

The proactive role played by sustainable wineries at times of economic crisis

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Abstract

Purpose – This paper analyses the behaviour of wineries after an economic crisis depending on their interest in the environment.

Design/methodology/approach – A questionnaire was drawn up to collect quantitative data on Spanish wineries; a total of 230 firms participated in the study. Subsequently, a detailed statistical analysis was performed using the Mann–Whitney U test and rank sum.

Findings – The results show that the wineries that were most interested in sustainability exhibited proactive behaviour during the post-crisis period, choosing to innovate in their different areas in order to deal with the situation.

Practical implications – The paper develops a simple and effective method for wineries to gain confidence that their sustainable behaviour will be compatible with innovating and overcoming a crisis.

Originality/value – This study contributes to the literature because, to the authors' knowledge, no other study has investigated the concepts of sustainability, crisis and innovation simultaneously. The model is also applicable to international wineries as well as companies in other sectors and would help them to define their strategic and sustainability plans.

Keywords Crisis, Sustainability, Innovation, Wineries, Spain

Paper type Research paper

1. Introduction

The various disruptions that affect societies and economies are becoming more frequent. If firms are to survive over time, they have to deal with a range of threats and adapt to today's global, changing environment. Resilience must therefore be considered a key concept. This has already been analysed, especially in the field of environmental sustainability (Golicic *et al.*, 2017), but economic and social perspectives must be taken into account, including the sectoral point of view. This article aims to study how the resilience in the wine sector that can result from innovation (Girotra and Netessine, 2013) can help wineries to be economically and environmentally sustainable, even in times of crisis.

A recession affects the economy in general as well as individual firms. They often face losses, reduced profitability or even closure and managing liquidity may well become their top priority (Miras *et al.*, 2015; Cucculelli and Peruzzi, 2020). During the 2007 crisis, the Gross Domestic Product and industrial production decreased, trade collapsed and unemployment increased in many of the world's main economies (OECD, 2012). This situation forced businesses to adapt and restructure their business models (Chindooroy *et al.*, 2007; Kuratko and Audretsch, 2013), although in different ways (Sarkar and Osiyevskyy, 2018).



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Some firms favoured more irrational and innovative actions with organisational changes (Miller and Chen, 2004); others adopted more rational thinking, supporting rigidity and risk aversion (Iyer and Miller, 2008; Shimizu, 2007) and the remainder combined the dimensions of importance, urgency and uncertainty (Osiyevskyy and Dewald, 2018).

One way or another, firms act (Zheng *et al.*, 2022) to hold back the negative effects of recessions (Duton, 1986) because, as stated by Kontogeorgos *et al.* (2016), it is precisely under changing and crisis conditions that adjustment is most needed. Such changes range from the introduction of new raw materials, new production assets or methods and the opening up of new markets, to changes in organisation or in management processes; essentially firms innovate, following the theory of Schumpeter (2017) whereby economic growth has to be centred on innovation and only on that basis can crises be mitigated (Archibugi *et al.*, 2013). Other authors point to sustainability measures as the foundation for resisting recessions that jeopardise business survival and growth (Karaibrahimoglu, 2010; Meflinda *et al.*, 2018; Broadstock *et al.*, 2021; Selmi *et al.*, 2021). Along the same line, Lu *et al.* (2022) suggest that firms interested in sustainability are more resilient (Albuquerque *et al.*, 2020; Ding *et al.*, 2021) and are valued more highly by a society concerned about the environment (Molina-Azorin *et al.*, 2009).

The wine sector does not remain untouched by economic crises. Economic cycles in the wine sector have coexisted with reduced domestic consumption in traditional producer countries and increased production and sales in emerging countries. These two factors led to a very marked increase in competition among wineries, especially from 2000 to 2005. After that period, it was the EU countries (Spain, France and Italy) that adopted strategies to sell their products abroad (Simon *et al.*, 2015). In fact, during the 2020 crisis, the wine sector reacted proactively, opening up new markets for its products (Prowein, 2023). This was also found by Simón and Castillo (2022) in a study of Spanish wine cooperatives.

