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Article

SUSTAINABILITY HEDONIC ENVIRONMENTAL MODELS APPLIED TO WINERIES

MODELOS AMBIENTAIS HEDÔNICOS DE SUSTENTABILIDADE APLICASDOS ÀS ADEGAS

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SUMMARY

This study introduced the application of a new methodology to the assessment of sustainability for wineries in Spain. It adapted Rosen's hedonic models, developed in other areas of the economy, to explain the environmental commitment of wineries in terms of trends in their attributes, considering: a) resources and capabilities; b) development variables; c) commercial factors. The database for the empirical analysis was drawn up from two surveys; the first was performed in 2016, and the second occurred between 2020 and 2021. Using the Box-Cox technique, the results showed that improving the companies' attributes, especially in human resources and management, exports and distribution via Horeca, promotes a greater valorization of sustainability by the wineries.

RESUMO

Este estudo introduziu a aplicação de uma nova metodologia para a avaliação da sustentabilidade de adegas em Espanha. Adaptou os modelos hedónicos de Rosen, desenvolvidos em outras áreas da economia, para explicar o compromisso ambiental das adegas em função da evolução dos seus atributos, considerando: a) recursos e capacidades; b) variáveis de desenvolvimento; c) fatores comerciais. A base de dados para a análise empírica foi elaborada a partir de dois inquéritos; o primeiro foi realizado em 2016, e o segundo decorreu entre 2020 e 2021. Utilizando a técnica Box-Cox, os resultados mostraram que uma melhoria nos atributos das empresas, especialmente nos recursos humanos e na gestão, na exportação e na distribuição via Horeca, promove uma maior valorização da sustentabilidade pelas adegas.

Keywords: Sustainability, hedonic model, wine industry, wineries.
Palavras-chave: Sustentabilidade, modelo hedónico, sector vitivinícola, adegas.

INTRODUCTION

Sustainability is a key goal of public, private, national and international institutions and is omnipresent in business activity. It has become a new paradigm entailing the search for social and economic advances to guarantee a good standard of living for current generations while not undermining the possibility of growth for future generations (Warner, 2007; Bermejo, 2014; Moscovici and Reed, 2018; Pomarici and Vecchio, 2019; UN, 2019; Muñoz *et al*., 2021). A society's sustainability is based on a balance between environmental, economic and social dimensions (Elkington, 1994; Vasileiou and Morris, 2006; Schader *et al*., 2014; Meynard *et al*., 2017; Bryceson and Ross, 2020).

Like other sectors, the wine sector has to face the challenge of moving towards sustainability (Santini *et al*., 2013; Pomarici and Vecchio, 2019; De Steur *et al*., 2020), but its approach must be different for several reasons; vines grow on land where it is often

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not possible to grow other crops (Ferrer *et al*., 2020); wine production encourages people to settle in rural areas, creating wealth and jobs in the local economy (Barbosa *et al*., 2018); it is based on values relating to the family and culture (Flores, 2018); winemaking has a longstanding tradition that requires time and the passing-on of values (Szolnoki, 2013; Corbo *et al*., 2014; Barbosa *et al*., 2018; OIV, 2021). The wine sector is a source of negative externalities, such as land use, consumption of water, energy and pesticides, wastewater, solid waste and carbon footprint (Santini *et al*., 2013; Szolnoki, 2013; Aubert and Enjolras, 2014; Corbo *et al*., 2014; Flores, 2018; Merli *et al*., 2018; Ayuda *et al*., 2020; Pinto, 2021). Since the start of the 21st century, sustainable practices have been adopted increasingly (Gilinsky *et al*., 2016; De Steur *et al*., 2020) even though sustainable wine production was considered and recommended by the International Organisation of Vine and Wine back in 2004. It has thus become a key, though complex, matter for the wine industry (Costa *et al*., 2022) and, according to Gilinski *et al*. (2016), one of its key priorities is to leave the land on which its activity takes place in good condition for coming generations.

However, there is no single type of sustainable behavior (Baiano, 2021), and different approaches are adopted by different wineries (Santini *et al*., 2013, Szolnoki, 2013). Studies such as those of Szolnoki *et al*. (2011), García-Cortijo *et al*. (2021) and Ferrer *et al*. (2022) indicate that the perception of sustainability varies depending on companies' characteristics, but how this perception is formed is not considered.

