oriented strategies to address these challenges and ensure long-term industry viability. A survey was administered to evaluate the factors that drive the adoption of sustainable practices within Italian wineries, revealing the barriers and opportunities they encounter. The survey was structured into four sections: first, it examined how wineries balance the economic, environmental and social aspects of sustainability; second, it investigated the various sustainability innovations that can be employed; third, it assessed the wineries' dynamic capabilities, specifically their ability to sense, seize and reconfigure; and fourth, it collected background information, including involvement in sustainability initiatives and supply chain integration. The collected data were used for descriptive and statistical analyses. The collected data were analyzed using descriptive and statistical methods.

The survey results clearly indicated the importance of sustainability within the wine industry. Wineries acknowledged the significance of sustainability across environmental, economic and social dimensions, demonstrating a holistic understanding of its multifaceted nature. The findings underscored the recognition of three key dimensions of sustainability within the wine industry in Italy.

Environmental sustainability was perceived as the most critical aspect of sustainability, which can be associated with growing awareness of climate change. Wineries prioritized the minimization of their ecological footprint through practices that reduce production impacts, protect the landscape and safeguard biodiversity. Key priorities included reducing chemical inputs, greenhouse gas emissions and plastic use. Wineries also highly valued economic sustainability, focusing on ensuring the long-term viability of their businesses. This involves enhancing competitiveness and profitability through improved energy efficiency, product differentiation and packaging optimization. Although considered slightly less pressing than the environmental and economic dimensions, social sustainability was recognized as an important aspect of winery operations. Wineries acknowledged their role in contributing to community well-being and ethical practices by preserving local characteristics, ensuring adequate working conditions and enhancing product safety.

The interconnectedness of economic, environmental and social sustainability dimensions is an important consideration. Initiatives in one area can generate positive outcomes in others. For instance, reducing chemical inputs (environmental) can enhance worker health (social) and lower production costs (economic). Similarly, improving energy efficiency (economic) can contribute to the reduction of greenhouse gas emissions (environmental). Furthermore, improving social equity (social) can enhance the stability and longevity of a business (economic). This interconnectedness underscores the need for a holistic approach to sustainability, where integrated strategies can maximize benefits across multiple dimensions. Therefore,

it is crucial to consider all three dimensions simultaneously to achieve comprehensive and lasting sustainability.

The successful implementation of sustainability-oriented practices depends on wineries' dynamic capabilities, their ability to sense, seize and reconfigure resources in response to changing conditions. Wineries recognized that participation in sustainability programs, engagement with the supply chain and investment in technical knowledge are crucial for identifying relevant sustainability challenges and opportunities. To seize these opportunities, wineries prioritized research, acquisition of new equipment and collaborations with research institutions to develop innovative sustainability solutions. Moreover, adapting and restructuring resources was considered essential, as wineries worked to integrate sustainability into their operations by modifying sales strategies, refining business models and innovating product development processes.

Another key finding was that active participation in sustainability programs and higher levels of supply chain integration were associated with more favorable attitudes toward sustainability-oriented innovations. This suggests that wineries engaged in structured sustainability initiatives and strong supply chain collaborations are better positioned to overcome barriers, leverage new opportunities and enhance the overall effectiveness of their sustainability efforts. These findings reinforce the importance of dynamic capabilities in enabling sustainability adoption within the Italian wine industry. Wineries that actively invest in sensing market trends, seizing innovations and reconfiguring their operations are more likely to achieve sustainable and competitive advantages. Furthermore, the interconnections among environmental, economic and social sustainability indicate that a comprehensive, integrated approach is essential.

5. Conclusion

The Italian wine industry is increasingly prioritizing sustainability, driven by global sustainability initiatives such as the UN Agenda for Sustainable Development. This study, based on dynamic capabilities theory, examined how wineries can adopt sustainability-oriented innovations by assessing their ability to sense changes, seize opportunities, and reconfigure internal processes. Survey findings indicate that wineries prioritize environmental sustainability through reductions in chemical inputs, greenhouse gas emissions and plastic use, while also valuing economic sustainability by improving energy efficiency, product differentiation and cost optimization. Social sustainability, though slightly less emphasized, remains important for ethical labor practices and community well-being. Wineries concur that sensing capabilities can improve by gathering information through sustainability programs and supply chain integration. To seize opportunities, however, wineries must invest in research and development, adopt advanced technologies and strategically market sustainable products. Furthermore, effective reconfiguring involves upgrading processes and technologies to align with sustainability goals. Finally, this study emphasizes that for the Italian wine industry, focusing on sustainable growth, wineries must first recognize sustainability as a strategic priority, integrating sustainable practices into their core business strategies to ensure long-term success. Second, dynamic capabilities enable sustainability, requiring wineries to develop the ability to sense market trends, seize innovative opportunities and reconfigure resources effectively. Third, collaboration strengthens sustainability efforts, as participation in industry programs, certifications, and supply chain integration allows wineries to leverage collective knowledge and resources. By integrating these elements, wineries can navigate sustainability challenges, ultimately achieving significant economic, environmental and social benefits.

