STRATEGIC **INNOVATION** AGENDA **FOR THE**

WINE

INDUSTRY

2021/24

PTV
PLATAFORMA
TECNOLÓGICA
DEL VINO

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1 PREFACE

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Ten years of history in which the PTV has positioned itself as a driver of innovation in Spain, with 159 projects facilitated and approved for funding.

As chairperson of the Wine Technology Platform, it's an honour to present the third edition of the Strategic Innovation Platform for the wine industry, which includes the main scientific and technical goals and priorities to be addressed between 2021–2024.

The document you have in your hands has been carefully prepared after a profound reflection on the state of the entire industry, represented by experts from the business and science sectors who comprise the Technical Committee of the PTV, in line with the input collected from all our members and partners, with the support of the Association's Technical Secretariat.

2021 is a very special year for our Association, with two extremely significant milestones for us taking place: the launch of this new Strategic Innovation Agenda and the celebration of our tenth anniversary.

Ten years of history in which the PTV has positioned itself as a driver of innovation in Spain, with 159 projects facilitated and approved for funding under the framework of public calls for R&D&I support, making it possible to mobilise a budget of €157m and getting more than €117m of funding.

At the PTV, we firmly believe in the proverb "in unity there is strength". This is because all the milestones achieved by the PTV in recent years would not have been possible without the close collaboration and synergies built with strategic organisations in the industry such as the Interprofessional Wine Organisation of Spain (OIVE), specially involved entity with which the PTV has collaborated since 2018 through a joint action plan, the Spanish Wine Federation (FEV), the Spanish Wine Market Observatory (OeMV) or, at the European level, the European Committee of Wine Companies (CEEV).

Likewise, on behalf of all of us in the PTV family, I would like to express our deepest gratitude to entities such as the Ministry of Science and Innovation, the Centre for the Development of Industrial Technology (CDTI) and the Ministry of Agriculture, Fisheries and Food for their support and recognition of our Association as a driving force for innovation in the wine industry.

With this new edition of the Strategic Innovation Agenda, the wine industry once again joins forces to show its firm commitment to R&D&I and to convey a unified message about the most immediate scientific and technical needs that we need to address from a common perspective, in order to improve the position, competitiveness and profitability of our winemaking industry.

Ms. Mireia Torres
Chairperson of the Wine Technology Platform

"The goal is to continue facilitating R&D&I projects applied to the entire wine value chain, with particular attention to those aimed at addressing the great challenge of contemporary viticulture: the effects of climate change."

We are facing a new stage with the conviction that research has never been more important in all areas of our lives. This is why your role throughout these years promoting innovation has made you a fundamental part and ally of our industry. With the creation of the Wine Technology Platform, you have proven that through the union of private and public institutions, traders and researchers, we can all work together to meet all the challenges we face along the way – despite how hard it may have seemed at the beginning. During this new period, we at the Interprofessional Wine Organisation of Spain will continue to work together with you through our collaboration agreement.

The goal is to continue facilitating R&D&I projects applied to the entire wine value chain, with particular attention to those aimed at addressing the great challenge of contemporary viticulture: the effects of climate change. In 2020, we have taken things one step further with our training programme for traders, which was very well received. Research cannot remain tucked away in a drawer or only shared among experts. We at the OIVE also consider your role as disseminators of knowledge in the industry to be important. Research and innovation will also be key during this post-COVID-19 stage, considering the European policies in the pipeline which revolve around two vectors of economic modernisation: the transition towards organic farming and sustainability and digitalisation.

Our industry has a lot to say – and must speak up – about these two fields, and the PTV, the OIVE and the entire sector must be on the lookout to take advantage of the opportunities we get in the immediate future. We have to continue working hand in hand with the entire wine value chain, to show our resilience as an industry, and be proud of everything that we are.

Mr. Ángel Villafranca
Chairperson of the Interprofessional Wine Organisation of Spain (OIVE)

The winemaking industry is a vital part not only of our economy but also our society. In economic terms, the pre-COVID-19 turnover of Spanish wineries was €6.5bn per year and the activities of the wine industry value chain accounted for 2.2% of the gross value added (GVA) in Spain (more than €23.7bn). Furthermore, in terms of employment, it accounted for around 2.4% (more than 427,700 jobs) full-time equivalent employment in Spain, generating €1.75 of added value for every euro of final demand in the wine industry.

Without a doubt, the health crisis caused by the COVID-19 pandemic has changed the entire socio-economic scenario and the winemaking industry has been severely affected by the effects of this pandemic (particularly by the closure and restrictions for the on-trade channels). Nevertheless, over the coming months, we will face a recovery scenario, in which the agri-food sector will play a crucial role in the country's economic recovery due to its strategic and essential nature, as well as its capacity to generate economic activity in rural areas. The winemaking industry cannot be excluded from this recovery, as it is a vital part of our culture and because it represents a responsible and sustainable industry that drives rural development and is clearly committed to innovation.

