Management Decision

Sustainable agriculture: profile and strategies of Argentine wineries

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Abstract

Purpose – The article aims to show the relationship between agricultural sustainability practices and the competitive strategies of Argentine wineries. It presents the strategic decisions, resources and capabilities of those Argentine wineries performing a sustainable agricultural approach.

Design/methodology/approach – Wineries in all wine regions of Argentina were surveyed to assess the interaction between wineries' dynamics and characteristics, as well as their business and agronomical practices. The dataset accounts for 204 wineries, a representative sample of Argentinean wineries. We developed an agricultural index representing the degree of application of sustainable practices of an Argentine winery based on answers related to two items from the production phase: soil maintenance and phytosanitary protection. We then relate the index to exogenous explanatory variables in terms of business practices: resources and capabilities (price, income from other activities, technological resources, human resources and export activities) and Robinson and Pearce's competitive strategies (innovation strategy, marketing strategy, strategy efficiency and service strategy). A microeconometric model is proposed since it best fits this research's objective and data type, specifically a logit/probit model.

Findings – The results show that wineries in Argentina performing agricultural sustainability practices have more technological and human resources and implement innovative product strategies. However, the results also show that wineries that receive more than 50% of their income from other activities do not show much concern about agronomical sustainability practices.

Originality/value – Wineries in Argentina that address objectives to reduce agricultural and environmental impact have more technological and human resources. Innovative wineries from Argentina that perform these sustainable agricultural practices develop a competitive advantage that shows consumers these sustainable agricultural practices worldwide as a differentiator. This attribute makes them different and helps them cope with their demands. The article delves into these new practices that are now reaching Argentina after being established in Europe for many years.

Keywords Agricultural sustainability, Argentina, Wineries, Business strategies

Paper type Research paper

1. Introduction

Sustainability has become an important paradigm that has accompanied society since the beginning of this century. Sustainability refers to the capacity of human activity to achieve its current objectives without impeding the development of future generations and contemplating three dimensions: environmental, economic, and social. The entire construct developed around the concept began in the first conclusions of the Brundtland report in 1987 and has achieved universal importance with the 17 United Nations' Sustainable Development Goals established in 2015 and the 2030 Agenda for Sustainable Development.

The wine industry has tried to orient itself towards sustainability in different ways, both from the individual initiative of some of its wineries and collectively and institutionally through the guidelines established by the International Wine Organization (OIV) in 2004. Thus, the OIV has established a strategic plan for the period 2020–2024 (OIV, 2024) based on

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five axes, of which three are related to the concepts of sustainability, environment, and social development: axis I promote environmentally friendly viticulture; axis II, promote economic activity based on the principles of sustainable development, growth and globalization of markets, and axis III, contribute to social development through viticulture (OIV, 2024).

Following these global goals and modern market demands, local organizations promote the sustainability of their wineries in practically all the main producing countries (Villanueva *et al*., 2023), for example, and among others, South Africa, Australia, New Zealand, the US, Chile, France, Spain, and Argentina. However, not all countries have followed the same calendar or goals. In the case of Argentina, there are two programs: one led by *Bodegas de Argentina*, which has a "*Wine Sustainability*" seal that approves wineries since 2010, and a second new program led by *Wines of Argentina* called "*Sustenta-Vitis*" which began its journey at the beginning of 2023 (WOA, 2024).

However, the reality is that although the development of sustainable practices in companies in the wine sector is institutionally encouraged, and the consequent accreditation of wineries serves as recognition by the public, the number of wineries that participate is limited. These programs are small. In the case of Argentina, the country of study, the Argentine Viticultural Observatory (OVA, 2024) determined the existence of 1,247 wineries in 2021, and the *Wines of Argentina* Association (WOA, 2024) *"Sustenta-Vitis"* program detailed that 181 wineries had been accredited as sustainable in August 2023, 14% of the total. There were 237 wineries certified with the *"Wine Sustainability"* seal in 2023 by the *Bodegas de Argentina* sustainability program (Bodegas de Argentina, 2023).

Different reasons can distance companies from sustainable practices: strategic disinterest, lack of management capabilities (Pomarici *et al*., 2015, 2023; Pomarici and Vecchio, 2019), lack of knowledge of consumer response (Sellers-Rubio and Nicolau-Gonzalbez, 2016; Schäufele and Hamm, 2017), increased costs and decreased profitability (Moscovici and Reed, 2018; Muñoz *et al*., 2021). However, there are indeed a series of reasons or drivers in companies that follow sustainable practices that align them with sustainability. Previous studies classify them into internal (most important) and external drivers (Santini *et al*., 2013; De Steur *et al*., 2019). Among the former, we can highlight the resources and capabilities of the company and the strategies that are implemented (De Steur *et al*., 2019; García-Cortijo *et al*., 2021), and among the latter are the influence of the market and the whole of the stakeholders that are related to the company and the institutions (Gabzdylova *et al*., 2009; De Steur *et al*., 2019).

Devia (2023) points out that for Argentine wineries, sustainability is a profitable fashion and a requirement to reach specific markets. It is a way to produce world-renowned wines that preserve the local conditions for future generations. Wine in Argentina is an important socioeconomic asset, a thriving business with a surface area cultivated with vines of almost 220,000 hectares, spread over just over 24,000 vineyards in 19 provinces, which represents 3% of the world's surface area and places the country in fifth place as a wine producer in the global ranking. More than 17,000 primary producers are spread from the North to the South of the country, generating more than 106,000 direct jobs and 280,000 indirect jobs (OVA, 2024). In 2024, the sector is expected to generate US$2.83 billion in domestic revenue and US$1.17 billion in exports. It is projected to grow by 7.88% between 2024 and 2029, reaching a total business revenue of US$4.13 billion for the sector at the end of the decade (King, 2024).

Climate change and related phenomena should be a cause for concern, as heat waves, hailstorms, and heavy rains cause damage to vineyards (Straffelini *et al*., 2023). Therefore, in a country culturally and economically connected to the world of wine, such as Argentina, overcoming this sustainability gap and preparing for a climate-adverse future is strategic. More and more Argentine wineries have changed their practices and are moving toward sustainability practices to fight against climate change. As Novaes *et al*. (2010) mentioned, from a sustainable perspective, Argentine wine shows advantages over other countries in organic and biodynamic wine production. Argentine wine producers face a crucial moment where tradition meets sustainability (King, 2024), and, in this sense, finding out what the keys are behind Argentina's sustainable wineries is presented as a fundamental aspect.

Few studies link agricultural sustainability practices and business strategy in the wine sector. Moreover, the few that exist are focused on the wine sector in the Old World, mainly Spain, France, and Italy. Studies on sustainability and its link to company strategy in the New World are scarcer (Gilinsky *et al*., 2016; Flores, 2018; Barbosa *et al*., 2018), and there are very few for the wine sector in Argentina. Straffelini *et al*. (2023) describe that under a climate change scenario, the wine industry is threatened in terms of added value and social impact; therefore, when defining adaptation or mitigation measures, it is essential to have a comprehensive vision of the industry and understand the different business units and their productive and social limitations, establishing communication strategies such as the use of eco-certifications and the generic promotion of regional or national agencies. Riera and Brümmer (2022) show that having economic resources can significantly improve environmental performance and reduce uncertainty for Mendoza wine. Elías *et al*. (2020) argue that innovation strategies should revolve around the preservation of the environment, and Abbona *et al*. (2007) suggest that traditional management practices are ecologically adequate when considered within their original ecological conditions, this being a crucial step toward an agricultural system that reconciles productivity with environmental conservation. However, these studies do not present the strategies adopted by sustainable Argentine wineries, nor have the actors been directly consulted about their actions.

To fill this gap, this article analyzes the orientation of Argentine wineries toward agricultural sustainability practices by examining their internal action drivers, strategies, resources, and capabilities. Regarding wineries' strategies, the article studies the Robinson and Pearce strategic model, differentiating four fundamental strategies: innovation, marketing, efficiency, and service. Regarding resources and capabilities, technological and human resources are analyzed, which are usually related.

2. Literature review

2.1 Agricultural wine sustainability

The sustainability and environmental impacts of the wine industry can be analyzed throughout its entire value chain or in the different phases that make it up (Gónzalez *et al*., 2006; Saxe, 2010; Merli *et al*., 2018; Ferrer *et al*., 2022a, b). In the case of wine, the phases are the cultivation of the vineyard, the production of the wine, storage, aging (when necessary), bottling, and distribution and sale. The literature does not have a single criterion in analyzing its environmental impact or the product's life cycle, L.C.A. (Life Cycle Assessment). Thus, Saxe (2010) distinguishes four phases: vine growth, winemaking, distribution, and bottle disposal. Vinci *et al*. (2022) three: grape production, winemaking process, and wine bottling (see Figure 1 below). Gonzalez *et al*. (2006) also differentiate three phases, viticulture, bottling, and transport, and Gazulla *et al*. (2010), four, viticulture, winemaking, bottling and barrels, and transport.

The wine value chain, spanning agriculture, manufacturing, production, and consumption, shows critical reasons for the urgency of addressing its environmental impact on wine production. From the heavy use of pesticides in vineyards to the carbon footprint of manufacturing, packaging, and transportation, the wine industry has a substantial environmental footprint.