Moreover, since 2004 the EU wine industry has faced a new disruption due to a quantitative disequilibrium on the international wine market. Many small firms suffer from the effects of King's law: beyond a certain quantity, each increase in supply leads to a fall in revenues that is higher than the increase in product quantity (Declerck and Viviani, 2012). The development of economic activity during the 21st century has converted it into a sort of paradigm that firms must adopt (Ferrer *et al.*, 2022; Moscovici and Reed, 2018). In addition, the wine sector, like much of the agrifood sector, has to face the challenge and the need to achieve sustainability (De Steur *et al.*, 2019; Pomarici and Vecchio, 2019; García-Cortijo *et al.*, 2023). Various studies propose that the core business of wine production should be expanded to include environmental activities (Madanaguli, 2021; Dressler and Paunovic, 2021a, b).

It is therefore necessary for firms to learn, grow stronger, build up resilience and take measures during times of crisis (Valdés and Rogel, 2020; Beuren *et al.*, 2020). Golicic *et al.* (2017) indicate that resilience in the wine sector can be generated, among other methods, from innovation (Girotra and Netessine, 2013), which can also be an instrument for achieving sustainability. To use the same terms as Kautish *et al.* (2020), sustainability can be said to have a terminal value, that is, it is an end goal, while resilience through innovation can be considered an instrumental value, that is, it is not an end in itself. Innovation therefore contributes to risk management and the development of resilience (Gunasekaran *et al.*, 2011; Girotra and Netessine, 2011, 2013), taking resilience to mean the capacity for coping in complex situations. Interest in innovation in the wine sector has been increasing over recent years (Frigon *et al.*, 2020; Angelova *et al.*, 2019; Berbegal *et al.*, 2019; Duarte *et al.*, 2018), because it is one of the main determinants of increased productivity in agriculture and the agrifood sector (Natário *et al.*, 2011; Hashi and Stojcic, 2013; Sauer and Latacz-Lohmann, 2015), and is essential for boosting firms' competitiveness and economic growth (FoodDrinkEurope, 2012; Dressler, 2013; Tóth *et al.*, 2020).

We are therefore dealing with three concepts: crisis, sustainability and innovation, all of which are very important in the wine sector, in which they have been widely studied but

rarely simultaneously or in an inter-related and systematic way. In fact, most research treats them in a rather reductionist fashion, as can be seen from the following examples: on sustainability, [Marx et al. \(2017\)](#), [Barbosa et al. \(2018\)](#), [Ferrer et al. \(2020\)](#), [García-Cortijo et al. \(2023\)](#), on innovation, [Gilinsky et al. \(2008\)](#), [Duarte et al. \(2018\)](#), on crises [Simón et al. \(2015\)](#), [Simón and Castillo \(2022\)](#). And in an economy that is constantly evolving, they cannot be studied from the prism of Newton because that implies, on the one hand, ignoring the existence of a link between crisis, sustainability and innovation and, on the other, assuming that behaviour has been identical. Such conditions do not exist in economic reality.

This is the knowledge gap that this article aims to fill. It focuses on the Spanish wine sector and is based on a survey sent to all the firms in the sector, to which 230 wineries responded. We aim to analyse the complex functioning of sustainability and innovation in the Spanish wine sector during times of crisis, which is when they may be most difficult to achieve.

The study is structured as follows. [Section 2](#) offers a review of the literature. [Section 3](#) presents the materials and methodology, [Section 4](#) the findings and the discussion and [Section 5](#) concludes.

2. Review of the literature

Economic crises in dynamic, uncertain and complex environments bring about both limitations and opportunities for organisations ([Frishammar 2006](#); [Sternad, 2012](#)). These can be seen in changes in their business models which reflect their characteristics, strategies and competitive structure ([Zott and Amit, 2007](#); [Teece, 2009](#); [Casadesus-Masanell and Ricart, 2010](#); [George and Bock, 2011](#)). Schumpeter gives guidance for firms to overcome crises or shocks, helping them to position themselves as leaders in recovery by focusing on the following: (1) the dynamic of economic performance (new products and processes, organisational changes and new ways to reach the market); (2) introducing these combinations in times of crisis and (3) the process of competition and market structure in which to apply them ([Yoguel et al., 2013](#)). In essence, innovation is necessary for growth.