This study aims to find out which factors determine the intrinsic valuation of sustainability, that is, which attributes are behind the decisions taken by individual wineries when assessing their environmental actions. The objective of this study, therefore, is to identify the characteristics that explain the value or essence of business sustainability for wineries.

MATERIALS AND METHODS

Methodological framework

The value of sustainability in the wine sector. Hedonic models

Wineries include their sustainability concerns in their business models (Brocado and Zicari, 2020; Ferrer *et al*., 2022), aiming to link them with their customers preferences (McGrath, 2010; Provance *et al*., 2011). Wine Intelligence (2022) finds that between 56% and 67% of consumers in the United States of America, Canada, United Kingdom, Sweden and Australia are very concerned about sustainability. Therefore, interest in sustainability and the adoption and development of sustainability practices have become a paradigm that should be clarified and explained (Hospido *et al*., 2022).

Sustainable behaviour by wineries depends on characteristics associated with each individual company (Herrera *et al*., 2013), and each winery values its degree of sustainability differently. This approach is the same as the one that lies behind Rosen's hedonic price theory. Briefly, Rosen's theory establishes that a good *i* with a number *k* of attributes *Q*, $Q= (Q_1, Q_2, ..., Q_k)$, has a *P* value determined by those attributes k of that good *i*, and that a hedonic model determines the relationship between *P* and *Q* based on the following analytical expression: $P=f(Q)$, where *f* is the functional relationship between *P* and *Q*.

Therefore, if this approach is extrapolated to the sustainability of wineries, it can be stated that a winery *i* has a number *k* of attributes *Q*, $Q= (Q_1, Q_2, ..., Q_k)$, which determine the value of its business sustainability *P*, through the relation $P=f(Q)$. Since $P=f(Q)$ is a generic mathematical representation with no precise functional form and unknown parameters, its econometric specification has to be used, which for $P=f(Q)$ would be that expressed in Equation 1.

$$P_i=f(Qji, \varepsilon_i) \quad \textbf{Eq. 1}$$

$$Q_{j,i}=(Q_{1i}, Q_{2i},...,Q_{ki})$$

$$\varepsilon_i \sim N(0, \sigma_\varepsilon)$$

$$i=1,2,3,\ldots h, \quad j=1,2,3, \ldots k$$

where *i* represents a winery, P_i is the sustainability value of *i*, Q_{ji} are the attributes of *i*, *f* is the functional relation between P_i and $Q_{j,i}$ and ε_i is the random disturbance which follows normal distribution with mean zero and constant variance $\varepsilon_i \sim N(0, \sigma_\varepsilon)$. It is considered that, as a winery's attributes (resources and results) improve, the value it places on sustainability should increase (Sogari *et al.* 2017; Laskar 2019; Bandinelli *et al*.; 2020; Ouvard *et al.* 2020; Luzzani *et al.* 2021). Mathematically, the first partial derivative of *f* for each $Q_{j,i}$ would be: $\partial f/\partial Q>0$, but the model could include negative first derivatives without losing validity but subtracting value from P_i.

Each element of the hedonic model, that is, P_i and $Q_{j,i}$, are presented below.

Valuation of business sustainability (Pi)

In this case, the valuation of sustainability, P_i, was considered to be the result of adding three items $P_{EWINE,i} + P_{FOOTPRINT,i} + P_{CSR,i}$, namely: 1) production in the winery of organic wines, P_{EWINE} (Szolnoki, 2013; Schäufele and Hamm, 2017); 2) concern about the carbon footprint, $P_{FOOTPRINT}$, (Merli *et al*., 2018; Pomarici and Vecchio, 2019); 3) corporate social responsibility, P_{CSR} (Muñoz *et al*., 2021). Organic wine is wine made from organically grown grapes without the help of, or need for, synthetic fertilizers, synthetic plant treatments or herbicides.

Organic grapes come from vineyards following organic farming methods, as defined at the European level by the Council Regulations (EC) No. 834/2007 and No. 889/2008 on organic production and the labelling of organic products, so the only rules to be applied to wines processed from organic grapes are those contained in the EC Regulations 479/2008 (annexes 4 and 5) and 1622/2000, which define the oenological practices and treatments allowed for wines in Europe (Cuilhé and Valor, 2013; Szolnoki, 2013).