Indeed, the health crisis has taught us all the significant value of research, innovation and collaboration among all stakeholders involved in order to face new challenges and adapt to new situations. Thus, this industry invests more than €570bn per annum in improving facilities, processes and equipment and more than €16m per annum on intangible assets (including patents, R&D&I expenses, design and brand image, etc.). Moreover, the Wine Technology Platform has facilitated 77 R&D&I projects approved between 2017–2020, representing more than €70m of the total executed budget and more than €50m of funding secured.

On behalf of the Ministry of Agriculture, Fisheries and Food, I would like to emphasise our commitment to innovation in the agri-food sector through the European Innovation Partnership for Agricultural Productivity and Sustainability, which has led us to co-finance the creation of 177 supra-regional operational groups at the national level and execute 68 innovative projects with a total of €53.74m invested so far under the 2014–2020 National Rural Development Programme. The winemaking industry has actively participated in these calls through 15 supra-regional operational groups, which have received nearly €3m in total, to implement innovations mainly related to the development of new methods of disease and pest control, precision viticulture and other innovations developed to improve the position of wine in the markets.

One of the other great commitments of the Ministry is the promotion of digitalisation. This is why we support initiatives such as the "National Digitalisation and Wine Hub" developed by the Spanish Wine Federation with the participation of the Wine Technology Platform, to turn digitalisation into one of the wine industry's pillars of the future. This goal is completely in line with our Digitalisation Strategy for agri-food, forestry and rural sectors, which seeks to promote business development and new business models, among other things.

In short, we continue to support the work being done by the Wine Technology Platform, which – through this new Strategic Innovation Agenda – continues to drive innovation as an essential tool to improve the competitiveness of Spanish wines.

Ms. Isabel Bombal
General Director for Rural Development, Innovation and Agri-Food Training, MAPA

The Wine Technology Platform (PTV) Association of Spain is a nonprofit public-private association supported by the Ministry of Science and Innovation and by the State Research Agency. Since it was created and launched ten years ago, the Ministry – and later the Agency I have the honour of heading – has found the PTV to be the ultimate, perpetual and clear example of the enormous benefits resulting from collaboration among companies, research centres and the public authorities for a sector of the economy through research, development and innovation. The PTV has contributed towards turning the Spanish winemaking industry into a benchmark for competitiveness, dynamism, growth and international recognition.

This is an industry that, despite the severe economic crisis we are experiencing as a result of the COVID-19 pandemic, has continued to grow in international markets and is trying to reinvent itself to find its place among local consumers. This is all thanks to a joint commitment to research and innovation. Wineries, auxiliary industries, researchers and managers are all working together to build an industry that – aware of its own needs and problems – uses R&D&I to find solutions, propose alternatives and drive sustainability, digitalisation and reindustrialisation.

Throughout these years, the Agency has supported the growth of the PTV's activity and institutional presence through two lines of action: the consolidation of its organisational and operational structure, through direct financial aid from the Support Programme for Spanish Technology Platforms and ongoing financial support so that its members can design and implement their R&D&I projects through different tools offered by the State Plan for Scientific and Technical Research and Innovation. This is the case for the current calls for Collaboration Challenges, Knowledge Generation or Research Challenges. The new calls for Strategic Projects and Proof of Concept Projects funded by the European Union's Recovery and Resilience Mechanism round off the range of funding instruments. Thanks to these funds, between 2017–2020, the Spanish wine industry benefited from direct aid or funding worth more than €56m, which meant a significant boost for the promotion of public-private collaboration in R&D&I and the achievement of multi-year goals set by the PTV in its successive Strategic Innovation Plans.

Through R&D&I, the PTV has contributed towards turning the Spanish winemaking industry into a benchmark f or competitiveness, dynamism, growth and international recognition.

The update of the 2021–2024 Strategic Innovation Agenda presented in this document will serve as a new catalyst that will undoubtedly let the public authorities and all stakeholders involved learn the strategic lines, scientific and technical needs and their prioritisation first-hand, with a view to their funding in the future, and consequently, the continuous dynamism of the industry. I am confident of the success that implementing it will bring the Spanish wine industry and I am certain that it will enable it to continue being an impressive benchmark for the Spanish agri-food sector in the world.

Mr. Enrique Playán
Director of the State Research Agency

2 INTRODUCTION AND BACKGROUND

2 INTRODUCTION AND BACKGROUND

STATE OF THE WINEMAKING INDUSTRY

2020 – with the global pandemic and serious threats in different markets – has tested the resilience of many of our economic sectors, but the wine industry is actually better off than many others, thanks to its degree of internationalisation, the variety of its product categories and the regard customers have for it.

The economics of the Spanish wine industry in 2020–2021 was inevitably influenced by the effects the COVID-19 pandemic had on sales, mainly in on-trade channels but also in international sales, as well as the positive impact it had on the direct sales channel and off-trade distribution channels.