From an agricultural perspective, the wine sector's reliance on the land is paramount. Sustainable practices not only help the environment but also ensure the long-term health of vineyards. Neglecting this aspect can lead to soil degradation and a decline in the quality of grapes. The first stage is considered independent and fundamental, with different names, viticulture, growth of the vine, or grape production, placing its impact between 27% and 50% of the total activity (Merli *et al*., 2018; Vinci *et al*., 2022). The fundamental environmental impacts in the viticulture phase are related to the change in land use and the threat to diversity, the availability of water and other nutrients, and the use of pesticides and synthetic fertilizers (Vinci *et al*., 2022).

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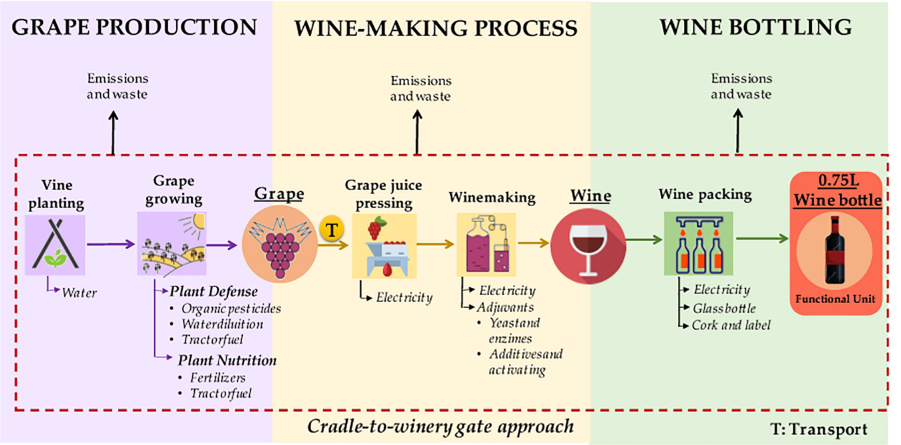

Source(s): Figure courtesy of Vinci *et al*. (2022)

Figure 1. System boundaries in life cycle assessment by Vinci *et al*. (2022)

Ultimately, agricultural wine sustainability (viticulture sustainability) is critical in agricultural management. Farmers must protect their soils to produce more, better, and sustainably. To achieve this, soil management techniques minimize erosion and pollution, promoting soil fertility and plant health (Civit *et al*., 2018; Sotés, 2018; Juste and Mendizábal, 2022). In addition to the soil, other external factors, such as phytosanitary factors, can cause environmental problems to the detriment of sustainability (White, 2013). The need to prevent the negative impact of synthetic chemical pesticides on human health and the environment and consumer expectations regarding chemical residues in food has stimulated sustainable pest management and disease treatment (Pertot *et al*., 2017).

2.2 Business strategy and resources and capabilities

Regarding business strategy, the work begins with Ansoff (1965), indicating the product to be offered and the target market. Strategy surely knows its heyday with Porter's theory of Competitive Advantage (1985), where the company must overcome the existing rivalry in the market by choosing a strategy that distances it from its competitors. Porter (1985) recommends choosing between three successful strategies: differentiation strategy, cost strategy, or focusing on a segment with differentiation or cost. Later strategic developments, among those of Mintzberg, modulate the concept of strategy, expanding it to practically any objective the company may have and how it can achieve it. Strategy is a plan that determines the objectives of the company (Brenes *et al*., 2014), integrates the policies and the most relevant action sequences (Mintzberg, 1997), and contemplates which markets to supply and with what products (Ansoff, 1965). Porter's model (1985), despite receiving criticism, continues to be the reference model when analyzing the company's strategy (e.g. Campbell-Hunt, 2000; Spanos and Lioukas, 2001; Camisón and Villar-López, 2014; Ortega, 2010; Brenes *et al*., 2014; Ali and Anwar, 2021; Habib, 2023). Porter (1985) argues that to achieve competitive advantage, the company must choose between two strategic options: cost leadership or differentiation leadership. Cost leadership focuses mainly on producing low-cost products to satisfy price-sensitive customers (Soltanizadeh *et al*., 2016). Differentiation focuses more on offering different and unique products and services in the industry to a wide range of relatively price-insensitive customers (Soltanizadeh *et al*., 2016). Robinson and Pearce (1988) expand Porter's (1985) model, presenting a greater variety of competitive options with four strategies: Efficiency, Service (high price), Innovation (product development), and Marketing (brand and

channel influence); first two are very close to Porter's cost and differentiation strategies, respectively. This configuration has been used in various studies in the wine sector (i.e. Villanueva and Ferrer, 2020).

There is no single concept of strategy, and the strategic possibilities of companies are diverse, presenting multiple combinations that will evolve depending on the environment in which they are located and their objectives (Bodlaj and Cater, 2022; Ferrer *et al.*, 2022a, b). Companies are continuously adapting to a volatile environment (Fakhreddin *et al.*, 2025). Different authors agree that corporate strategy, from the different options available at the senior management level, is a key factor for success in the design and implementation of sustainability and its development in the wine sector, as well as for achieving competitive advantage (Martínez-Falcó *et al.*, 2024; Fakhreddin *et al.*, 2025).

The Theory of Resources and Capabilities or the Resource-Based View (RBV) (Wernerfelt, 1984; Barney, 1991) expands the analysis of what elements lead to business performance by considering three factors: the company's resources, its competitive advantage, and the sustainability of the competitive advantage (Ferreira and Ferreira, 2024). Thus, the theory analyses the company's external factors (strategy) and internal factors; these factors must meet a series of conditions to drive competitive advantage. Analyzing the characteristics of these internal resources and capabilities allows companies to recognize their core competencies; in short, they can identify the key assets and skills that distinguish them and give them a lasting competitive advantage (Monson, 2024).

The factors considered must have the ability to 1) establish a competitive advantage, 2) sustain the competitive advantage, and 3) allow the appropriation of the rents of the competitive advantage. Resources should be limited, inimitable, non-transferable, or reproducible (Grant, 2010). The Theory of Resources and Capabilities (Barney, 1991) expands the external vision of the company with the differentiating capabilities that the company internally has or can develop; thus, their resources and capabilities modulate the company's strategy and enter a kind of virtuous circle where both reinforce and align each other (Grant, 2010).

Since its beginnings, the RBV has developed vastly, expanding and collecting different conceptual approaches (Pereira and Bamel, 2021). Different studies have demonstrated the validity of the RBV as a key, enduring, and influential element in strategic management research and its application and interest in corporate governance (Helfat *et al.*, 2023; Monson, 2024). The recurrent incorporation in the RBV literature of terms such as "sustainability," "innovation," and "corporate social responsibility" suggests a growing connection of the Resources and Capabilities Theory with broader business issues related to environmental and social governance (Monson, 2024; Warrad and Khaddam, 2020).

An example of this phenomenal expansion and recognition of how valuable the RBV can be is the return of 198,000 scientific articles in Google Scholar in October 2024, with 11,400 corresponding only to 2024. The research related to the RBV has been, therefore, pervasive, and Ferreira and Ferreira (2024) separate it into six clusters: 1) RBV, 2) Customer orientation and Alliance portfolio, 3) Resource-based theory, 4) Firm performance, 5) Entrepreneurial orientation, and 6) Dynamic capabilities. Following this classification, this article could be aligned within the firm performance cluster (4). It searches for the link between wineries' resources and their orientation towards environmental sustainability in pursuing a competitive advantage (Lin *et al.*, 2021).

The capabilities are built on the idiosyncratic characteristics of managers and the history-honed routines and culture of the organization; thus, they are considerably more difficult for rivals to replicate, which results in a competitive advantage (Ferreira, Coelho and Moutinho, 2020).

2.3 Business strategy and sustainability, RBV and sustainability

2.3.1 Strategy and sustainability. Studies that combine sustainability and business strategy are scarce in the wine industry; a few that relate to the topic are Broccardo and Zicari (2020) in

Italy, Ouvrard *et al*. (2020) in France and Italy, and García Cortijo *et al*. (2021), Ferrer *et al.* (2022a, b), and García *et al*. (2023), in Spain. Ferrer *et al.* (2022a, b) highlight how vineyard ownership, bottled versus bulk wine, network resources, exports, and positioning in the premium sector facilitate the sustainability of wineries in Spain.

No research relates sustainability and business strategy in the South American or Argentine wine industries. However, the topic of sustainability practices in the wine sector in Argentina has started to attract attention. The works of Salas-Zorrilla (2020) and Salas-Zorrilla and Farreras (2022) can be highlighted; the latter surveyed 105 wineries in the Mendoza wine region where sustainability policies, barriers, and motivations for their implementation are analyzed. Among the barriers, financial investment and the lack of institutional incentives stand out, as well as motivations, care for the environment, and positioning in international markets. The study concludes that the largest wineries have implemented these principles and are oriented more toward sustainability practices. Also relevant is the work of Abraham *et al*. (2014) and Farreras and Abraham (2020). The latter analyses residents' concerns in the Mendoza region about the three main impacts of the wine industry: water availability, chemical fertilizers, and biodiversity conservation. Based on a survey of 226 people, the study evaluates the monetary value of sustainable agricultural management, concluding that water availability is the most concerning question for the population, followed by chemical fertilizers and biodiversity conservation.