In parallel, the environment is emerging as a top-priority target for business leadership ([Khoury et al., 2022](#)), becoming a globalised concept that can send a positive signal to the market ([Duarte Alonso and Bressan, 2016](#); [Freeman, 1999](#); [Frooman, 1999](#)) and inspire trust in consumers and investors ([Campbell, 2007](#)). It is thus turning into a new paradigm for the search for social and economic progress that will achieve healthy and productive life, without affecting the possibilities of future generations ([Warner, 2007](#); [Moscovici and Reed, 2018](#); [Pomarici and Vecchio, 2019](#); [UN, 2021](#); [García-Cortijo et al., 2021](#)). In addition, sustainability is crucial for maintaining and assigning value ([Cantino et al., 2019](#)). Organisations should therefore work towards a sustainable model ([Schaltegger et al., 2016](#); [Massa et al., 2017](#); [Dentchev et al., 2018](#); [Nosratabadi et al., 2019](#); [Lüdeke-Freund and Froese, 2020](#), [Bocken, 2019](#)) even at times of crisis, because environmental targets are being maintained in international policy ([Yunhee, 2013](#)) and firms that are committed to the environment are less affected by crises ([Albuquerque et al., 2020](#); [Ding et al., 2021](#); [Lee and Lu, 2021](#)). [Santos et al. \(2022\)](#) state that wine tourism can serve as an element for sustainable local development and contribute to recovery after a crisis. Along these lines, [Gilinsky et al. \(2015\)](#) show how, after the economic crisis of 2008, sustainable practices in wineries in the US, Italy and Spain afforded them a competitive advantage. [Esposito et al. \(2021\)](#) indicate that, after the Covid-19 crisis, wineries were required to introduce Corporate Social Responsibility practices into their commercial strategies.

Associated with environmental considerations are innovation ([Khoury et al., 2022](#)) and crises. [Frederking \(2011\)](#) suggests that entrepreneurs in the Oregon wine sector with a greater commitment to sustainability introduced innovative practices. Innovations, changes and adaptations seem to increase in times of recession, as stated by Schumpeter and supported

years later by [Aghion and Howitt \(1992\)](#). In fact, firms that cannot grow, at a time when other firms grow in line with or above their sector average, end up losing market share and may disappear altogether ([Penrose, 1959](#); [Porter, 1985](#); [Barney, 1991](#); [Grant, 2010](#)). Innovation results in a situation of temporary monopoly and improved performance ([Utterback and Suárez, 1993](#)); it pushes up productivity and helps society to face two importance challenges, namely, climate change and shortage of resources ([OECD, 2015](#)). Innovation can be classified according to its objective, of which there are four types ([OECD, 2015](#)): (1) product innovation; (2) process innovation; (3) marketing innovation and (4) organisational innovation. [Szolnoki et al. \(2021\)](#) show how on-line wine tastings were used as an innovative tool after the Covid-19 crisis. [Costa et al. \(2023\)](#) point to the importance for family-run wine SMEs in southern Italy of adopting digital technologies as well as the need to preserve sustainability in a context of uncertainty and possible business crises. Sustainability and innovation foster the development of virtuous circles, creating opportunities and reconciling different goals ([Días et al., 2021](#); [Genus, 2021](#)), thus being converted into a dynamic capacity ([Aragón-Correa and Sharma, 2003](#)) that facilitates growth paths ([Gupta et al., 2013](#)). When a firm follows green, sustainable policies, it improves its differentiation strategy and gains a competitive advantage ([Choi and Gray, 2008](#); [Andersen, 2021](#); [Edwards, 2021](#); [Chan et al., 2022](#)).

In the wine sector, many research papers have covered crises, sustainability and innovation. For example, the impact of the crisis on Italian wineries is studied by [Migliaccio and Tucci \(2019\)](#), in Spanish wineries by [Simon et al. \(2015\)](#) and in Spanish cooperatives by [Simón and Castillo \(2022\)](#). Regarding innovation, [Montella \(2017\)](#) and [Nuebling et al. \(2016\)](#) focus on new crops and product packaging; [Cusmano et al. \(2010\)](#) study wine processing and technological modernisation and [Barrena et al. \(2021\)](#) and [Di Vita et al. \(2013\)](#) consider new marketing techniques ([Dressler, 2013](#)). [Broccardo and Zicari \(2020\)](#) and [Pradana et al. \(2020\)](#) focus on organisational innovation. In the field of sustainability, crop management is studied by [Schultz \(2016\)](#), [Flores \(2018\)](#), [Pomarici and Vecchio \(2019\)](#), [De Steur et al. \(2019\)](#) and [Ouvrard \(2020\)](#), the effect of climate change on the potential yield of grapes by [Fraga et al. \(2022\)](#) and water use by [Costa et al. \(2020\)](#) and [Matos and Pirra \(2020\)](#).