Spain has been producing an average of 41 million hectolitres of wine over the past few years – including both wine and grape must – making is the third-largest producer in the world, behind Italy and France. We produce relatively less than our main competitors, despite having the largest land area dedicated to vineyards in the world, with China closing in fast in recent years, but with vineyards mostly dedicated to table grapes and much less to grapes to be turned into wine. Out of this substantial amount – and with a lot of variations each season – some 3 or 4 million go to the production of grape must, between 3 and 5 million – depending on the year – are used to make grape spirits, and a similar amount is intended for industrial uses, to make wine-based drinks or is naturally lost during the transformation process. As for the rest, between 10 and 11 millions of hectolitres go to the domestic market and between 20 and 22 million hectolitres are exported. It is therefore an industry with an extraordinarily high degree of internationalisation, where more than half of the production is intended for export and for which recent developments have shown what the three main challenges are for its improvement:

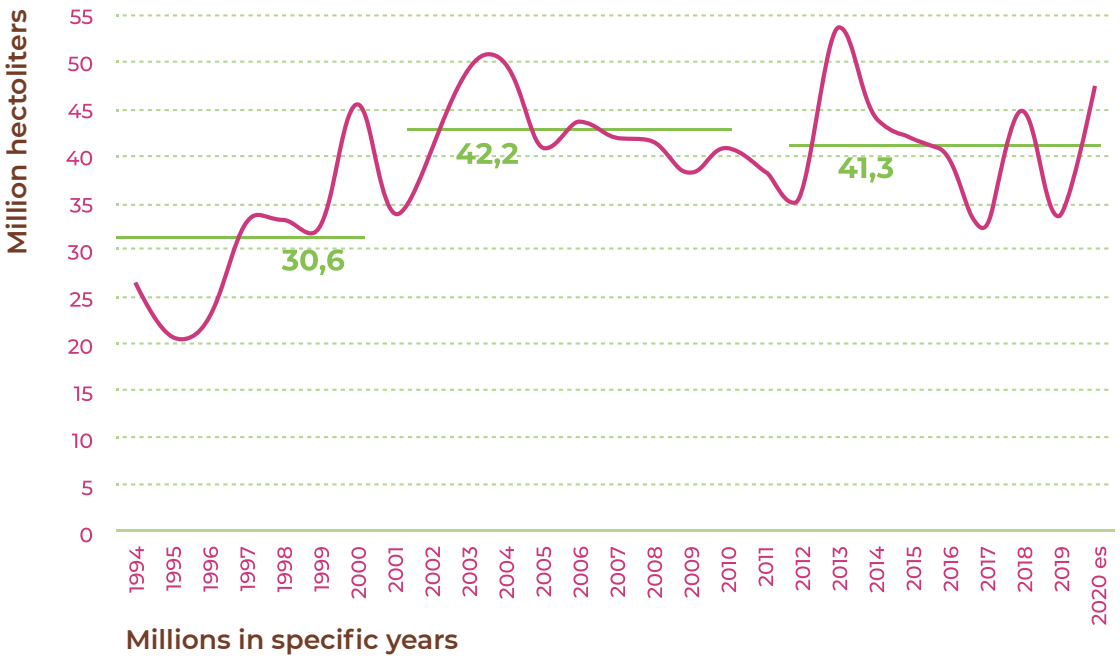
- **Correct short-term imbalances between production and sales.**
- **Boost wine consumption in Spain.**
- **Increase value – and image – generation for international sales.**

There are large annual differences in **the production of wine and grape** must **in Spain**, with years of surpluses and shortages, and their consequences with regard to price volatility, storage needs and effects on the image and quality of the products. Although these variations are relatively natural for crops grown in the open air and dependent on weather conditions, the figure showing the growth of our production shows greater variability since 2011, coinciding with the end of subsidies for distillation as a market regulation measure and in parallel with an extraordinary restructuring and conversion of vineyards and the gradual increase of irrigation. We have the capacity to produce more than 50 million hectolitres, although weather conditions each year may cause production to drop to only 35 million hectolitres (Figure 1).

This great variability, confronted with markets that evolve more slowly and change less, creates strong tensions in grape and wine prices, as well as years with a great need to sell large amounts – years with surplus production – followed by years in which we barely have enough to meet customer demand. All of this has consequences on the image of Spanish wine in the different markets.

The grape must market varies according to the price at which it can be offered. In some cases, it serves as a “commodity” with a great potential for demand, particularly for juices, when prices are low and yields are high, but it is harder to sell during seasons of shortages and higher prices.

FIGURE 1. WINE AND GRAPE MUST PRODUCTION IN SPAIN



Source: data from the Spanish Wine Market Observatory (OeMV).

Industrial uses for the manufacture of vinegar, vermouth or wine-based drinks are relatively stable, although the strong rise in vermouth consumption in Spain lately has increased this type of use over the past few years, as well as the growth of sparkling drinks, sangrias, tintos de verano ("summer red wines") and low-alcohol "wines" or other "wine-based drinks". The spirits market was customarily the main adjustment market for wine surpluses when European aid was available. But this disappeared with the reform of the CMO in 2008, and after a transition period until 2011, distillation has remained very stable over the years, except when there has been government intervention during times of crisis. Since the summer of 2014, when the effects of the previous year's bountiful harvest were felt sharply, there have been different "road maps", ministerial plans or even royal decrees that consider the possibility of obliging distillation in the event of excess yields. In 2020, the possibility of additional subsidised distillation was implemented using funds available to the industry for the disposal – and repurposing for industrial uses – of up to 2 million hectolitres as a direct result of the effects of the pandemic.