The carbon footprint is one of the most widespread indicators for assessing the environmental effects of food production and consumption (Scrucca *et al*., 2018), and the publication of ISO 14067 has standardized the methodology for quantifying it, including for wine (Hospido *et al*., 2022). Point *et al*. (2012) found that bottling and distribution logistics are highly carbon-intensive and account for around 50% of the carbon dioxide (CO_2) generated in the entire wine supply chain.

Corporate social responsibility can be a requirement for business competitiveness in the medium and long term and a major issue for future market positioning (Pinto, 2021). It was already recommended by Pomarici and Vecchio (2014), who indicate that market and regulatory forces reduce and communicate the environmental and social performance of the wine sector. Corporate sustainability requires socioenvironmental practices that can reduce the negative impacts of the wine industry in alignment with economic objectives (Szolnoki, 2013; Taylor, 2017). Unlike the environmental dimension, the social dimension of sustainability has often been neglected (Merli *et al*., 2018; Santos *et al*., 2019; Atanda and Öztürk, 2020; Nilipour, 2020; Trigo *et al*., 2020; Costa *et al*., 2022), but today it is conceived as a tool to rectify bad practices that harm the well-being of employees and the community (Martucci *et al*., 2019). In other words, improving employees' health and well-being promotes good community relationships, optimizes organizational skills and boosts both the company's economic performance and its collaboration with partners or suppliers (Taylor, 2017; Annunziata *et al*., 2018; Costa *et al*., 2022).

Attributes. $Q_{j,i}$

From the different elements that define the essence of a winery, the following have been selected: resources and capabilities (technology-innovation, marketing, human resources and management); development factors (ROA and growth); sales (exports, distribution methods). The hypotheses to be tested in this study have been organised based on this classification of resources.

Hypotheses

The main hypothesis (MH) is that the score for sustainability of a winery *i*, that is, P_i, is a function of the attributes $Q_{j,i}$ listed above. This hypothesis is then broken down into sub-hypotheses for each of these attributes.

To start with resources and capabilities, this research analysed technology-innovation, marketing, human resources and management. Technology-innovation allows for organic production and lower emissions of harmful gases into the atmosphere and is a key for acting to improve sustainability (BAI and Cimas, 2008; Stasi *et al*., 2016; Montella, 2017; Broccardo and Zicari, 2020; Ouvrard *et al*., 2020). Without such resources, it would be difficult to set up sustainable policies (Pomarici *et al*., 2015; Montella, 2017; Carroquino 2018). The following hypothesis is therefore posed:

H1.1 The valuation of sustainability, $P_{SUSTAINABILITY}$, rises as technology and innovation resources increase.

Continuing with resources, marketing and advertising constantly encourage consumers to incorporate into their lives all the products and services offered to them (Garcés, 2018). They can communicate the characteristics of a product, set it apart and help it reach potential consumers who are increasingly sensitive to sustainable products (Buil *et al*., 2009; Peterle, 2013; Szolnoki, 2013; Castellano *et al*., 2015; Sellers and Nicolau, 2016; Sogari *et al*., 2017; Flores, 2018; Merli *et al*., 2018). The following hypothesis is therefore posed:

H1.2. The valuation of sustainability, $P_{SUSTAINABILITY}$, rises as marketing resources rise.

Sustainability begins with human resources (Figueroa and Rotason, 2018; Baiano, 2021; Luzzani *et al*., 2021), that is, with employees who are committed to and involved in the environmental goals that will lead to the best performance (Milliman, 2013; Renwick *et al*., 2013; Gutiérrez-Rúa *et al*., 2019). DuBois and Dubois (2012) observed that the better the approach to talent the greater the support for the company's environmental strategy. Renwick *et al*. (2013), Yusoff *et al*. (2015), Guerci and Carollo (2016) and Renwick *et al*. (2016) reported that talent attraction and retention are important practices because, by creating value associated with environmental sustainability, companies are able to attract the sort of people they need to properly implement their environmental sustainability strategy. This leads to another hypothesis:

H1.3. The valuation of sustainability, $P_{SUSTAINABILITY}$, rises as human resources increase.