[Golicic et al. \(2017\)](#), based on a sample drawn up over seven years and interviews with representatives from 141 wineries in 12 wine-producing regions in six countries (USA, Australia, New Zealand, Italy, Germany and France), conclude that achieving sustainability depends on resilience, and resilience can be achieved through innovation. An example of innovation to achieve sustainability can be seen in New Zealand wineries, with the Zero Carbon initiative promoted on bottle labels. [Dressler and Paunovic \(2020\)](#), taking a sample of 125 German wineries, propose a business model based on sustainability and innovation. Along the same lines, [Fiore et al. \(2017\)](#), with a sample of 280 wineries in southern Italian region of Apulia, conclude that wineries that use innovative marketing tools show more sustainable behaviour. [Sánchez-García et al. \(2023\)](#), with a sample of 196 Spanish wineries, conclude that their managers should foster ecological motivation and creativity in order to introduce environment-friendly innovations. [Gerini et al. \(2021\)](#), based on data for sales by Italian wineries during two separate periods – March–April 2020, and June–July 2020 – conclude that economic agents change their performance during a crisis, adapting their approach towards climate change. [Petridou et al. \(2018\)](#), with a sample of 39 wineries in Athens and Salonica, find that during crisis periods in Greece the reduction in bottled wine required the introduction of new processes for innovation, such as exports and wine tourism. The latter, apart from being a source of revenue and a tool for transmitting local culture, is considered because of the environmental commitment it entails ([Marco-Lajara et al., 2023](#)).

Considering the above and that the purpose of this study is to analyse the systemic relationship between resilience, innovation, crisis and sustainability, the main hypothesis (MH) is that:

MH. The wineries that are most sustainable in times of crisis have built up resilience by developing:

MH1. A general innovation dynamic

MH2. Environment-friendly innovations

MH3. Innovations in wine processing

MH4. Access to new markets

MH5. Innovations in management systems

The following section presents the materials and methods used that allowed the data to be collected and analysed and the above hypotheses to be tested, as explained in the results section.

3. Materials and methods

A questionnaire was drawn up to collect quantitative data on Spanish wineries; a total of 230 firms participated in the study. The surveys were held in 2016/2017 and aimed to detect the position adopted by the wineries after the 2007/2008 crisis. This sample of 230 wineries represents a margin of error of 0.062 at a 95% confidence level, using the formula for finite samples, $n = \frac{Z^2 * p * (1-p) * N}{N * e^2 + Z^2 * p * (1-p)}$, and bearing in mind that the number of firms (N) producing wine in Spain in 2016/2017 was 3,544.

[Table 1](#) shows the questions the wineries were asked and the results of the survey.

The results shown in the Table vary widely. In view of the disparity in the data and in order to complete the information, the Mann–Whitney U test and rank sum were performed. These point to any differences between wineries that showed sustainable behaviour during the economic crisis and those that were less likely to show such behaviour.

4. Results

To explain the behaviour of wineries after an economic crisis depending on their interest in sustainability, we applied an independent sample test ([Ferrer *et al.*, 2020](#)). For the grouping variable, *Interest in the Environment during the 2007/2008 crisis*, we distinguished between firms that applied sustainable measures (group 1) and those that did not (group 2). The Kolmogorov–Smirnov, with a level of significance below 0.05, shows that the variables to be tested follow distribution that is not normal ([Table 2](#), column 2), so the type of test for two independent samples is the Mann–Whitney U test. In the results of this Mann–Whitney U test ([Table 2](#), columns 3, 4 and 5), values of bilateral asymptotic significance below 0.05 indicate differences between the groups represented, that is, firms showing little interest and firms showing more interest in sustainability.