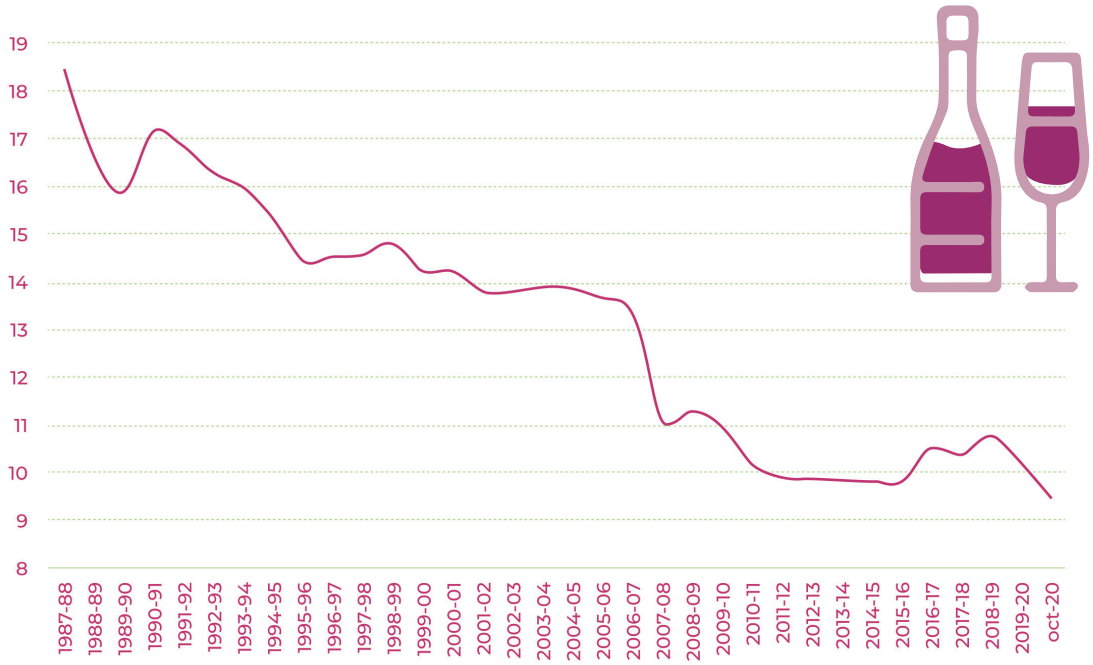
However, the main markets where we can strike the right balance between what we produce and what we can sell well at profitable prices for the entire wine value chain are the domestic and international markets.

The wine market in Spain – domestic consumption – has been showing clear signs of recovery for years now. There has been stability and a halt to the decline for almost ten years, with a strong rise since mid-2015 and particularly in 2019, cut short by COVID-19 in 2020 (Figure 2).

In Spain, the sales of wines with protected designations of origin have grown briskly. They have surpassed the sales of wines without geographical indications in terms of value for years, but now they also outstrip them in terms of volume for consumption through off-trade channels. But the importance of on-trade wine consumption – more than a third of sales in terms of volume and more than half in terms of value – has meant that the sharp increases recorded in 2020 in the off-trade, direct or online sales did not offset – not by a long shot – the huge los-

FIGURE 2. WINE CONSUMPTION IN SPAIN

(Estimated million hectolitres)



Source: data from the Spanish Wine Market Observatory (OeMV).

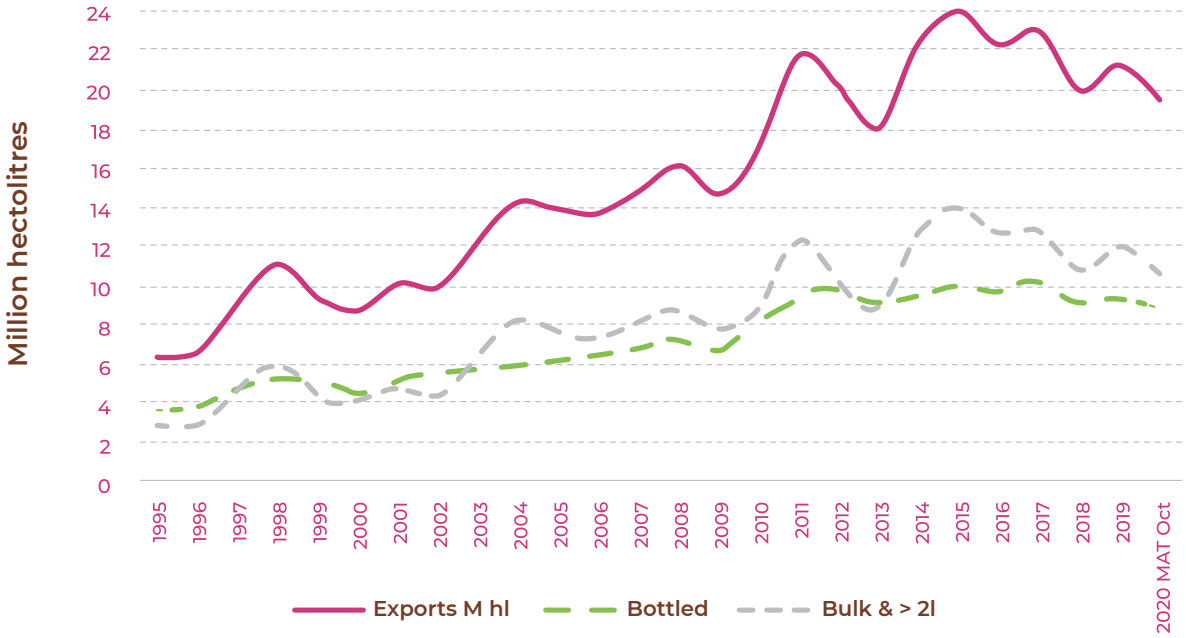
ses in sales in bars and restaurants. With the latest data available until October 2020, the period from March to October – the most affected by the pandemic last year – recorded losses of 1.6 million hectolitres compared with the same period the year before. This figure is equivalent to a drop of 21.5%. And the decline right in the middle of lockdown was very sharp, with a decrease of 24% in March, 31% in April and 40% in May. The decline recorded in September 2020, at the start of the second wave, was even greater, with a decrease of almost 48% of estimated total sales in Spain. For the time being, there is no sign of recovery for wine consumption in Spain, which is expected for a potentially strong 2021, when the health situation will allow a return to normal. Wine consumption in Spain had been growing until the pandemic hit and everything suggests that once the pandemic is over, this trend of growth will continue.