2.3.2 RBV and sustainability. More significant studies on sustainability and RBV exist. They can be grouped within the articles that link resource availability and performance (Ferreira and Ferreira, 2024) and those that analyze the orientation toward environmental practices in the search for competitive advantage (Lin *et al*., 2021). Many articles in the wine industry link the availability of differential resources and sustainability; however, none are related to the Argentinian wine industry. These studies have different conclusions when determining the drivers that favor sustainability. Marketing resources and their ability to capture needs and present a sustainable product are essential in the international markets (Gabzdylova, 2009; Flores, 2018; De Steur *et al.*, 2019; García-Cortijo *et al*., 2021). Technological resources and innovation, which facilitate the change of production processes towards less harmful environmental practices, are also determinants of sustainability practices (Stasi *et al*., 2016; Broccardo and Zicari, 2020; García-Cortijo *et al*., 2021). It appears that human resources and their management, which allows talent retention and training and development of assertive capabilities with stakeholders, is also a clear determinant of practicing sustainability as an attribute of differentiation (Gabzdylova, 2009; De Steur *et al*., 2019; Ferrer *et al*., 2020).

The interconnection between sustainability and achieving competitive advantage, supported by the theories of strategic management and the RBV, is not a theoretical academic exercise. Its critical analysis is a fundamental element of business management to ensure resilience and growth in an increasingly complex environment such as that in which the wine industry finds itself (Frost *et al*., 2020; Martínez-Falco *et al*., 2024).

3. Materials and methods

A micro-econometric model, specifically a Logit, has been proposed to analyze the relationship between agricultural sustainability practices and the competitive strategies of Argentine wineries. Micro-econometric models study the individual behavior of economic agents and the relationships inherent to this process (Horowitz and Savin, 2001; Alonso, 2000). Furthermore, as Johnston and Di Nardo (1997) point out, micro-econometrics provides a methodology that allows the results extracted from surveys to be examined and modeled individually, allowing the capture of effects that are difficult to capture with aggregated data. Many micro-econometric models have been developed according to the characteristics of the endogenous variable that models the different alternatives implicit in the decision problem faced by the individual. In this article, the endogenous variable is discrete binomial; it takes the

value one if the winery adopts sustainability measures and zero otherwise. For this reason, there are two modeling options: a Logit or a Probit. Therefore, the first step of the methodology is to determine which model is appropriate for the available data. Akaike's information and Bayesian criteria will allow the appropriate model to be selected. Afterward, it will be estimated and validated. The Chi-square statistics will determine the overall goodness of fit, McFadden's pseudo-R2, the Specification Error Test, and the area under the ROC curve (the closer to 1, the better). The significance of the exogenous variables will be contrasted with the *p*-value associated with the Z distribution. The variables in the micro-econometric model are presented in the following section.

3.1 Sample and variables

The database contains information from a survey conducted among 204 wineries from August 2019 to May 2021, a representative sample throughout all wine-producing areas of Argentina. The survey had a sampling error of 0.063 for limited populations and a 95% confidence level. With 26.3% of all Argentine wineries responding to the study, the average response rate for an industrial-level survey was noticeably high (Baruch and Holton, 2008; Krishnan and Poulose, 2016). A comprehensive procedure was implemented to contact survey participants before, during, and after they completed it; potential outliers were found, and the respondents were questioned again to address them. Geographical stratification of wineries was implemented to achieve a minimum response rate of 20% in each province that produces wine in Argentina, and the sample was also based and divided in terms of the size of the wineries (production measured in liters). With 137 questions, the 45-min survey was broken up into five sections. Winery profile questions covered age, size, ownership, location, sales, unit pricing, exports, and employment. The survey also covered the marketing and sales functions at the winery and relayed information about their production process, with questions evaluating choices made on vineyard management and the winemaking process (Depetris Chauvin and Villanueva, 2024).

3.2 Dependent variable

This article analyzes the degree of agricultural sustainability practices that wineries perform within their vineyards, creating a sustainability index. It is based on two items from the production phase: soil maintenance and phytosanitary protection. Soil maintenance is critical in agricultural management. Farmers are aware that they must protect soils through soil management techniques, minimizing erosion and pollution and promoting soil fertility and plant health (Civit *et al*., 2018; Sotés, 2018; Juste and Mendizábal, 2022). Moreover, as Abraham *et al*. (2014) point out, the soil is one of the environmental resources whose management is the direct responsibility of the producer within the vineyard. For this reason, this is one of the most important environmental variables for the system's sustainability. Phytosanitary and the need to prevent their negative impact on human health and the environment and consumer expectations regarding chemical residues in food have stimulated sustainable pest management and disease treatment. Conventional viticultural practices, such as the intensive use of agrochemicals, deepen ecological imbalances, generating severe environmental risks. The problem requires redesigning these systems and rethinking their current practices (Pertot *et al*., 2017; Martín *et al*., 2019).

Analytically, and following Ferrer *et al.* (2022a, b), the *Sustainability Index* proposed, $Y_{SUSTAINABILITY,\,i,}$ is the result of the two mentioned items: 1) soil maintenance, $Y_{SOIL,\,i}$, and 2) the application of phytosanitary products, $Y_{PHYTOSANITARYPROD,\,i}$. The index takes a zero value if the companies do not follow any sustainability policy in the two options considered: soil and application of phytosanitary treatments. Otherwise, it takes a value of one. See Table 1 below.

Table 1. Description and statistics of the dependent variable (grouping variable)

Grouping variable	Description	0 frequency	1 frequency
$Y_{SOIL,\ i}$	It takes a value of 0 if the winery does not have any sustainability practices on the soil; it carries out a conventional agricultural practice (*) It takes a value of 1 if the winery carries out sustainable soil management (**)	133	71
$Y_{PHYTOSANITARYPROD,\ i}$	It takes a value of 0 if the winery does not have any sustainability practices on the phytosanitary treatment; it carries out a conventional agricultural practice (*) It takes a value of 1 if the winery carries out sustainable phytosanitary treatments (**)	125	79
$SUSTAINABILITY,\ i$	$SUSTAINABILITY,\ i, = Y_{SOIL,\ i} + Y_{PHYTOSANITARYPROD,\ i}$ = if 0, then 0. If > 0, then 1 It can be defined as the degree of sustainability of a winery, considering its practices in the grape production phase Value 0 = does not have agriculturally sustainable practices Value 1 = Does have some agriculturally sustainable practices	116	88

Note(s): (*) Conventional agriculture is driven by production and profits and is characterized by efficiency and yield maximization
(**) Agriculture with sustainable soil management refers to a) the use of agricultural methods and techniques to minimize the depletion of natural soil resources and b) ecosystem services provided by functional and well-maintained biodiversity
Source(s): Table by authors

3.3 Independent variables

The business variables chosen following the literature and the survey that can explain the different degrees of agricultural sustainability in Argentine wineries are presented in Table 2.

The descriptive statistics of the variables are presented in Table 3 below.

3.4 Functional model

A micro econometric model, specifically a Logit/Probit model, is proposed since it best fits this research's objective and data type. Thus, the $Y^{*}_{SUSTAINABILITY}$ variable adopts the values of 0 and 1, where zero represents that no agricultural sustainability is practiced and 1 represents some practices. The Akaike (AIC) and Bayesian (BIC) information criteria determined that a Logit model (AIC = 277.7744, BIC = 310.9556) was convenient for the development of the study versus a Probit (AIC = 277.7385, BIC = 310.9197) (see Table 4 below).

Thus, considering that the dependent variable $Y^{*}_{SUSTAINABILITY,i}$ represents the degree of application of agriculture-sustainable practices of an Argentine winery (i), the model is defined as follows:

$$Y^{*}_{SUSTAINABILITY,i} = \beta_k X_{k,i} + \varepsilon_i \tag{1}$$

where $Y^{*}_{SUSTAINABILITY,i}$, takes the values 0, 1; X is the matrix of k independent variables, β are the parameters to be estimated, ε is the random perturbation that follows a normal distribution, $\varepsilon \sim N(0,1)$.