[Figure 1](#), in line with the significance seen in the findings presented in [Table 2](#), shows two types of behaviour in Spanish wineries during times of crisis. The first group (right-hand column in [Figure 1](#)) is associated with more innovations, a higher degree of resilience and greater sustainability. The second group (left-hand column in [Figure 1](#)) is associated with traditional behaviour based on the international market, with sustainability being left in second place.

The most resilient wineries showed the best environmental performance. They considered: (1) under *general innovations* new bottle and cork design, new wines, new products, re-use and recycling of materials and concern for employees, so hypothesis HM1 is proved; (2) in the *agronomic area*, changing vinestocks and fertilisers, so hypothesis HM2 is

Question (variables)		Response frequency (yes or no)
Interest in the environment during the 2007/2008 crisis: did your firm apply measures to minimise its negative effect on the environment?		No:88, Yes:142
<i>Did you apply any of the following innovations during the postcrisis period?</i>		
General innovation dynamic	Bottle design	No: 64, Yes: 166
	Cork	No: 63, Yes: 167
	Label	No:40, Yes:190
	New blends of grapes	No:91, Yes:139
	New wines	No:44, Yes:186
	New alcohol content in existing wines	No:99, Yes:131
	New products (vinegar, cava, others . . .)	No:132, Yes:98
	Re-use and recycling of materials	No:123, Yes:107
Agronomic actions	Concern for employees	No:131, Yes:99
	Modification of vinestocks	No:121, Yes:109
	Modification of fertilisers	No:164, Yes:65
Wine processing	Modification of the ageing process	No:119, Yes:11
	Modification of the conservation process	No:181, Yes:49
Markets	New domestic markets	No:54, Yes:176
	New international markets	No:37, Yes:193
	New groups of purchasers	No:44, Yes:186
	Entry into select (gourmet) markets	No:58, Yes:172
Management system	New techniques or channels for product promotion (use of a new advertising channel, new brands for new markets, loyalty cards, etc.)	No:65, Yes:165
	Change in the logistics system, delivery methods or distribution	No:122, Yes:108
	New methods for managing external relations with other firms or public institutions (creation of partnerships, associations or sub-contracting, etc.)	No:133, Yes:97
	Change in the management systems of the General Management department	No:137, Yes:93
	Change in the management systems of the Marketing department	No:106, Yes:124
	Change in the management systems of the production plant (winery)	No:100, Yes:130
	Change in the management systems of the Oenology department	No:107, Yes:123
	Change in the management systems of the Sales department	No:75, Yes:155
	Change in the management systems of the Distribution department	No:95, Yes:134
Source(s): Authors work		

Table 1.
Shows the questions addressed to the wineries and the results of the survey. Description of the variables