The negative growth of the domestic market for Spanish wines, however, has been mitigated in many cases by improvements – or growth that is less negative – in the **export markets**, proving once again that diversification of markets and market segments provides an important safeguard against crises.

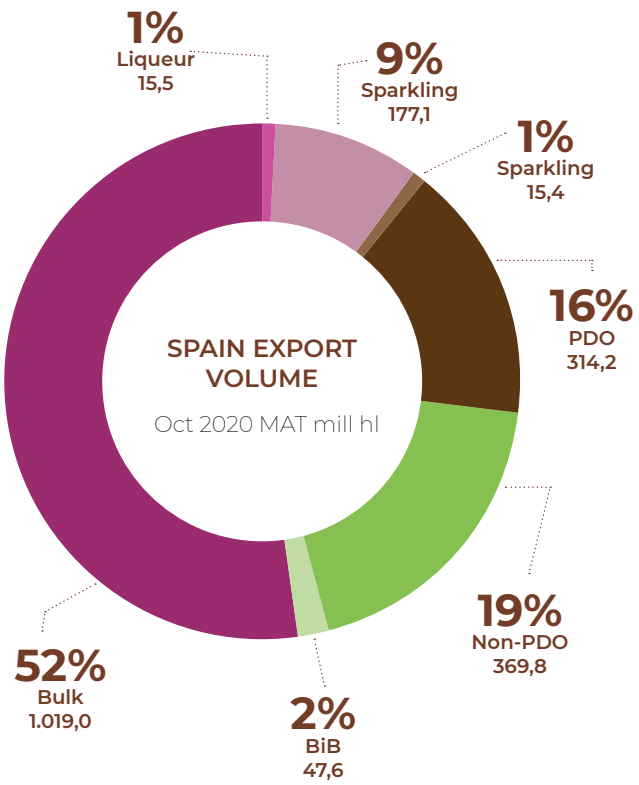
As of October 2020, Spain's exports (12 months) were 19.6 million hectolitres year-on-year, worth €2.585bn. These figures represent a decrease of 5.7% in euros and 9.3% in litres, which means our country is the only top wine-producing country that has increased its average wine prices in international markets – perhaps not so much as a consequence of the pandemic but instead of a season of low grape yields and therefore a sharp drop in bulk wine sales (-14%). (Figure 3)

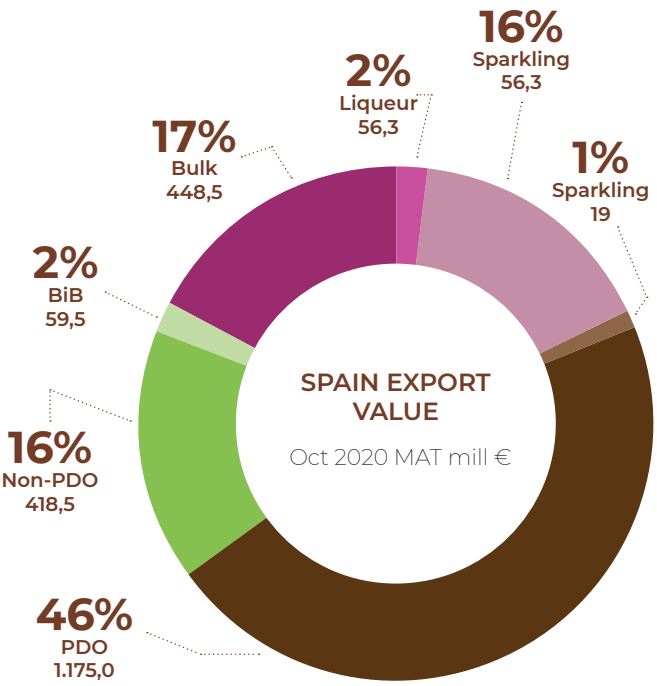
As a matter of fact, bulk wine has a strong impact on overall Spanish wine export data. It accounts for 52% of our sales in litres, but only 17% of the total value. It greatly fluctuates with harvest yields and is mainly concentrated in four major markets – France, Germany, Italy and Portugal – which are similar in that: (i) they are all wine producers and (ii) they are all major wine exporters. Hence, these exports of bulk wine, which are so important for Spain, are