Maicas and Mateo (2020), Baiano (2021) and Luzzani *et al*. (2021) found that when a winery's management resources increase, it becomes more sustainable. Rodríguez and Traconis (2012), Milliman (2013), Guerci and Carollo (2016) agree that an organisation should design new tasks and goals linked to environmental performance. This leads to the following hypothesis:

H1.4. The valuation of sustainability, $P_{SUSTAINABILITY}$, rises with an increase in management resources.

Regarding the development variables, the winery's profitability and level of production were analysed. For the former, León and Varela (2011) and Mariani and Vastola (2015) point to environmental practices in the wine sector as a key for business growth over time. Laskar (2019) found positive links between profitability and environmental practices. López *et al*. (2007), however, found a negative relationship, and Chaihuaque (2021) concludes that the relation between profitability and sustainability gives contradictory results. Thus, the following hypothesis is posed:

H2.1. The valuation of sustainability, $\underline{P}_{SUSTAINABILITY}$, rises as the winery's profitability increases.

Growth in the wine sector stresses how important it is for it to be sustainable throughout the supply chain (Bandinelli *et al*., 2020). Because of the massive scale of wine production and distribution and the associated environmental implications, it is essential to analyse and optimise the wine supply chain, considering all the specific stages of production (Varsei and Polyakovskiy, 2017). The following hypothesis is therefore posed:

H2.2. The valuation of sustainability, $P_{SUSTAINABILITY}$, rises as the winery's production increases.

Finally, with regarding to sales, the wine sector is very globalised, with over 43% of the wine consumed worldwide being exported (Anderson and Pinilla, 2022). Wine exporters facing the challenge of adapting to climate change are at an advantage (Atance, 2018). The international market has proved to be very sensitive to sustainable wine, allowing for entrance into new markets (Gabzdylova, 2009; Santini *et al*., 2013; Corbo *et al*., 2014; Stasi *et al*., 2016; Schäufele and Hamm, 2017; Flores, 2018; Barbosa *et al*., 2018; Moscovici and Reed, 2018). The hypothesis posed is:

H3.1. The valuation of sustainability, $P_{SUSTAINABILITY}$, rises as exports rise.

Wineries use various compatible distribution lines: the Horeca channel, the food channel, direct sales from the winery, Internet, intermediaries. The Horeca and food channels account for over 80% of sales in Spain (OEMV, 2021). Wineries that use distribution channels with greater added value, such as Horeca, are more likely to draw up sustainability policies (Ferrer *et al*., 2022). So, the next hypothesis is:

H3.2. The valuation of sustainability, $P_{SUSTAINABILITY}$, rises when the distribution channel used is Horeca, rather than the food channel.

Case study: Spain

Spain is the country with the largest vineyard area in the world, with 964 Mha in 2021 (OIV, 2022a). In terms of production, it stands in third place with 35.3 billion hL, after Italy (50.2 billion hL) and France (37.6 billion hL), which accounted for 47% of global wine production in 2021. Wine production in Spain dropped by 14% from 2020 to 2021, falling 8% below its last five-year average. Spain increased its consumption of wine in 2021, reaching 10.5 billion hL (+9.9 %/2020), in line with its pre-pandemic levels. In 2021, worldwide exports of wine amounted to 111.6 billion hL, an increase of 4% over 2020. Spain was the greatest exporter in 2021 with 23.0 billion hL, representing 21% of the global market (OIV, 2022a).

Spain's organic wine is attracting increasing interest due to efforts to promote more sustainable agriculture. Organic vineyards in Spain grew by 7% per year in 2019 reaching 121,290 ha, that is, 13% of the country's total vineyards and 26.88% of the world's organic production area. Spain lies in first position in terms of the area given over to organic production, above Italy, France and China. This type of cultivation has grown constantly: between 2009 and 2019, organic vineyards almost tripled in surface area, from 53,958 to 121,279 ha. Furthermore, the number of wineries producing organic wine has risen from 408 to 1,152, representing 13.9% of total wineries (OEMV, 2020). However, one of the elements that has proved to be relevant with respect to consumers is the identification of organic or sustainable wine production. This has yet to be fully developed as can be seen in the existing certifications. The Spanish Wine Federation (FEV) grants sustainability accreditation with the name "Wineries for Climate Protection" which, in May 2021, had been assigned to 32 wineries (FEV, 2021). The Spanish Organic Wines association groups together small wineries that produce organic wine and aims to promote these wines abroad in view of the difficulties encountered in the domestic market. In May 2021, there were 39 associated wineries (Spanish Organic Wine, 2021). It seems, therefore, that although the first steps have been taken, there is still a long way to go for wine and wineries to be positioned as sustainable and to enjoy the advantages of consumer recognition (Sellers and Nicolau, 2016).