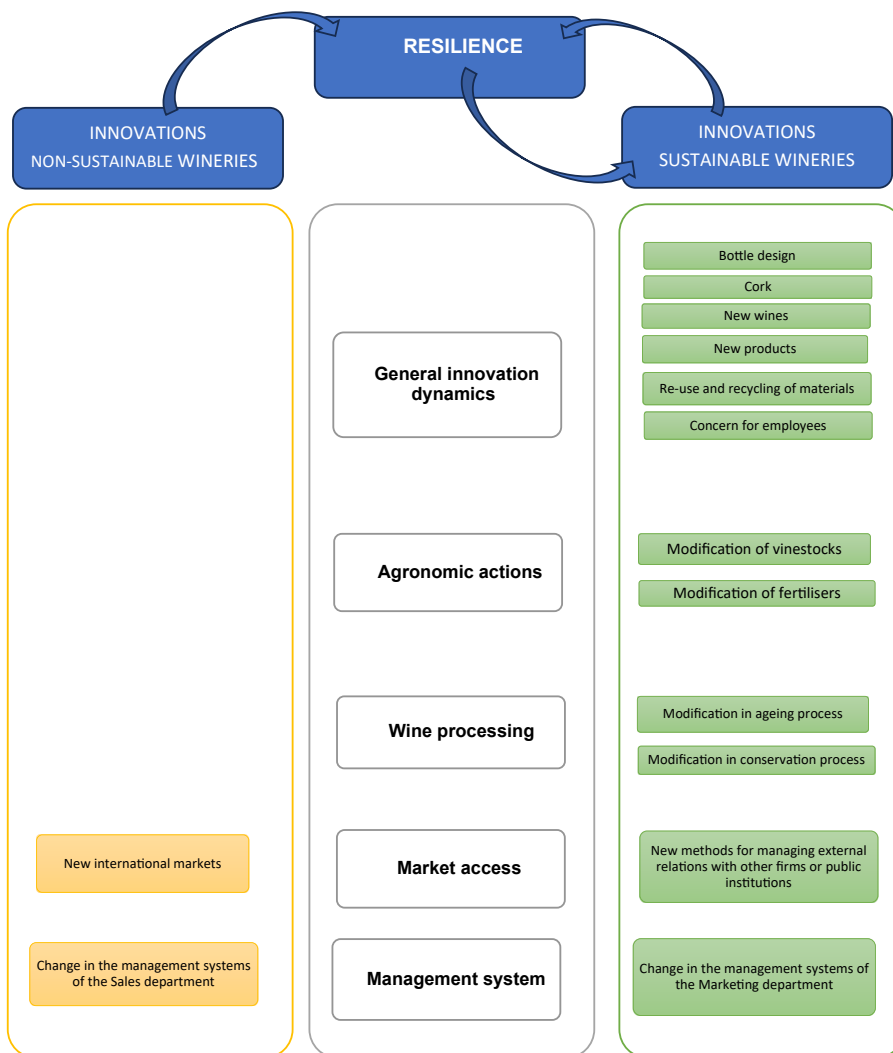
proved; (3) in the *wine processing area*, modifications in ageing and conservation, so hypothesis HM3 is proved; (4) entry into *new domestic markets*, so hypothesis HM4 is partially proved, and (4) in the *management area*, new methods for planning external relations and in the marketing department, so hypothesis HM5 is partially proved. The least resilient wineries showed little interest in environmental considerations during the crisis, and limited their subsequent action to searching for new *international markets* (so hypothesis HM4 is partially proved) and changing the management of their *sales departments* (so hypothesis HM5 is partially proved).

Table 2.
Kolmogorov–Smirnov,
and Mann–Whitney U
and rank-sum tests

Area	Variables	Statistic from test (1)	Asymptotic significance (bilateral) (2)	Mann– Whitney U test (3)	Z (4)	Asymptotic significance (bilateral) (5)	Sum of ranges sustainable wineries (6)	Sum of ranges non-sustainable wineries (7)
General innovation dynamics	Bottle design	0.99088	0.15949	5,269,000	−2,572	0.010 ^(a)	122.39 ^(b)	104.38
	Cork	0.99041	0.13276	5,110,000	−3,004	0.003 ^(a)	123.51 ^(b)	102.57
	Label	0.97211	0.00017	6,098,000	−0.466	0.641	114.44	117.20
	New blends of grapes	0.99849	0.99922	5,767,000	−1,158	0.247	118.89	110.03
	New wines	0.97673	0.00077	5,309,000	−2,810	0.005 ^(a)	122.11 ^(b)	104.83
Agronomic actions	New alcohol content in existing wines	0.99935	1.00000	6,032,000	−0.514	0.608	113.98	117.95
	New products (vinegar, cava, others, etc.)	0.99794	0.99282	4,811,000	−3,421	0.001 ^(a)	125.62 ^(b)	99.17
	Re-use and recycling of materials	0.99909	0.99999	1,540,000	−11,111	0.000 ^(a)	148.65 ^(b)	62.00
	Concern for employees	0.99810	0.99577	1,892,000	−10,356	0.000 ^(a)	146.18 ^(b)	66.00
	Modification of vinestocks	0.99927	1.00000	1,452,000	−11,307	0.000 ^(a)	149.27 ^(b)	61.00
Wine processing	Modification of fertilisers	0.98746	0.04223	3,344,000	−7,510	0.000 ^(a)	135.28 ^(b)	82.50
	Modification in ageing process	0.99942	1.00000	1,364,000	−11,505	0.000 ^(a)	149.89 ^(b)	60.00
Market access	Modification in conservation process	0.97621	0.00064	4,092,000	−6,198	0.000 ^(a)	130.68 ^(b)	91.00
	New domestic markets	0.98523	0.01727	5,749,000	−1,386	0.116 ^(a)	119.01 ^(b)	109.83
	New international markets	0.97673	0.00077	5,540,000	−2,268	0.023 ^(a)	110.51	123.55 ^(b)
	New groups of purchasers	0.98776	0.04659	5,884,000	−1,089	0.276	118.06	111.36
	Entry into select (gourmet) markets	0.99133	0.18990	6,111,000	−0.371	0.710	114.54	117.06