FIGURES 3 AND 4. SPANISH WINE EXPORTS



Source: data from the Spanish Wine Market Observatory (OeMV).





subject to two major risks: (i) the harvest yields of our main customers – the more of their own wine they have each year, the less Spanish wine they will buy – and (ii) the performance of their own sales – they will buy our wine if they need it to meet the demands of their markets.

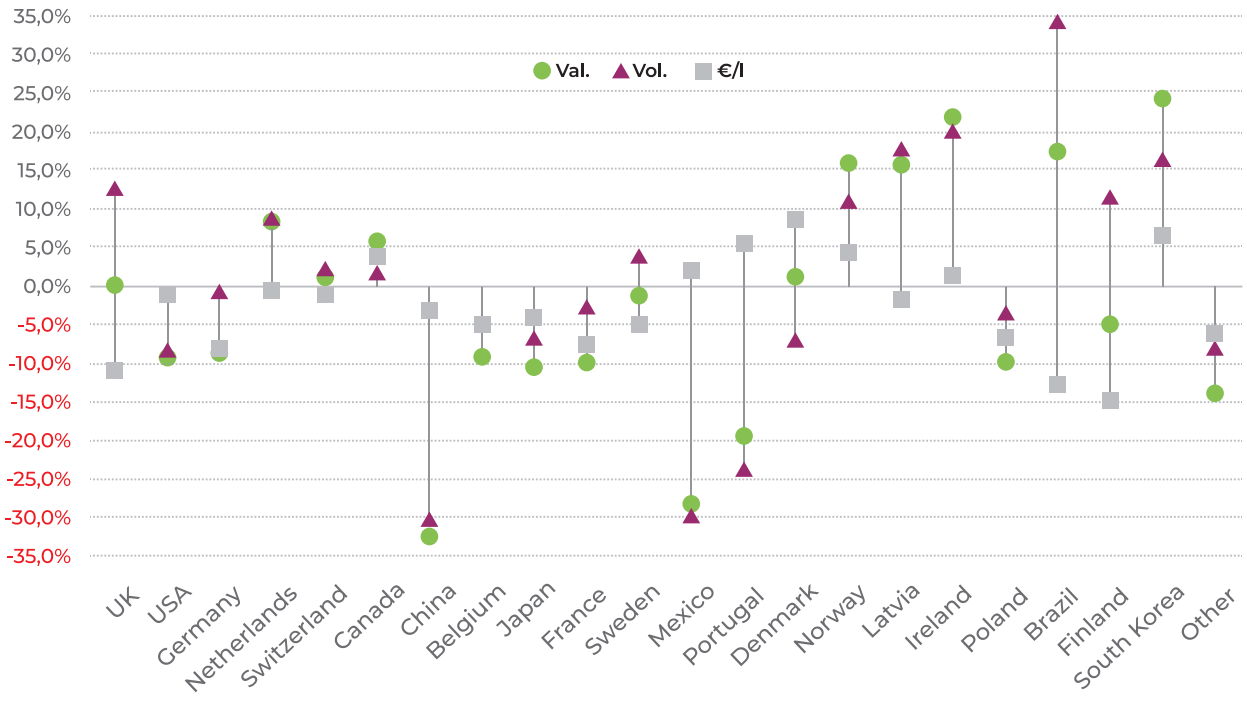
In terms of value, however, almost half of our total sales are bottled PDO wines that, together with PDO sparkling wines (mainly cava) and liqueurs (mainly Jeréz and to a lesser extent, Montilla-Moriles), account for almost two-thirds of the total non-domestic turnover for Spanish wines (Figure 4).

In terms of recent growth, with a tough 2020, bottled PDO wines approached the end of the year with a slight decline of 2.6% in euros, with a much better performance than non-PDO wines, particularly led by the growth recorded by Rioja wines. Liqueur and sparkling wines performed much more poorly in international markets, with decreases of around 13% year-on-year to October, while sparkling wines fell by 9%. By far, bag-in-box (BiB) wines performed the best, growing almost 15% in 2020 worldwide. Due to the increased home consumption and the relatively good performance of the Scandinavian markets, this product type was the big winner in a negative year such as 2020.