Sample and variables

The database used comprises companies operating in Spain whose economic activity is wine production (code 1102 in Spain's National Register of Economic Activities 2009). The data were obtained from two surveys: the first was performed in 2016, and the second occurred during 2020 and 2021 by random sampling, resulting in a total of 52 companies. The variables studied are presented in Tables I and II. Table I shows the dependent variable, a measure of sustainability P_i that results from adding three items: production of organic wine in the winery, $P_{EWINE,i}$, concern for the carbon footprint, $P_{FOOTPRINT,\ i}$, and corporate social responsibility, $P_{CSR,i}$. Each item values the company's interest in this environmental

Table I

Description and statistics for the dependent variable

Variable	Description	Mean	Standard deviation	Minimum	Maximum
Organic wine: P_{EWINE}	Wineries valued their interest in organic wine as an environmental measure on a scale from 1 to 5, with 1 being very low interest and 5 very high interest. The value given comes from the 2021 survey.	3.568627	1.2846	1	5
Carbon footprint: $P_{FOOTPRINT}$	Wineries valued their interest in calculating their carbon footprint on a scale from 1 to 5, with 1 being very low interest and 5 very high interest. The value given comes from the 2021 survey.	3.921569	0.9130857	1	5
Corporate responsibility: P_{CSR}	Wineries valued their interest in adopting this measure on a scale from 1 to 5, with 1 being very low interest and 5 very high interest. The value given comes from the 2021 survey.	3.666667	0.993311	1	5
$P_{SUSTAINABILITY}$	$P_{EWINE}, i + P_{FOOTPRINT}, i + P_{CSR}, i$	11.15686	2.618187	1	15

measure on a Likert scale, with 1 being for very low interest, and 5 very high interest.

Table II presents the statistical description of the independent variables used to explain the degree to which the wineries valued sustainability, according to the methodological framework.

Functional form

To estimate the hedonic model $P_i=f(Q_{ji}, \varepsilon_i)$ the Box-Cox technique has been used, on the one hand because the dependent variable (P_i) does not follow normal distribution for the Shapiro-Wilk W test: W= 0.96261 (p=0.10773) and, on the other, to identify the functional form *f*; in this case, since all the independent variables are discrete, the left-hand-side (lhsonly) Box–Cox model has been applied. Thus, the hedonic model is that of Equation 2.

$$P_i^{\theta}=\beta_0+ \beta_1ITR_i + \beta_2MKR_i + \beta_3HR_i + \beta_4MGR_i + \beta_5ROA_i + \beta_6PRO_i + \beta_7X_i + \beta_8HS_i + \beta_9FCS_i + \varepsilon_i \quad \textbf{Eq. 2}$$

where i= 1,2, 3,…,52;

the variable P_i^{θ} is the value placed by the winery on sustainability, subject to θ transformation; the exogenous variables used are Innovation and Technology resources (ITR), Marketing resources (MKR), Human resources (HR), Management resources (MGR), Return on assets (ROA), Production (PRO), Exports (X), Horeca sales (HS) and Food channel sales (FCS); ε_i is random disturbance, which follows normal distribution with mean zero and constant variance, $\varepsilon_i \sim N(0,\sigma_\varepsilon)$.

Statistical analysis

Stata v15 (StataCorp, USA) has been used to estimate the model.

RESULTS AND DISCUSSION

First, θ was identified using the left-hand-side (lhsonly) Box–Cox model, selecting the power θ with a p-value above 0.05 for the LR test associated with θ with values (-1, 0, 1) - Table III, and below 0.05 for specific θ values - Table IV.

The model estimated is correctly specified according to the specification link test for a single-equation model, because the probability t associated with the hatsq parameter is non-significant, so there is no specification error. Nor, according to the Reset test, are any variables omitted. The F-Snedecor, with a p-value below 0.05, shows the model's overall explanatory capacity. The model has multicollinearity, with average VIF below 10.