(continued)

Área	Variables	Statistic from test (1)	Asymptotic significance (bilateral) (2)	Mann-Whitney U test (3)	Z (4)	Asymptotic significance (bilateral) (5)	Sum of ranges sustainable wineries (6)	Sum of ranges non-sustainable wineries (7)
Management system	New techniques or channels for product promotion	0.99919	1.00000	5,888,000	−0.941	0.347	116.78	113.43
	Changes in logistics system, delivery method or distribution	0.99777	0.98834	5,940,000	−0.726	0.468	121.53	105.77
	New methods for managing external relations with other firms or public institutions	0.99703	0.94515	5,571,000	−1.614	0.107 ^(a)	117.72 ^(b)	111.92
	Change in management systems of the General Management department	0.99970	1.00000	6,066,000	−0.437	0.662	116.36	114.11
	Change in the management systems of the Marketing department	0.99942	1.00000	5,392,000	−2.021	0.043 ^(a)	120.61 ^(b)	107.26
	Change in the management systems of the Production plant (winery)	0.99972	1.00000	5,933,000	−0.748	0.454	121.09	105.25
	Change in the management systems of the Oenology department	0.99503	0.65885	6,126,000	−0.288	0.773	118.04	111.41
	Change in the management systems of the Sales department	0.99902	0.99999	5,523,000	−1.821	0.069 ^(a)	113.33	119.00 ^(b)
Note(s): ^(a) The hypothesis of equality of medians is rejected ^(b) Significant range								
Source(s): Authors work								



Source(s): Authors' work

Figure 1.
Process of resilience,
innovation and
sustainability in a
winery in times of
economic crisis

5. Discussion

As can be seen in [Figure 1](#), innovations in wineries became a tool for building up resilience, which allowed them to withstand the economic crisis and become sustainable. [Cabaleiro *et al.* \(2016\)](#) find that the firms that function best after an economic crisis do so because of their focus on competitiveness and innovation, which makes them more likely to weather the storm and helps build up resilience ([Girotra and Netessine, 2013](#)). As found by [Yunhee \(2013\)](#), a direct link can be seen between innovation and sustainability.

For the most sustainable wineries, the crisis was the germ of new products and new agronomic and organisational processes ([Jemala, 2021](#); [Sharma *et al.*, 2022](#)), which helped them to continue being competitive during crises and to minimise any negative impact. This

was especially the case with SMEs, which are a feature of the wine sector in Spain (Ibarra *et al.*, 2020; Adam and Alarifi, 2021; Almeida, 2021; Surya *et al.*, 2021; Clauss *et al.*, 2022). Similar results were obtained by Miras *et al.* (2015) for a set of firms in Greece, Ireland, Italy, Spain and Portugal, using panel data (2005–2012), who conclude that proactive environmental actions did not decrease during the crisis but that, on the contrary, the crisis saw an increase in the firms' environmental commitment with the introduction of new products. We consider this could be for two reasons: first, because adopting sustainability policies requires available resources (Muñoz, 2021; De Steur, 2019) and, second, because it is the premium wine consumer segment that is usually most receptive to sustainable products (Flores, 2018; Seller-Rubio, 2016; Moscovici and Reed, 2018; Pomarici and Vecchio, 2019; Schäufele and Hamm, 2017; De Steur *et al.*, 2019; Ferrer *et al.*, 2020). In the case of Spain, the specificity of bulk exports makes it necessary to treat this segment separately in international positioning. This aspect reinforces the need to promote the adoption and follow-up of wineries' sustainability policies. For this purpose, it is essential for there to be leadership within public and private organisations that can take on board and adopt sustainable attitudes and values (Sánchez-García *et al.*, 2023), connecting directly with innovation (Li and Ramanathan, 2020; Çop *et al.*, 2020).