If fact – and as a great lesson to be learned in such a difficult period – we found out that not all markets performed in the same way and that some of them even increased their purchases. Most of these have been in terms of volume and at prices lower than those in the previous year, but some have increased in euro terms. With Spanish sales data as of October 2020, and focusing on the performance of bottled wine sales, the United Kingdom, the Netherlands, Canada, Sweden, Norway, Latvia, Ireland, Brazil, Finland and South Korea increased their purchase of Spanish wines in litres and many of them in euros as well. On the downside, China and Mexico, and to a lesser extent, Portugal, experienced huge declines, with other markets showing lacklustre performance,

FIGURE 5. MAIN MARKETS FOR SPANISH BOTTLED WINES

(MAT as of Oct 2020)



Source: data from the Spanish Wine Market Observatory (OeMV).

in many cases affected by the evolution of the pandemic and the different ways in which the governments have reacted to it. In other cases such as China, it was the outcome of processes that were already under way before. For others, it was affected by some of the great challenges facing Spanish wines in international markets in 2020 such as Brexit, the new tariffs in the US, the new wine law in Russia and, in general, greater global competition amidst the stagnation of consumption and international sales in terms of volume. Until the start of the COVID-19 pandemic though, there was a certain increase in the value of the wines sold, which made a higher turnover possible despite selling almost the same amount.

The trend towards wine premiumisation of the global wine market exists in parallel with strong competition in the entry-level wine segment – where efficiency, marketing, good distribution and, in many cases, bulk sales of quality wines to far-off destinations – is posing new challenges. In both segments, Spain has great opportunities to successfully compete, but to do so, the strategy for the coming years must place an emphasis on (i) limiting fluctuations in harvest yields, to avoid surpluses that lead to huge sales at low prices, (ii) stressing the need for value creation instead of the number of litres sold (iii) strong investments and improving the distribution capacity of our brands. Product quality in the different markets and segments, image, promotion, packaging and many other elements that are certainly essential, but the ones mentioned first are absolutely musts to craft successful strategies (Figure 5).

STATE OF R&D&I IN SPAIN

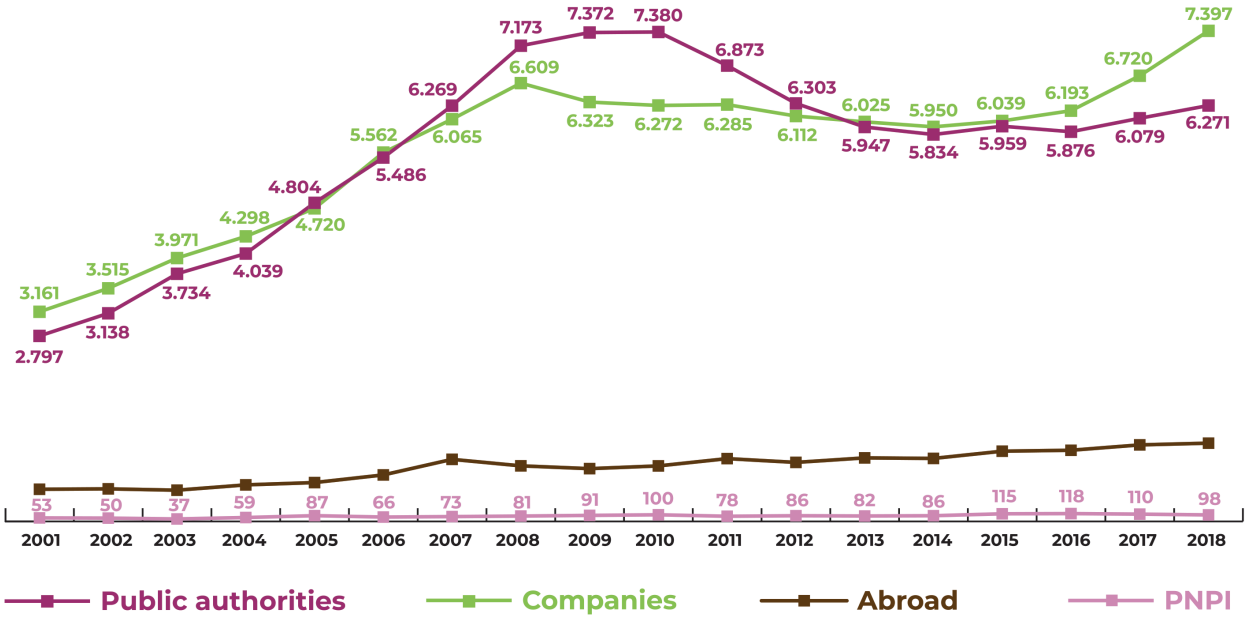
According to the 2020 COTEC Report, which refers to data from 2019, and based on the latest data published by the National Statistics Institute (INE), it can be said that Spanish R&D&I investment has gone back to the levels prior to the financial crisis (2007–2008) – which is highly encouraging, bearing in mind that it bounced back from a cumulative drop of 5.8% for the 2009–2017 period (2019 COTEC Report). This is corroborated by figures for Spain's total R&D&I expenditure, which, according to the INE, successively reached €14.063bn in 2017, €14.946bn in 2018 and €15.572bn in 2019.

Both the private sector and the public sector contributed positively to this increase (Figure 6). The latter increased its R&D investment for the second consecutive year, but the growing investment of the private sector is particularly worth mentioning, as it rose from an investment of €5.950bn in 2014 to €7.397bn in 2018. This, together with the slight increase in public investment by the public authorities (+3.3%), showed an upward trend for the third consecutive year.