5. References

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6. Appendix A: Questionnaire

This questionnaire aimed to assess the perspectives of winery stakeholders on sustainability dimensions, innovations, and dynamic capabilities. Each question was rated using a scale from 0 (least important) to 10 (most important). The questionnaire is divided into three sections: Sustainability Dimensions (Section 1), Innovations for Sustainability (Section 2), and Dynamic Capabilities (Section 3).

Section 1: Sustainability Dimensions

1. How important do you think the economic dimension is for a winery?
2. How important do you think the environmental dimension is for a winery?
3. How important do you think the social dimension is for a winery?
4. Regarding the economic dimension of sustainability, how much importance do you attach to increasing the energy efficiency of production?
5. Regarding the economic dimension of sustainability, how much importance do you attach to ensuring the differentiation of its products from competitors?
6. Regarding the economic dimension of sustainability, how much importance do you attach to using alternative packaging?

7. Regarding the environmental dimension of sustainability, how much importance do you attribute to reducing the impact of production?
8. Regarding the environmental dimension of sustainability, how much importance do you attribute to protecting the landscape?
9. Regarding the environmental dimension of sustainability, how much importance do you attribute to safeguarding biodiversity?
10. Regarding the social dimension of sustainability, how much importance do you attach to preserving and enhancing typicality and origin?
11. Regarding the social dimension of sustainability, how much importance do you attach to ensuring adequate working conditions and training?
12. Regarding the social dimension of sustainability, how much importance do you attach to achieving greater product safety?

Section 2: Innovations for Sustainability

1. To what extent do you believe the reduction of organic and inorganic waste affects economic terms (cost-revenue)?
2. To what extent do you believe the more efficient use of water and energy affects economic terms (cost-revenue)?
3. To what extent do you believe soil and vineyard fertility management affects economic terms (cost-revenue)?
4. To what extent do you believe the use of lighter bottles, recycled packaging, and alternative packaging affects economic terms (cost-revenue)?
5. To what extent do you believe the management of deficit irrigation and reduction of the water footprint affects the reduction of environmental impact?
6. To what extent do you believe the minimization of pesticides, fertilizers, and pesticides affects the reduction of environmental impact?
7. To what extent do you believe the reduction of greenhouse gas emissions affects the reduction of environmental impact?
8. To what extent do you believe the reduction of the use of plastic materials affects the reduction of environmental impact?
9. To what extent do you believe the adoption of integrated/organic/biodynamic agricultural control and management plans affects the reduction of environmental impact?
10. To what extent do you believe the use of active ingredients with reduced impact on useful fauna affects the reduction of environmental impact?
11. To what extent do you believe the minimization of wine additives affects the improvement of health and safety?
12. To what extent do you believe enhancing typicality according to origin affects the improvement of health and safety?
13. To what extent do you believe pesticide reduction and controls affect the improvement of health and safety?
14. To what extent do you believe contractual regularization and adequate training affects the improvement of health and safety?

Section 3: Dynamic Capabilities

3.1. Sensing

1. How important do you think inter-company dialogue is to understand changes for sustainability?
2. How important do you think monitoring reports on the company's environmental impacts are to understand changes for sustainability?
3. How important do you think consumers are, through reviews and feedback at events, to understand changes for sustainability?
4. How important do you think suppliers or operators at other stages of the supply chain are to understand changes for sustainability?
5. How important do you think competitors in the market are to understand changes for sustainability?
6. How important do you think public research centers, institutes, and universities are to understand changes for sustainability?
7. How important do you think cooperatives, consortia, or trade associations are to understand changes for sustainability?
8. How important do you think research institutes or private consultants are to understand changes for sustainability?
9. How important do you think trade fairs, conferences, and webinars are to understand changes for sustainability?
10. How important do you think technical or commercial publications are to understand changes for sustainability?
11. How important do you think sustainability programs and certification guidelines are to understand changes for sustainability?