Substituting X for each of the independent variables, we have:

Table 2. Description of the independent variables

Independent variables	Description
Theory of resources and capabilities	
Price (PX)	The average price of the retail market in which the produced wines are sold in a 750 ml bottle. It is calculated as the average price of the segments in which each winery sells. Considering that it is calculated as the average of each segment, which takes value one if it is Economical (less than 10 dollars), value two if it is Premium (from 10 to 40 dollars), value three if it is Luxurious (from 40 to 100 dollars) and value four if it is Icon (more than 100 dollars)
Income from other activities (IA)	Percentage of the winery's income from other activities (touristic and/or recreational) Value 0: less than 50% Value 1: equal or more than 50%
Technological resources (TR)	Position of the winery concerning the competition, from very weak (value 1) to very strong (value 5)
Human resources (HR)	Position of the winery concerning the competition, from very weak (value 1) to very strong (value 5)
Exports (EXP)	Do you export wine, or have you exported wine in the last five years? Value 0: no Value 1: yes
Robinson and Pearce's competitive strategies	
Innovation strategy (IRD)	It is calculated as the average value of the items that the winery considers. The scale of the items (answers) ranges from 1 (item not considered) to 5 (primary emphasis). The items (answers) are (Robinson and Pearce, 1988) (1) New product development (2) Developing and refining existing products (3) Emphasis on the manufacturing of specialty products (4) Increased investment in process efficiency-oriented R&D
Marketing strategy (MKT)	It is calculated as the average value of the items that the winery considers. The scale of the items (answers) ranges from 1 (item not considered) to 5 (primary emphasis). The items (answers) are (Robinson and Pearce, 1988) (1) Brand identification (2) Strong influence over distribution channels (3) New product development (4) Innovation in marketing techniques and methods
Efficiency strategy (EF)	It is calculated as the average value of the items that the winery considers. The scale of the items (answers) ranges from 1 (item not considered) to 5 (primary emphasis). The items (answers) are (Robinson and Pearce, 1988) (1) Specific efforts to ensure a pool of highly trained, experienced personnel (2) Stringent quality control procedures (3) Emphasis on improving cost per unit (4) Innovation in manufacturing processes (5) Innovation in marketing techniques and methods (6) Pricing below competitors
Service (SS)	It is calculated as the average value of the items that the winery considers. The scale of the items (answers) ranges from 1 (item not considered) to 5 (primary emphasis). The items (answers) are (Robinson and Pearce, 1988) (1) There is no concern for pricing below competitors (negative load) (2) Customer service (3) Reputation-building efforts within the industry (4) Products in higher-priced market segments (5) Avoid low-priced market segments (negative load)

Source(s): Table by authors

Table 3. Descriptive statistics of the independent variables

Independent variables	Minimum	Maximum	Std. dev.	Mean
Price (PX)	0.25	2.5	0.6876029	0.9558824
Income from other activities (IA)	0	1	0.3397077	0.1323529
Technological resources (TR)	1	5	1.120515	3.357843
Human resources (HR)	1	5	1.19437	3.416667
Exports (EXP)	0	1	0.4448477	0.7303922
Innovation strategy (IRD)	1	5	0.8552265	3.306373
Marketing strategy (MKT)	1	5	0.8384166	3.409314
Efficiency strategy (EF)	1	5	0.6614282	3.28268
Service strategy (SS)	1	5	0.7276244	3.285784

Source(s): Table by authors

Table 4. Akaike's information criterion and Bayesian's information criterion

Model	ll(null)	ll(model)	df	AIC	BIC
Logit	−139.4744	−128.8872	10	277.7744	310.9556
Probit	−139.4744	−128.8872	10	277.7385	310.9197

Source(s): Table by authors

$$Y^{*}_{SUSTAINABILITY,i} = \beta_{0+}\,\beta_1 \mathrm{PX_i} + \beta_2 \mathrm{IA_i} + \beta_3 \mathrm{TR_i} + \beta_4 \mathrm{HR_i} + \beta \mathrm{EXP_{5i}} + \beta_6 \mathrm{IRD_i} + \beta_7 \mathrm{MKT_i} + \beta_8 \mathrm{EF_i} + \beta_9 \mathrm{SS_i} + \varepsilon_i \quad (2)$$

The endogenous variable, $Y^{*}_{SUSTAINABILITY}$ shows the degree of a winery's agriculture sustainability practices. Exogenous variables are Price (PX), Income from other activities (IA), Technological Resources (TR), Human Resources (HR), Exports (EXP), Innovation Strategy (IRD), Marketing Strategy (MKT), Efficiency Strategy (EF), and Service Strategy (SS). The random disturbance (ε) follows a normal distribution, $\varepsilon \sim N(0, 1)$.

4. Results and discussion

STATA 15 software has been used to obtain the econometric results. The estimation of the Logit model is summarized in Table 5 below. The model estimated, with a chi-square statistic whose associated probability is less than 0.05 (0.0119) and a McFadden pseudo-R2 greater than 0.2 (0.2119), represents an excellent fit quality. In addition, it has a correct specification, associated with the Specification Error Test (_hatsq | −0.237497, *p*-value 0.379), and good predictive capacity, associated with the area under the ROC curve (0.7173). As for the exogenous variables, they turned out to be significant, at least with one p-associated value of less than 0.10.

The variables that explain the model and, therefore, the sustainable profile of the wineries are those that result in a *p*-value (P>|z|) less than 0.10. Thus, the significant variables are Innovation Strategy (IRD with a *p*-value = 0.041, Income from other activities (IA) with a *p*-value = 0.07 but negative Z, Technological Resources (TR) with a *p*-value = 0.072, and Human Resources (HR) with a *p*-value = 0.08. The relationship of these variables with $Y^{*}_{SUSTAINABILITY}$ is positive, except for Income from other activities (IA).

Table 5. Estimation of logit coefficients

SUSTAINABILITY	Coef.	Std. err.	z	P>|z|	[95% conf.	interval]
Price (PX)	0.234687	0.251524	0.93	0.351	−0.25829	0.727665
Income from other activities (IA)	−0.88293	0.487795	−1.81	0.07	−1.83899	0.073131
Technological resources (TR)	0.294762	0.163768	1.8	0.072	−0.02622	0.615741
Human resources (HR)	0.262245	0.14987	1.75	0.08	−0.03149	0.555984
Exports (EXP)	−0.19504	0.378605	−0.52	0.606	−0.93709	0.547014
Innovation strategy (IRD)	0.557444	0.273119	2.04	0.041	0.022141	1.092748
Marketing strategy (MKT)	−0.34483	0.29316	−1.18	0.239	−0.91942	0.22975
Efficiency strategy (EF)	−0.36036	0.360884	−1	0.318	−1.06768	0.346955
Service strategy (SS)	−0.00503	0.283635	−0.02	0.986	−0.56094	0.550888
_cons	−1.63356	0.88604	−1.84	0.065	−3.37016	0.10305
LR	$\chi^2(13) = 21.17$					
	Prob > $\chi^2 = 0.0119$					
Pseudo R2	0.2119		*p*-value 0.379			
Area under ROC curve	0.7885					
Specification test error	hatsq | −0.2374974					

Source(s): Table by authors

The results show that wineries in Argentina performing agricultural sustainability methods have more technological and human resources and implement innovative product strategies. However, the results also show that wineries that receive more than 50% of their income from other activities show little concern about agronomical sustainability practices.

Based on these results, the search for sustainable solutions in a competitive market and environmentally demanding consumers is directly related to the search for innovative solutions (IRD) for wine companies. (Kneipp *et al*., 2019; Lekics, 2021; Ahmed *et al*., 2023). Thus, investment in innovation becomes essential to survive, improve, and grow (Elkington, 1998; Gilinsky *et al*., 2008). If this innovation is for environmental purposes, it plays a crucial role in improving resource efficiency and its reputation in the market, as well as the company's performance, both financially and strategically (Packalén, 2010; Cheng and Chang, 2013; Yong *et al*., 2019a, b; Sánchez-García *et al*., 2023).

Innovation is accompanied by the provision of specific resources in technology (TR) and human resources (HR) to implement sustainability policies (Ikram *et al*., 2019; Ferrer *et al*., 2022a, b). The integration of sustainable and technologically advanced practices in viticulture, in addition to optimizing production processes and improving product quality, can lead the way to a more resilient and dynamic future in the wine industry (Cabrera-Flores *et al*., 2020; Tyler *et al*., 2020; Martínez-Falcó *et al*., 2024). In this effort to establish and implement a structured environmental control system (Qiu *et al*., 2020), another key factor is human resources (Gilal *et al*., 2019). Human resource management is a company's most critical asset since it can integrate all activities to achieve positive performance (Hamadamin and Atan, 2019). The importance of the relationship between human resources and environmental management facilitates sustainable development within organizations and increases the ecological knowledge of employees, thus improving the organization's environmental conservation capabilities (Ahmed *et al*., 2023; Tirno *et al*., 2023; El Ayoubi *et al*., 2023). In this sense, the gap between human resource management and environmental management is sought to be reduced, encouraging companies to inspire their employees to be more environmentally conscious and thus boost environmental performance (Amrutha and Geetha, 2020; Montalvo-Falcón *et al*., 2023).

Interest in sustainability in the wine sector is growing simultaneously with awareness of the environmental impacts of climate change. The consequences of climate change have led to the search for practices to identify and reduce greenhouse gas emissions (D'Ammaro *et al*., 2021; Rugani *et al*., 2013). Like many agri-food industries, the wine sector faces challenges and

needs to achieve sustainability (Pomarici and Vecchio, 2019; De Steur *et al.*, 2019). As noted by Schäufele and Hamm (2017) and D'Ammaro *et al*. (2021), consumer interest in wineries' environmental profile also puts enormous pressure on achieving sustainability practices (Plank and Teichmann, 2018; Pomarici and Vecchio, 2019). However, investing in sustainability entails costs (Ferrer *et al.*, 2022a, b), which is why sustainability is not a priority for Argentine wineries whose primary income comes from other activities.