The Breusch-Pagan/Cook-Weisberg test, with a p-value above 0.05, shows there is no heteroskedasticity. Finally, according to Student's t test, all the variables are significant except when sales go through the food channel. If a company increases its resources over time, it assigns a higher value to sustainability, especially if improvements are in management and human resources, followed by innovation and technology (p = 0.05).

Table II

Description of the independent variables

		Description	Frequency 0	Frequency 1
Resources	Innovation and technology resources (ITR)	Value 1: the winery increased these resources during the period 2016-2021; Value 0: the winery did not increase these resources	18	34
	Marketing resources (MKR)	Value 1: the winery increased these resources during the period 2016-2021; Value 0: the winery did not increase these resources	20	32
	Human resources (HR)	Value 1: the winery increased these resources during the period 2016-2021; Value 0: the winery did not increase these resources	40	12
	Management resources (MGR)	Value 1: the winery increased these resources during the period 2016-2021; Value 0: the winery did not increase these resources	44	6
Development factors	ROA	Value 1: the winery increased its profits during the period 2016-2021; Value 0: the winery did not increase its profits	27	25
	Production (PRO)	Value 1: the winery increased its production during the period 2016-2021; Value 0: the winery did not increase its production	6	46
Sales area	Exports (X)	Value 1: the winery increased its exports during the period 2016-2021; Value 0: the winery did not increase its exports	27	25
	Horeca sales (HS)	Value 1: the winery increased its Horeca sales during the period 2016-2021; Value 0: the winery did not increase its Horeca sales	50	2
	Food channel sales (FCS)	Value 1: the winery increased its food channel sales during the period 2016-2021; Value 0: the winery did not increase its food channel sales	43	9

Marketing, with p = 0.10, has a smaller effect. Guerras and Navas (2015) point to the importance of adapting resources and capabilities in order to achieve a sustainable competitive advantage. For Barney (1991), companies with resources are valuable in the sense that they take up opportunities and/or neutralise any threats in the environment. Prior studies pointed to the important role played by managers in orienting the company towards sustainability and growth (Andersén *et al*., 2020; Anderson and Eshima, 2013). It can therefore be concluded that sustainability depends on how valuable the resources are, so hypothesis 1 is proven, as well as its sub-hypotheses (H1.1, H1.2, H1.3 and H1.4).

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An increase in ROA (p = 0.1) shows a positive impact with the winery's scores for environmental practices. This result is in line with that obtained by a study on Italian wineries in which the economic situation was found to influence environmental practices (UIV 2015) and is pivotal for their sustainability and business growth over time (Mariani and Vastola 2015; León and Varela 2011).

The Model (lhsonly) determines the possible values of theta: θ=1 and θ= 1.437481. Therefore, the lower root mean square error was used as the selection criterion, so for θ=1 there was a Root MSE of 2.216 and, for θ=1.437481 a Root MSE of 94.805. The model was, therefore estimated with θ=1 (Table V).

Table III

LR statistic for powers with theta values (-1, 0, 1)

	LR statistic Test h0	**Restricted log likelihood**	**LR statistic $\chi 2$**	**P-value Prob > $\chi 2$**
Left-hand-side (lhsonly) Box–Cox model	$\theta = -1$	-128.05698	42.37	0.000
	$\theta = 0$	-113.34228	12.94	0.000
	$\theta = 1$	-107.38066	1.02	0.313

Table IV

Theta powers estimated by the Box-Cox procedure

	Power	**Std. Coeff.**	**Err.**	**z**	**P>z**
(lhsonly) left-hand-side Box–Cox model	θ	1.437481	0.4499782	3.19	0.001

Table V

Estimation Results

Variables	**Coeff.**	**Std. Err.**
Innovation and Technology Resources (ITR)	1.39651**	0.704233
Marketing Resources (MKR)	1.091353*	0.666846
Human Resources (HR)	1.81883**	0.884573
Management Resources (MGR)	2.06394**	1.082421
ROA	0.83041*	0.718174
Production (PRO)	1.035832*	1.079961
Exports (X)	1.542423***	0.691431
Horeca sales (HS)	3.23829**	1.717237
Food channel sales (FCS)	0.572923	0.85154
cons	9.553289***	1.15891
Linktest – Specification link test for single-equation models	hatsq= -.078682	Prob>|t|=0.255
Ramsey RESET	F(3, 38) = 2.26	Prob > F = 0.0967
F-Snedecor	F(9, 41) = 3.20	Prob > F = 0.0051
Mean VIF	1.23	
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity	$\chi 2$ (1) = 0.61	Prob > $\chi 2$ = 0.4359

* Denotes significance at the p = 0.1; ** p = 0.05; *** p=0.01.