The least sustainable wineries followed the traditional practice for overcoming crises of focusing their strategies on the international market. As stated by Migliaccio and Tucci (2019), one of the reasons for this is perhaps because such wineries were in a worse financial position and had no alternative for survival but to adopt austerity plans (Karabrahimoglu, 2010) while concentrating on different management of sales and on the international market. Simón *et al.* (2015), taking a sample of 102 wineries in Castilla-La Mancha (Spain) and two time periods – a cycle of economic growth (2004–2006) and a period of recession (2007–2010) – conclude that exports were considered one way of guaranteeing survival in the sector. These results were similar to those obtained by Petridou *et al.* (2018) who, with a sample of 39 wineries in Athens and Salónica, conclude that during crisis periods in Greece, the decrease in bottled wine required new processes of innovation such as exports and wine tourism. The less sustainable wineries continued to approach their business conventionally, that is, as the capacity to generate revenue to pay for production factors, replace assets used and invest to continue competing (Cabaleiro *et al.*, 2016).

This study has both theoretical and practical implications. Amongst the theoretical implications is the fact that the most resilient wineries identified the opportunity to minimise the effects of the economic crisis by taking actions such as: new corks, bottles or products, changes in their management systems, new agronomic and wine processing actions on the path towards sustainability. The results show that the most sustainable wineries faced the post-crisis period proactively, adopting strategies based on dynamism and innovation. The least sustainable wineries, on the other hand, had a very low profile, focusing only on the search for new international markets. Sustainability does not hold firms back or reduce their competitiveness but, on the contrary, is key for assertive, resilient actions in times of global economic recession. Amongst the practical implications, it can be considered that geopolitical conflicts, tension in markets for energy and raw materials and/or in global supply chains, rising interest rates and inflation continue to hold back economic activity. In this context, the climate crisis is still present and measures are needed to mitigate it. However, with so many disruptions, climate change is an even greater challenge because it usually takes second place in complicated situations. Considering the findings of this research, wineries would be wrong to neglect sustainability.

In spite of the scope and novelty of this research, it has limitations. Certain important aspects still need to be studied in depth. Sustainability should be measured, as stated by Dressler and Paunovic (2020), and there should be more nuanced differentiation so that a methodology using a non-binary dependent variable can be used. Also, the range of

innovations should be expanded to included activities such as hospitality and tourism (Dressler and Paunovic (2021a, 2021b)).

Future avenues for research include expanding the study into other territories and other agri-food sectors in order to generate a massive data set that can be exploited using Big Data and Artificial Intelligence. This would allow for the development of models to optimise processes and identify patterns, thus improving the analysis of information and decision-making.

6. Conclusions

Like other sectors, the Spanish wine sector understands, on the one hand, the danger of the greenhouse effect for their vineyards and wines and, on the other, that its customers have become more demanding and increasingly aware of environmental considerations. So sustainability has become almost an obligation and the only option for the future. And any disruptions along the way have to be overcome or turned into advantages. Firms have to adapt to adversity, even though adapting to the climate emergency is no easy task. For this reason, this study linked the concepts of resilience, innovation, sustainability and crisis to analyse whether the most sustainable wineries had gained in resilience after the crisis by innovating in different areas: (1) a general innovation dynamic, (2) environment-friendly innovations, (3) innovations in wine processing, (4) access to new markets and (5) innovations in management systems. In order to perform the analysis, a questionnaire was sent out to a total of 230 Spanish wineries. The quantitative data obtained were then subjected to statistical analysis, namely, the Mann–Whitney U-test and rank sum. The conclusion was that, during the economic crisis of 2008, Spanish wineries showed two types of behaviour. One group followed its normal practice of resorting to the export market and leaving sustainability in second place. The other adopted a wide range of innovations – from new products to new agronomic and organisational actions – thus becoming more resilient and not moving away from the path towards sustainability.

This research, therefore, not only reveals compatible, dynamic links between innovation, resilience and sustainability in times of crisis but also indicates that sustainability does not hold firms back during recessions. Quite the opposite. Wineries have to adapt to change, and sustainability can serve as a lever for improvement and growth in the short term. And a sustainable approach is equally important if a firm is to survive in the long term because: (1) environmental damage will not stop; (2) regulations associated with the control of climate change will be constantly stepped up and (3) consumers are becoming increasingly demanding in relation to environmental considerations. It must also be remembered that sustainability, based on the principle of meeting present needs while not affecting those of future generations, does not sacrifice economic growth or social development.

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