3.2. Seizing

12. How important do you think experimental research and development is to enable the company to seize the opportunities offered by a greater focus on sustainability?
13. How important do you think the acquisition of equipment, machinery, and systems is, including digital ones, to support decisions and improve environmental performance to enable the company to seize the opportunities offered by a greater focus on sustainability?
14. How important do you think marketing activities for the launch of new products are to enable the company to seize the opportunities offered by a greater focus on sustainability?
15. How important do you think process/product design and prototype production is to enable the company to

seize the opportunities offered by a greater focus on sustainability?

16. How important do you think cooperation with consortium companies is to enable the company to seize the opportunities offered by a greater focus on sustainability?
17. How important do you think cooperation with suppliers is to enable the company to seize the opportunities offered by a greater focus on sustainability?
18. How important do you think cooperation with public research centers and universities is to enable the company to seize the opportunities offered by a greater focus on sustainability?
19. How important do you think cooperation with research institutes and private consultants is to enable the company to seize the opportunities offered by a greater focus on sustainability?

3.3. Reconfiguring

20. How important do you think media and technologies for product promotion are for the renewal of internal resources and skills in line with the external environment?
21. How important do you think methods for placing products in sales channels are for the renewal of internal resources and skills in line with the external environment?
22. How important do you think pricing processes are for the renewal of internal resources and skills in line with the external environment?
23. How important do you think business practices for the organization of procedures are for the renewal of internal resources and skills in line with the external environment?
24. How important do you think methods of organizing external relations with other companies or public institutions are for the renewal of internal resources and skills in line with the external environment?
25. How important do you think the development or improvement of process technology is for the renewal of internal resources and skills in line with the external environment?

Section 4: Other Information

1. Location
2. Utilized agricultural area (in hectares)
3. Average annual quantity of grapes produced (in tons)
4. Average annual quantity of wine produced (in hectoliters)
5. Average annual quantity of bottled wine (in hectoliters)
6. Memberships in trade associations (If yes, specify which ones)
7. Certified productions (If yes, specify which ones)
8. Joining sustainability programs (If yes, please specify which ones)

7. Appendix B: Residual analysis

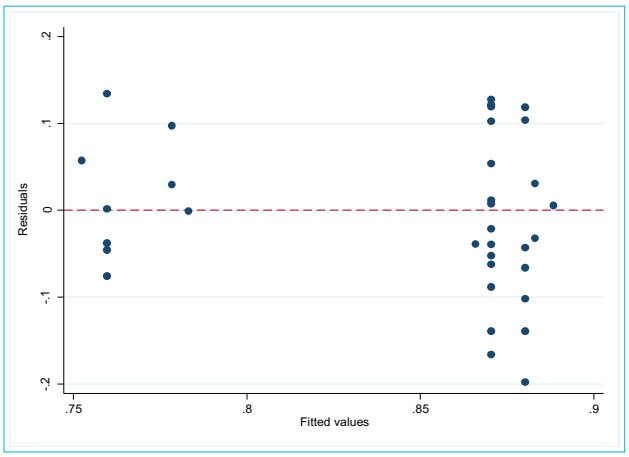

Figure 1. Scatter of residuals and fitted values

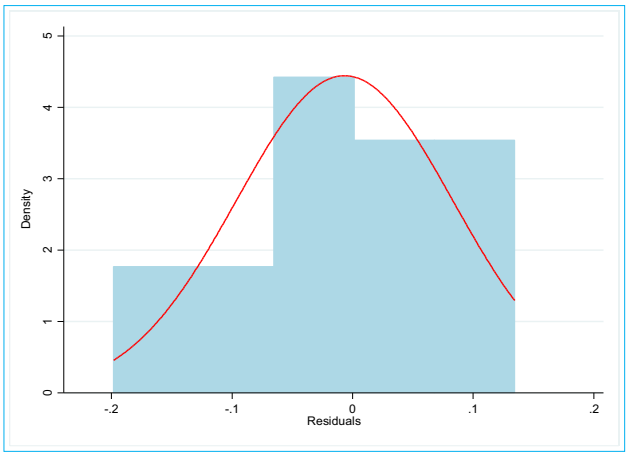

Figure 2. Histogram of residuals