Moreover, an upward trend in production (p=0.1) is positively related to the score for environmental policies, as found by Bandinelli *et al*. (2020) and Varsei and Polyakovskiy (2017). It can therefore be concluded that a winery's valuation of sustainability depends on growth in its production and ROA; the hypotheses 2.1 and 2.2 are proven.

One of the factors that most affects a winery's valuation of sustainability is its export orientation (p =0.01). In volume, the Spanish wine market exports about 58% of its production (OIV, 2022b). The main destinations are countries that highly value producers who offer sustainable and environment-friendly characteristics by producing organic wine, aiming to reduce their carbon footprint or showing corporate social responsibility (Gilinsky *et al*., 2016; Prowein, 2021).

Finally, the Horeca sales channel proved significant (p = 0.05), which is not the case for the food channel even though this does have a positive effect on sustainability.

The Horeca channel allows the distribution of a product with greater added value, which helps wineries to direct their resources towards this type of product, despite the increased costs. Wineries selling in the food channel are less likely to produce value-added wines because they are under greater pressure from large retailers (Ferrer *et al*., 2022). Consumers expect companies to be socially responsible, so wineries have strengthened their commitment to more sustainable production (Acuti *et al*., 2019). It can therefore be concluded that a winery's valuation of sustainability will be higher if it sells through the Horeca channel than through the food channel; the hypothesis 3 is partially proven, that is, H3.1.

CONCLUSIONS

The objective of the present study was to determine the relationship between trends in certain attributes of wineries and their sustainability orientation, particularly in Spain. A hedonic model was adopted, which reflects the valuation of sustainability as a process that is similar to the price value that consumers place on a given product. To the best of our knowledge, this novel approach, not used in this way in the prior literature, provides an indicator of how much a company values sustainability in line with its resources, business situation and sales.

The factors studied to explain sustainability orientation are, first, the company's available resources, based on the theory of resources and capabilities. Here, innovation-technology, human resources, management resources and marketing resources were studied. Development variables that determine a company's functioning were also analysed, such as its ROA, production, exports and the sales channel it uses (Horeca as opposed to the food channel). By taking variation in resources and development variables together, the trend of the companies analysed during the period 2016-2021 can be portrayed. The sustainability orientation was measured as the sum of three variables: production of organic wine; interest in reducing the carbon footprint; corporate responsibility.

Management and human resources, as drivers of sustainability, were as capable of positioning the company in terms of its environmental policies. Similarly important, but less so, were innovation-technology resources, which serve as a tool for setting up new production methods. Marketing also plays an essential role in informing consumers, who are increasingly aware of environmental issues, about a wine's characteristics.

Moreover, exports and entry into global markets oblige companies to adapt to a market that is increasingly committed to the environment, pushing them to increase their sustainability orientation. Regarding the type of sales channel, it is in the Horeca channel (in which customers are prepared to pay higher prices) that wineries can raise their profits and show their value-added wines, thus gaining recognition of their sustainable practices.

The need to protect the environment is a reality of the 21st century and, therefore, is a vital consideration for businesses. Sustainability is a value in itself, a key intangible element in business action and a basic credential for products. This article shows that wineries that grow and improve are those that maintain an active commitment to the fight against climate change. This intangibility will become crucial to the future of business performance in the wine sector.

Finally, it should be emphasised that one limitation of this study is the size of the sample. This means that the model had to be redirected to a cross-sectional analysis, in which the evolutionary treatment of the model is reduced to rates of variation, although the results obtained are econometrically consistent. For future research, in addition to considering the temporal perspective to assess the dynamics of the sustainability variable and thus propose future scenarios, a territorial approach will be taken into account. This approach will be differentiated by the diversity of the wine-growing regions in Spain, where there a total of 97 protected designations of origin listed in the EU register.

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