From the point of view of business management, several elements deserve to be mentioned. Regarding business strategy, it should be noted how adaptation to volatile environments leads companies to use various strategic combinations, beyond those mentioned as a classic by Porter (1985) of differentiation, cost, and segmentation (Bodlaj and Cater, 2022; Ferrer *et al.*, 2022a, b; Fakhreddin *et al*., 2025). The analysis shows how the debate on strategic adaptations remains open. In this study, it is evident that neither the cost strategy (efficiency) nor the differentiation strategy (service) is relevant, being surpassed in their relevance by the innovation strategy that can lean towards one or another of Porter's strategies. This points out the relevance of broad and adaptive strategic analysis models since they broaden the company's perspective and overcome traditional theories' limitations. Concerning resources and capabilities (RBV), the study shows how the company's key competencies in achieving its objectives remain relevant, consolidating itself as a fundamental tool for business management, in line with what has been expressed in previous studies (Helfat *et al*., 2023; Monson, 2024). Finally, the study highlights sustainability and its close link with business strategy and the availability of resources, connecting it directly with corporate governance objectives and comparative advantage, a topic of special relevance in the wine sector, a sector that faces uncertainties from climate change and market fluctuations (Frost *et al*., 2020; Martínez-Falco *et al*., 2024).

5. Conclusion

Wineries in Argentina performing agricultural sustainability practices have more technological and human resources and implement innovative product strategies. However, wineries that receive more than 50% of their income from other activities do not show much concern about agronomical sustainability practices.

Vacchi *et al*. (2021) point out that sustainability is an element of competitiveness and an integral part of business strategy. The wine sector faces the challenge and the need to achieve sustainability (Pomarici and Vecchio, 2019; De Steur *et al.*, 2019; Ferrer *et al.*, 2022a, b). Salas and Ferreras (2022) indicate that one main reason Argentine wineries become sustainable is that consumers integrate environmental and sustainability considerations into their lifestyles. In their vision of the future of Argentinian viticulture, they suggest that the image of a conscientious and environmentally responsible producer is a crucial factor in the consumer's purchasing decision (Salas and Ferreras, 2022).

Wineries addressing reducing environmental impacts have more technological and human resources. Those wineries that do not have these resources will be unable to implement these practices and perform sustainably (Pomarici *et al*., 2015; Montella, 2017; Carroquino, 2018).

The *human factor* is considered vital when making any change at the organizational level, and the implementation of the green supply chain is no exception since the benefits of having effective human resources processes make the organization have a high level of adaptability to the changes generated by implementing a sustainable environment (Lengnick-Hall *et al*., 2013). González-Arizpe (2019) mentions the need for trained human resources committed to environmental impact, therefore improving their competitiveness (Davenport and Prusak, 1998; Boons and Lüdeke-Freund, 2013; Yong *et al*., 2019a, b; Yadiati *et al*., 2019).

At the same time, the *technological process* can be leveraged to generate sustainable behaviors, confirming how innovation and sustainability constitute an increasingly close binomial (Vacchi *et al*., 2021). Technology and sustainability should be considered critical factors in a company's competitiveness since, without these factors, it is more difficult to

achieve positive, sustainable results and maintain them over time (Yang *et al*., 2017; Kao *et al*., 2019; García-Granero *et al*., 2020).

Innovations are considered to optimize the efficient and clean use of vital resources (Cancino *et al*., 2018; Pomarici *et al*., 2023). Therefore, wineries must be able to pilot research and innovative activity in their territory of operation (MAPA, 2023). Research projects have experienced exceptional growth to improve the quality of grapes and wines, recover ancestral breeding systems, and alleviate the effects of climate change (López-Altares, 2020). Hernández *et al*. (2023) highlight that Argentine viticulture has many organizations representing the different sectors of the wine-based production chains. National and provincial public and private universities and science and technology organizations collaborate with human resources training, research, development, and knowledge transfer of agricultural wine sustainability practices.

Argentina's 2030 Wine Strategic Plan proposes, among others, compliance with sustainability principles. The Argentine wine agroindustry must organize its future through participatory mechanisms and achieve some consensus on strategic actions allowing sustainable development (Hernández *et al*., 2023), overcoming specific barriers such as 1) low plot diversity, 2) low organic matter content, nutrients, and reduced biological activity, 3) limited alternatives for low-impact inputs, which can replace traditional agrochemicals with high economic value, 4) more significant need for labor, 5) high operating costs, and 6) lower yields (Martin *et al*., 2019).

Innovative wineries from Argentina use sustainable agricultural practices to develop competitive advantages. They can show consumers these sustainable agricultural practices as a differentiator, an attribute that makes them different and coping with consumers' demand worldwide.

References

Abbona, E., Sarandón, S., Marasas, M. and Astier, M. (2007), "Ecological sustainability evaluation of traditional management in different vineyard systems in Berisso, Argentina", *Agriculture, Ecosystems and Environment*, Vol. 119 Nos 3-4, pp. 335-345, doi: 10.1016/j.agee.2006.08.001.

Abraham, L., Alturria, L., Fonzar, A., Ceresa, A. and Arnés, E. (2014), *Propuesta de indicadores de sustentabilidad para la producción de vid en Mendoza*, Vol. 46, Revista de la Facultad de Ciencias Agrarias, Argentina.

Ahmed, R., Akbar, W., Aijaz, M., Channar, Z.A., Ahmed, F. and Parmar, V. (2023), "The role of green innovation on environmental and organizational performance: moderation of human resource practices and management commitment", *Heliyon*, Vol. 9 No. 1, e12679, doi: 10.1016/j.heliyon.2022.e12679.

Ali, B.J. and Anwar, G. (2021), "Porter's generic competitive strategies and its influence on the competitive advantage", *International Journal of Advanced Engineering, Management and Science*, Vol. 7 No. 6, pp. 42-51, doi: 10.22161/ijaems.76.5.

Alonso (2000), "Reconocimiento a la microeconometría en el estudio de los problemas sociales", *Revista: Debate, Pág*, pp. 62-64, Octubre.

Amrutha, V. and Geetha, S. (2020), "A systematic review on green human resource management: implications for social sustainability", *Journal of Cleaner Production*, Vol. 247, 119131, doi: 10.1016/j.jclepro.2019.119131.

Ansoff, H.I. (1965), *Corporate Strategy: Business Policy for Growth and Expansion*, McGraw-Hill Book, New York.

Barbosa, F.S., Scavarda, A.J., Sellitto, M.A. and Marques, D.I.L. (2018), "Sustainability in the winemaking industry: an analysis of Southern Brazilian companies based on a literature review", *Journal of Cleaner Production*, Vol. 192, pp. 80-87, doi: 10.1016/j.jclepro.2018.04.253.

Barney, J. (1991), "Firm resources and sustained competitive advantage", *Journal of Management*, Vol. 17 No. 1, pp. 99-120, doi: 10.1177/014920639101700108.

Baruch, Y. and Holtom, B.C. (2008), "Survey response rate levels and trends in organizational research", *Human Relations*, Vol. 61 No. 8, pp. 1139-1160, doi: 10.1177/0018726708094863.

Bodegas de Argentina (2023), "Bodegas de Argentina", available at: https://www.bodegasdeargentina.org/protocolo-sustentabilidad-2/

Bodlaj, M. and Čater, B. (2022), "Responsive and proactive market orientation in relation to SMEs' export venture performance: the mediating role of marketing capabilities", *Journal of Business Research*, Vol. 138, pp. 256-265, doi: 10.1016/j.jbusres.2021.09.034.

Boons, F. and Lüdeke-Freund, F. (2013), "Business models for sustainable innovation: state-of-the-art and steps towards a research agenda", *Journal of Cleaner Production*, Vol. 45, pp. 9-19, doi: 10.1016/j.jclepro.2012.07.007.

Brenes, E.R., Montoya, D. and Ciravegna, L. (2014), "Differentiation strategies in emerging markets: the case of Latin American agribusinesses", *Journal of Business Research*, Vol. 67 No. 5, pp. 847-855, doi: 10.1016/j.jbusres.2013.07.003.

Broccardo, L. and Zicari, A. (2020), "Sustainability as a driver for value creation: a business model analysis of small and medium enterprises in the Italian wine sector", *Journal of Cleaner Production*, Vol. 259, 120852, doi: 10.1016/j.jclepro.2020.120852.

Cabrera-Flores, M., López-Leyva, J., Peris-Ortiz, M., Orozco-Moreno, A., Francisco-Sánchez, J. and Meza-Arballo, O.A. (2020), "The framework of the penta-helix model to improve the sustainable competitiveness of the wine industry in Baja, California is based on innovative natural resource management", *E3S Web of Conferences*, Vol. 167, 06005, EDP Sciences.

Camisón, C. and Villar-López, A. (2014), "Organizational innovation as an enabler of technological innovation capabilities and firm performance", *Journal of Business Research*, Vol. 67 No. 1, pp. 2891-2902, doi: 10.1016/j.jbusres.2012.06.004.

Campbell-Hunt, C. (2000), "What have we learned about generic competitive strategy? A meta-analysis", *Strategic Management Journal*, Vol. 21 No. 2, pp. 127-154, doi: 10.1002/(sici)1097-0266(200002)21:2<127::aid-smj75>3.0.co;2-1.

Cancino, C., La Paz, A., Ramaprasad, A. and Syn, T. (2018), "Technological innovation for sustainable growth: an ontological perspective", *Journal of Cleaner Production*, Vol. 179, pp. 31-41, doi: 10.1016/j.jclepro.2018.01.059.

Carroquino, J. (2018), "La sostenibilidad de las bodegas españolas Oportunidades de mitigación en materia energética", in *El Sector Vitivinícola Frente al Desafío del Cambio Climático. Estrategias Públicas and Privadas de Mitigación and Adaptación en el Mediterráneo*, 1st ed., Cajamar Caja Rural, Almeria, Spain, pp. 313-336.

Chen, Y. and Chang, C. (2013), "Towards green trust: the influences of green perceived quality, green perceived risk, and green satisfaction", *Management Decision*, Vol. 51 No. 1, pp. 63-82, doi: 10.1108/00251741311291319.

Civit, B., Piastrellini, R., Curadelli, S. and Arena, A.P. (2018), "The water consumed in producing grapes for vinification (Vitis vinifera). Mapping the blue and green water footprint", *Ecological Indicators*, Vol. 85, pp. 236-243, doi: 10.1016/j.ecolind.2017.10.037.

D'Ammaro, D., Capri, E., Valentino, F., Grillo, S., Fiorini, E. and Lamastra, L. (2021), "Benchmarking carbon footprint data from the Italian wine sector: a comprehensive and extended analysis", *Science of the Total Environment*, Vol. 779, 146416.

Davenport, T. and Prusak, L. (1998), *Working Knowledge: How Organizations Manage What they Know*, Harvard Business Press, Boston, MA.

De Steur, H., Temmerman, H., Gellynck, X. and Canavari, M. (2019), "Drivers, adoption, and evaluation of sustainability practices in Italian wine SMEs", *Business Strategy and the Environment*, Vol. 29 No. 2, pp. 744-762, doi: 10.1002/bse.2436.

Depetris Chauvin, N. and Villanueva, E.C. (2024), "The anatomy of exporting wineries of Argentina", *International Journal of Wine Business Research*, Vol. 36 No. 3, pp. 329-350, doi: 10.1108/IJWBR-08-2023-0049.

Devia, S. (2023), "Sustentabilidad: el camino de las bodegas argentinas para hacer el vino del futuro", in *Wines of Argentina*, available at: https://blog.winesofargentina.com/es/destacadas/vitivinicultura-sustentable/ (accessed October 2024).

El Ayoubi, M.S. and Radmehr, M. (2023), "Green food supply chain management is a solution for mitigating food supply chain management risk and improving environmental health", *Heliyon*, Vol. 9 No. 2, e13264, doi: 10.1016/j.heliyon.2023.e13264.

Elías, J., García Negro, A., Ferro, G. and De Salvo, C.P. (2020), "Análisis sobre el conocimiento y la innovación en el sector vitivinícola en Argentina", *IADB*, available at: https://publications.iadb.org/es/analisis-sobre-el-conocimiento-y-la-innovacion-en-el-sector-vitivinicola-en-argentina

Elkington, J. (1998), *Cannibals with Forks: the Triple Bottom Line of the 21st Century*, New Society, Stoney Creek, CT.

Fakhreddin, F., Foroudi, P. and Kooli, K. (2025), "The influence of key account management on competitive advantage and firm performance: a dynamic capability approach", *Industrial Marketing Management*, Vol. 124, pp. 266-286, doi: 10.1016/j.indmarman.2024.12.002.

Farreras, V. and Abraham, L. (2020), "Valuation of viticultural adaptation to climate change in vineyards: a discrete choice experiment to prioritize trade-offs perceived by citizens", *Wine Economics and Policy*, Vol. 9 No. 2, pp. 99-112, doi: 10.36253/web-9823.

Ferreira, N.C. and Ferreira, J.J. (2024), "The field of resource-based view research: mapping past, present and future trends", *Management Decision*, doi: 10.1108/md-10-2023-1908.

Ferrer, J.R., Abella-Garcés, S. and Maza-Rubio, M.T. (2020), "Human resource practices and performance in small Spanish wineries, and their evolution with age and size", *Ciência e Técnica Vitivinícola*, Vol. 35 No. 2, pp. 107-119, doi: 10.1051/ctv/ctv20203502107.

Ferrer, J.R., García-Cortijo, M.C., Pinilla, V. and Castillo-Valero, J.S. (2022a), "The business model and sustainability in the Spanish wine sector", *Journal of Cleaner Production*, Vol. 330, 129810, doi: 10.1016/j.jclepro.2021.129810.

Ferrer, J.R., Serrano, R., Abella, S., Pinilla, V. and Maza, M.T. (2022b), "The export strategy of the Spanish wine industry", *Spanish Journal of Agricultural Research*, Vol. 20 No. 3, p. e0103, doi: 10.5424/sjar/2022203-18966.

Flores, S.S. (2018), "What is sustainability in the wine world? A cross-country analysis of wine sustainability frameworks", *Journal of Cleaner Production*, Vol. 172, pp. 2301-2312, doi: 10.1016/j.jclepro.2017.11.181.

Frost, W., Frost, J., Strickland, P. and Maguire, S. (2020), "Seeking a competitive advantage in wine tourism: heritage and storytelling at the cellar-door", *International Journal of Hospitality Management*, Vol. 87, 102460, doi: 10.1016/j.ijhm.2020.102460.

Gabzdylova, B., Raffensperger, J.F. and Castka, P. (2009), "Sustainability in the New Zealand wine industry: drivers, stakeholders and practices", *Journal of Cleaner Production*, Vol. 17 No. 11, pp. 992-998, doi: 10.1016/j.jclepro.2009.02.015.

García Cortijo, M.C., Ferrer Lorenzo, J.R., Castillo Valero, J.S., Gonçalves, T., Marta Costa, A., Pinilla, V., Rebello, J. and Serrano, R. (2023), "Sustainability determinants in the Iberian wine industry", *New Medit, A Mediterranean Journal of Economics, Agriculture and Environment*, Vol. 2023 No. 4.

García-Cortijo, M.C., Ferrer, J.R., Castillo-Valero, J.S. and Pinilla, V. (2021), "The drivers of the sustainability of Spanish wineries: resources and capabilities", *Sustainability*, Vol. 13 No. 18, 10171, doi: 10.3390/su131810171.

García-Granero, E.M., Piedra-Muñoz, L. and Galdeano-Gómez, E. (2020), "Measuring eco-innovation dimensions: the role of environmental corporate culture and commercial orientation", *Research Policy*, Vol. 49 No. 8, 104028, doi: 10.1016/j.respol.2020.104028.

Gazulla, C., Raugei, M. and Fullana, P. (2010), "Taking a life cycle look at Crianza wine production in Spain: where are the bottlenecks?", *International Journal of Life Cycle Assessment*, Vol. 15, pp. 330-337.

Gilal, F., Ashraf, Z., Gilal, N., Gilal, R.G. and Channa, N.A. (2019), "Promoting environmental performance through green human resource management practices in higher education institutions: a moderated mediation model", *Corporate Social Responsibility and Environmental Management*, Vol. 26 No. 6, pp. 1579-1590, 2019, doi: 10.1002/csr.1835.

Gilinsky, A., Santini, C., Lazzeretti, L. and Eyler, R. (2008), "Desperately seeking serendipity: exploring the impact of country location on innovation in the wine industry", *International Journal of Wine Business Research*, Vol. 20 No. 4, pp. 302-320, doi: 10.1108/17511060810919425.

Gilinsky, A., Jr, Newton, S.K. and Vega, R.F. (2016), "Sustainability in the global wine industry: concepts and cases", *Agriculture and Agricultural Science Procedia*, Vol. 8, pp. 37-49, doi: 10.1016/j.aaspro.2016.02.006.

Gonzalez, A., Klimchuk, A. and Martin, M. (2006), *Life Cycle Assessment of Wine Production Process: Finding Relevant Process Efficiency and Comparison to Eco-Wine Production*, Royal Institute of Technology, Stockholm.

González-Arizpe, J.L. (2019), "La cadena de suministro verde: su importancia e integración en las organizaciones contemporáneas", *Daena: International Journal of Good Conscience*, Vol. 14 No. 1, pp. 320-334.

Grant, R.M. (2010), *Contemporary Strategy Analysis: Text and Cases Edition*, John Wiley & Sons.

Habib, A.M. (2023), "Do business strategies and environmental, social, and governance (ESG) performance mitigate the likelihood of financial distress? A multiple mediation model", *Heliyon*, Vol. 9 No. 7, e17847, doi: 10.1016/j.heliyon.2023.e17847.

Hamadamin, H. and Atan, T. (2019), "The impact of strategic human resource management practices on competitive advantage sustainability: the mediation of human capital development and employee commitment", *Sustainability*, Vol. 11 No. 20, p. 5782, doi: 10.3390/su11205782.

Helfat, C.E., Kaul, A., Ketchen Jr, D.J., Barney, J.B., Chatain, O. and Singh, H. (2023), "Renewing the resource-based view: new contexts, concepts, and methods", *Strategic Management Journal*, Vol. 44 No. 6, pp. 1357-1390, doi: 10.1002/smj.3500.

Hernández, J.J., Santi, C., Battistella, M., Pérez Peña, G. and Parera, C. (2023), "The 2030 strategic wine plan in Argentina. Eutopía", *Revista de Desarrollo Económico Territorial No. 23 – junio*.

Horowitz, J.L. and Savin, N.E. (2001), "Binary response models: logits, probits and semiparametrics", *The Journal of Economic Perspectives*, Vol. 15 No. 4, pp. 43-56, doi: 10.1257/jep.15.4.43.

Ikram, M., Zhou, P., Shah, S.A.A. and Liu, G.Q. (2019), "Do environmental management systems help improve corporate sustainable development? Evidence from manufacturing companies in Pakistan", *Journal of Cleaner Production*, Vol. 226, pp. 628-641, doi: 10.1016/j.jclepro.2019.03.265.

Johnston, J. and Di Nardo, J. (1997), *Econometric Methods*, MacGraw-Hill, New York.

Juste, J.J. and Mendizábal, G. (2022), "Clustering and sustainability: an approach from the Spanish wine sector and its designations of origin", *Revista de Estudios Empresariales. Segunda época*, No. 2, pp. 116-156, doi: 10.17561/ree.n2.2022.7070.

Kao, Y.S., Nawata, K. and Huang, C.Y. (2019), "Systemic functions evaluation based technological innovation system for the sustainability of IoT in the manufacturing industry", *Sustainability 2019*, Vol. 11 No. 8, p. 2342, doi: 10.3390/su11082342.

King, R. (2024), "Las claves detrás del movimiento vitivinícola sustentable en Argentina", *Forbes Argentina*, October 2024, available at: https://www.forbesargentina.com/lifestyle/las-claves-detras-movimiento-vitivinicola-sustentable-argentina-n59848

Kneipp, J.M., Gomes, C.M., Bichueti, R.S., Frizzo, K. and Perlin, A.P. (2019), "Sustainable innovation practices and their relationship with the performance of industrial companies", *REGE Revista De Gestão*, Vol. 26 No. 2, pp. 94-111, doi: 10.1108/REGE-01-2018-0005.

Krishnan, T.N. and Poulose, S. (2016), "Response rate in industrial surveys conducted in India: trends and implications", *IIMB Management Review*, Vol. 28 No. 2, pp. 88-97, doi: 10.1016/j.iimb.2016.05.006.

Lekics, V. (2021), "Sustainable innovation in the wine industry: a systematic review", *Regional and Business Studies*, Vol. 13 No. 1, pp. 55-73, 2021, doi: 10.33568/rbs.2817.

Lengnick-Hall, M.L., Lengnick-Hall, C.A. and Rigsbee, C.M. (2013), "Strategic human resource management and supply chain orientation", *Human Resource Management Review*, Vol. 23 No. 4, pp. 366-377.

Lin, H., Chen, L., Yu, M., Li, C., Lampel, J. and Jiang, W. (2021), "Too little or too much of good things? The horizontal S-curve hypothesis of green business strategy on firm performance", *Technological Forecasting and Social Change*, Vol. 172, 121051, doi: 10.1016/j.techfore.2021.121051.

López-Altares, L. (2020), "La I+D+i en el vino: ¿asignatura pendiente?", available at: https://www.mivino.es/noticia/47/reportaje/20682/la-i-d-i-en-el-vino-asignatura-pendiente

MAPA (2023), "Agricultura, Ganadería y Pesca de España", available at: https://www.mapa.gob.es/es/alimentacion/temas/calidad-diferenciada/estudio_retrato_de_situacion_sostenibilidad_do-vino_tcm30-676541.pdf

Martin, E.A., Dainese, M., Clough, Y., Báldi, A., Bommarco, R., Gagic, V., Garratt, M.P.D., Holzschuh, A., Kleijn, D., Kovács-Hostyánszki, A., Marini, L., Potts, S.G., Smith, H.G., Al Hassan, D., Albrecht, M., Andersson, G.K.S., Asís, J.D., Aviron, S., Balzan, M.V., Baños-Picón, L., Bartomeus, I., Batáry, P., Burel, F., Caballero-López, B., Concepción, E.D., Coudrain, V., Dänhardt, J., Diaz, M., Diekötter, T., Dormann, C.F., Duflot, R., Entling, M.H., Farwig, N., Fischer, C., Frank, T., Garibaldi, L.A., Hermann, J., Herzog, F., Inclán, D., Jacot, K., Jauker, F., Jeanneret, P., Kaiser, M., Krauss, J., Le Féon, V., Marshall, J., Moonen, A., Moreno, G., Riedinger, V., Rundlöf, M., Rusch, A., Scheper, J., Schneider, G., Schüepp, C., Stutz, S., Sutter, L., Tamburini, G., Thies, C., Tormos, J., Tscharntke, T., Tschumi, M., Uzman, D., Wagner, C., Zubair-Anjum, M. and SteffanDewenter, I. (2019), "The interplay of landscape composition and configuration: new pathways to manage functional biodiversity and agroecosystem services across Europe", *Ecology Letters*, Vol. 22 No. 7, pp. 1083-1094, doi: 10.1111/ele.13265.

Martínez-Falcó, J., Sánchez-García, E., Marco-Lajara, B. and Georgantzis, N. (2024), "The interplay between competitive advantage and sustainability in the wine industry: a bibliometric and systematic review", *Discover Sustainability*, Vol. 5 No. 1, p. 13, doi: 10.1007/s43621-024-00196-4.

Merli, R., Preziosi, M. and Acampora, A. (2018), "Sustainability experiences in the wine sector: toward the development of an international indicators system", *Journal of Cleaner Production*, Vol. 172, pp. 3791-3805, doi: 10.1016/j.jclepro.2017.06.129.

Mintzberg, H. (1997), "Managing on the edges", *International Journal of Public Sector Management*, Vol. 10 No. 3, pp. 131-153, doi: 10.1108/09513559710166020.

Monson, F.K.S. (2024), "Unveiling the strategic resource dimension: a bibliometric and systematic review of the resource-based view and its application to corporate governance", *The Journal of High Technology Management Research*, Vol. 35 No. 2, 100516, doi: 10.1016/j.hitech.2024.100516.

Montalvo-Falcón, J., Sánchez-García, E., Marco-Lajara, B. and Martínez-Falcó, J. (2023), "Green Human resource management and economic, social and environmental performance: evidence from the Spanish wine industry", *Heliyon*, Vol. 9 No. 10, e20826, doi: 10.1016/j.heliyon.2023.e20826.

Montella, M. (2017), "Wine tourism and sustainability: a review", *Sustainability*, Vol. 9 No. 1, p. 113, doi: 10.3390/su9010113.

Moscovici, D. and Reed, A. (2018), "Comparing wine sustainability certifications worldwide: history, status, and opportunity", *Journal of Wine Research*, Vol. 29, pp. 1-25, doi: 10.1080/09571264.2018.1433138.

Muñoz, R.M., Fernández, M.V. and Salinero, Y. (2021), "Sustainability, corporate social responsibility, and performance in the Spanish wine sector", *Sustainability*, Vol. 13 No. 1, p. 7, doi: 10.3390/su13010007.

Novaes, S., Friel, D., Machado, F. and Nascimento, L. (2010), "Organic wine production: the case of Bodega Colomé in Argentina", *International Journal of Wine Business Research*, Vol. 22 No. 2, pp. 164-177.

OIV (2024), *OIV*, International Wine Organization, available at: https://www.oiv.int/es/quienes-somos/estrategia

Ortega, M.J. (2010), "Competitive strategies and firm performance: technological capabilities' moderating roles", *Journal of Business Research*, Vol. 63 No. 12, pp. 1273-1281, doi: 10.1016/j.jbusres.2009.09.007.

Ouvrard, S., Jasimuddin, S.M. and Spiga, A. (2020), "Does sustainability push to reshape business models? Evidence from the European wine industry", *Sustainability*, Vol. 12 No. 6, p. 2561, doi: 10.3390/su12062561.

OVA (2024), "Observatorio vitivinícola Argentino", available at: https://www.observatoriova.com/category/reportes-interactivos/?page=5

Packalén, S. (2010), "Culture and sustainability", *Corporate Social Responsibility and Environmental Management*, Vol. 17 No. 2, pp. 118-121, doi: 10.1002/csr.236.

Pereira, V. and Bamel, U. (2021), "Extending the resource and knowledge-based view: a critical analysis into its theoretical evolution and future research directions", *Journal of Business Research*, Vol. 132, pp. 557-570, doi: 10.1016/j.jbusres.2021.04.021.

Pertot, I., Caffi, T., Rossi, V., Mugnai, L., Hoffmann, C., Grando, M.S., Gary, C., Lafond, D., Duso, C., Thiery, D., Mazzoni, V. and Anfora, G. (2017), "A critical review of plant protection tools for reducing pesticide use on grapevine and new perspectives for implementing IPM in viticulture", *Crop Protection*, Vol. 97, pp. 70-84, doi: 10.1016/j.cropro.2016.11.025.

Plank, A. and Teichmann, K. (2018), "A facts panel on corporate social and environmental behavior: decreasing information asymmetries between producers and consumers through product labeling", *Journal of Cleaner Production*, Vol. 177, pp. 868-877, doi: 10.1016/j.jclepro.2017.12.195.

Pomarici, E. and Vecchio, R. (2019), "Will sustainability shape the future wine market?", *Wine Economics and Policy*, Vol. 8 No. 1, pp. 1-4, doi: 10.1016/j.wep.2019.05.001.

Pomarici, E., Vecchio, R. and Mariani, A. (2015), "Wineries' perception of sustainability costs and benefits: an exploratory study in California", *Sustainability*, Vol. 7 No. 12, pp. 16164-16174, doi: 10.3390/su71215806.

Pomarici, E., Di Chiara, V. and Liggieri, S. (2023), "Make the prosecco DOC wine chain sustainable: the case of the prosecco sustainability project", *BIO Web of Conferences*, Vol. 56, 03019, EDP Sciences.

Porter, M.E. (1985), *Competitive Advantage: Creating and Sustaining Superior Performance*, Free Press, New York, NY.

Qiu, L., Jie, X., Wang, Y. and Zhao, M. (2020), "Green product innovation, green dynamic capability, and competitive advantage: evidence from Chinese manufacturing enterprises", *Corporate Social Responsibility and Environmental Management*, Vol. 27 No. 1, pp. 146-165, doi: 10.1002/csr.1780.

Riera, F. and Brümmer, B. (2022), "Environmental efficiency of wine grape production in Mendoza, Argentina", *Agricultural Water Management*, Vol. 262, 107376, doi: 10.1016/j.agwat.2021.107376.

Robinson, R.B. and Pearce, J.A. (1988), "Planned patterns of strategic behavior and their relationship to business-unit performance", *Strategic Management Journal*, Vol. 9 No. 1, pp. 43-60, doi: 10.1002/smj.4250090105.

Rugani, B., Vázquez-Rowe, I., Benedetto, G. and Benetto, E. (2013), "A comprehensive review of carbon footprint analysis as an extended environmental indicator in the wine sector", *Journal of Cleaner Production*, Vol. 54, pp. 61-77, doi: 10.1016/j.jclepro.2013.04.036.

Salas Zorrilla, J. (2020), "Sustentabilidad del sector vitivinícola en la provincia de Mendoza, Argentina: su posible impacto en el mercado mundial", (Tesina de grado, Universidad Nacional de Cuyo).

Salas Zorrilla, J. and Farreras, V. (2022), "¿Avanzamos hacia una vitivinicultura sostenible? Un estudio exploratorio de la industria del vino de Argentina", *Estudios Económicos*, Vol. 39 No. 79, pp. 127-167, doi: 10.52292/j.estudecon.2022.2775.

Sánchez-García, E., Martínez-Falcó, J., Alcon-Vila, A. and Marco-Lajara, B. (2023), "Developing green innovations in the wine industry: an applied analysis", *Foods*, Vol. 12 No. 6, p. 1157, doi: 10.3390/foods12061157.

Santini, C., Cavicchi, A. and Casini, L. (2013), "Sustainability in the wine industry: key questions and research trends[a]", *Agricultural and Food Economics*, Vol. 1, pp. 1-14, doi: 10.1186/2193-7532-1-9.

Saxe, H. (2010), "LCA-based comparison of the climate footprint of beer vs wine and spirits. Fødevareøkonomisk Institut, Københavns Universitet", *Report*, No. 207.

Schäufele, I. and Hamm, U. (2017), "Consumers' perceptions, preferences and willingness-to-pay for wine with sustainability characteristics: a review", *Journal of Cleaner Production*, Vol. 147, pp. 379-394, doi: 10.1016/j.jclepro.2017.01.118.

Sellers-Rubio, R. and Nicolau-Gonzalbez, J.L. (2016), "Estimating the willingness to pay for a sustainable wine using a Heckit model. Wine Econ", *Policy*, Vol. 5 No. 2, pp. 96-104, doi: 10.1016/j.wep.2016.09.002.

Soltanizadeh, S., Rasid, S.Z.A., Golshan, N.M. and Ismail, W.K.W. (2016), "Business strategy, enterprise risk management, and organizational performance", *Management Research Review*, Vol. 39 No. 9, pp. 1016-1033, doi: 10.1108/mrr-05-2015-0107.

Sotés, V. (2018), "Impactos y adaptación al cambio climático en España", available at: https://www.publicacionescajamar.es/publicacionescajamar/public/pdf/series-tematicas/informescoyuntura-monografias/el-sector-vitivinicola-frente-al.pdf

Spanos, Y.E. and Lioukas, S. (2001), "An examination into the causal logic of rent generation: contrasting Porter's competitive strategy framework and the resource-based perspective", *Strategic Management Journal*, Vol. 22 No. 10, pp. 907-934, doi: 10.1002/smj.174.

Stasi, A., Muscio, A., Nardone, G. and Seccia, A. (2016), "New technologies and sustainability in the Italian wine industry", *Agriculture and Agricultural Science Procedia*, Vol. 8, pp. 290-297, doi: 10.1016/j.aaspro.2016.02.023.

Straffelini, E., Carrillo, N., Schilardi, C., Aguilera, R., Orrego, M.J.E. and Tarolli, P. (2023), "Viticulture in Argentina under extreme weather scenarios: actual challenges, future perspectives", *Geography and Sustainability*, Vol. 4 No. 2, pp. 161-169, doi: 10.1016/j.geosus.2023.03.003.

Tirno, R., Islam, N. and Happy, K. (2023), "Green HRM and eco-friendly behavior of employees: relevance of pro-ecological climate and environmental knowledge", *Heliyon*, Vol. 9 No. 4, e14632, doi: 10.1016/j.heliyon.2023.e14632.

Tyler, B., Lahneman, B., Beukel, K., Cerrato, D., Minciullo, M., Spielmann, N. and Discua, C.A. (2020), "SME managers' perceptions of competitive pressure and the adoption of environmental practices in fragmented industries: a multi-country study in the wine industry", *Organization and Environment*, Vol. 33 No. 3, pp. 437-463, doi: 10.1177/1086026618803720.

Vacchi, M., Siligardi, C., Demaria, F., Cedillo-González, E.I., González-Sánchez, R. and Settembre-Blundo, D. (2021), "Technological sustainability or sustainable technology? A multidimensional vision of sustainability in manufacturing", *Sustainability*, Vol. 13 No. 17, p. 9942, doi: 10.3390/su13179942.

Villanueva, E.C. and Ferrer, J.R. (2020), "Rhode Island and Connecticut wineries business strategy, performance, and management capabilities: a survey of managerial practices", *Journal of Wine Research*, Vol. 31 No. 2, pp. 124-140, doi: 10.1080/09571264.2020.1780574.

Villanueva, E.C., Depetris-Chauvin, N. and Pinillla, V. (2023), "The wine industry: drivers and patterns of global transformation", in Kipping, M., Kurosawa, T. and Westney, D.E. (Eds), *The Oxford Handbook of Industry Dynamics*, Oxford Academic, Oxford.

Vinci, G., Prencipe, S.A., Abbafati, A. and Filippi, M. (2022), "Environmental impact assessment of an organic wine production in central Italy: case study from Lazio", *Sustainability*, Vol. 14 No. 22, 15483.

Warrad, L. and Khaddam, L. (2020), "The effect of corporate governance characteristics on the performance of Jordanian banks", *Accounting*, Vol. 6 No. 2, pp. 117-126, doi: 10.5267/j.ac.2019.12.001.

Wernerfelt, B. (1984), "A resource-based view of the firm", *Strategic Management Journal*, Vol. 5 No. 2, pp. 171-180, doi: 10.1002/smj.4250050207.

White, R. (2013), *Crimes against Nature: Environmental Criminology and Ecological Justice*, Willan, London.

WOA (2024), "Wines of Argentina", available at: https://blog.winesofargentina.com/es/news-nl/bodegas-certifican-sustentabilidad/

Yadiati, W., Nissa, N., Paulus, S., Suharman, H. and Meiryani, M. (2019), "The role of green intellectual capital and organizational reputation in influencing environmental performance", *International Journal of Energy Economics and Policy*, Vol. 9 No. 3, pp. 261-268, doi: 10.32479/ijeep.7752.

Yang, Z., Sun, J., Zhang, Y. and Wang, Y. (2017), "Green, green, green: a triad model of technology, culture, and innovation for corporate sustainability", *Sustainability 2017*, Vol. 9 No. 8, p. 1369, doi: 10.3390/su9081369.

Yong, J., Yusliza, M., Jabbour, C. and Ahmad, N. (2019a), "Exploratory cases on the interplay between green human resource management and advanced green manufacturing in light of the ability-motivation-opportunity theory", *The Journal of Management Development*, Vol. 39 No. 1, pp. 31-49, doi: 10.1108/jmd-12-2018-0355.

Yong, J.Y., Yusliza, M.Y., Ramayah, T. and Fawehinmi, O. (2019b), "Nexus between green intellectual capital and green human resource management", *Journal of Cleaner Production*, Vol. 215, pp. 364-374.

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