This highlights the contrast between a private sector that has clearly recovered to the pre-financial crisis level (+24%), and a public sector that has not yet managed to do this (+7.5%), with growth below GDP and therefore losing relative weight. It is definitely not enough to catch up to the levels of other countries.

Thus, the growth in investment, together with the slowdown in nominal GDP, which fell from 4.3% in 2017 to 3.5% in 2018, has led to the greater weight of R&D in the production structure, reaching 1.24% of GDP in 2019.

FIGURE 6. DISTRIBUTION OF R&D INVESTMENT BY SOURCE OF FUNDS (€M)

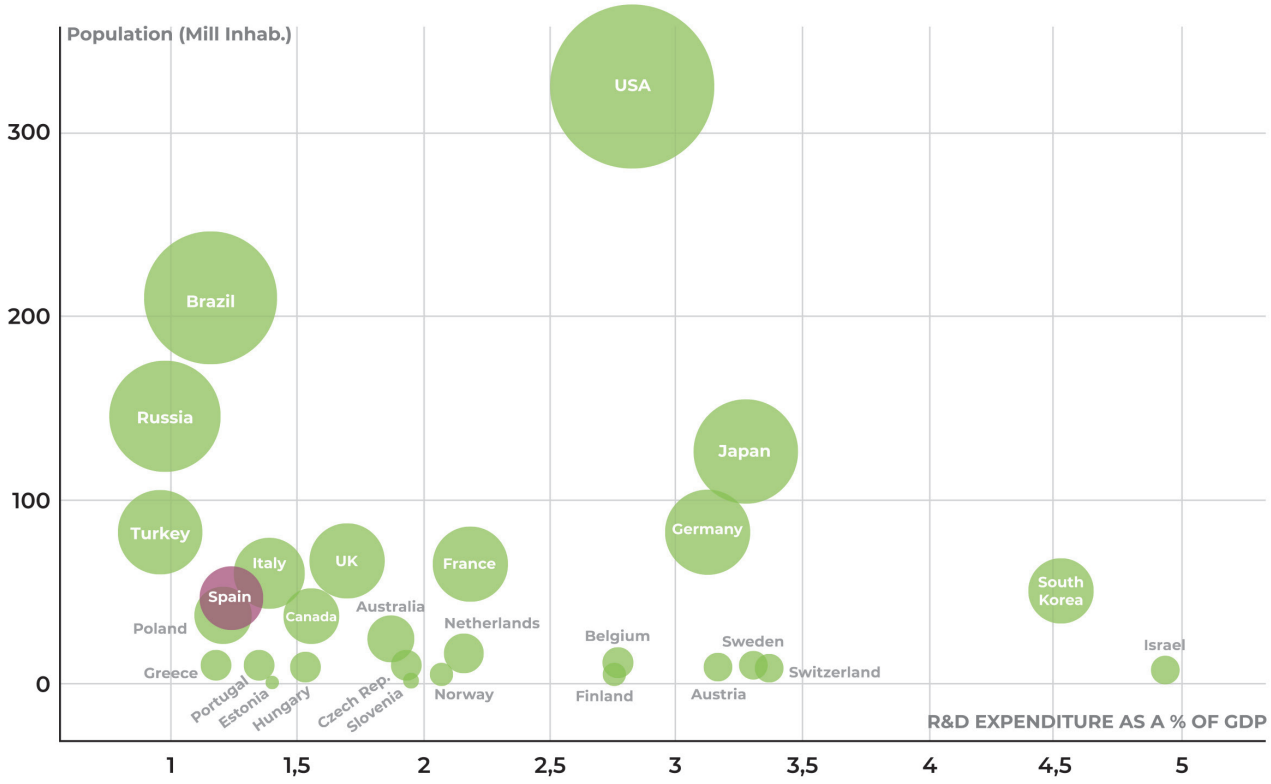


Source: R&D Statistics. INE (2018).

This is why despite the increase in R&D investment over the past few years, Spain is still a long way away from the appropriate level of investment in relation to GDP (Figure 7), as well as the minimum optimal level (3%) specified in the State Plan for Scientific and Technical and Research Innovation for 2030, thus showing a significant gap with the EU. Consequently, R&D&I expenditure/% GDP in Spain is 1.24%, a far cry from the EU average (2.07%) and even further away from the target set by the EU itself for 2030 of 3%, nowhere near that of other EU countries (Germany, Switzerland, Finland, etc.) and non-EU countries such as Japan, South Korea or the USA, whose R&D&I expenditure exceeds 3–4%.

The gap between Spain and the EU average in terms of R&D expenditure and investment increases every year. This is due, not to Spain's economic clout but instead to R&D investment per capita. In 2018, there were 5 countries in Europe with a lower per capita income than Spain which spent more on R&D. These were Slovenia, Estonia, Hungary, Portugal and the Czech Republic. It is worth pointing out that this gap was at its lowest in 2008, with a differential of 0.52%, while it is now at -0.87% (2019 COTEC Report).

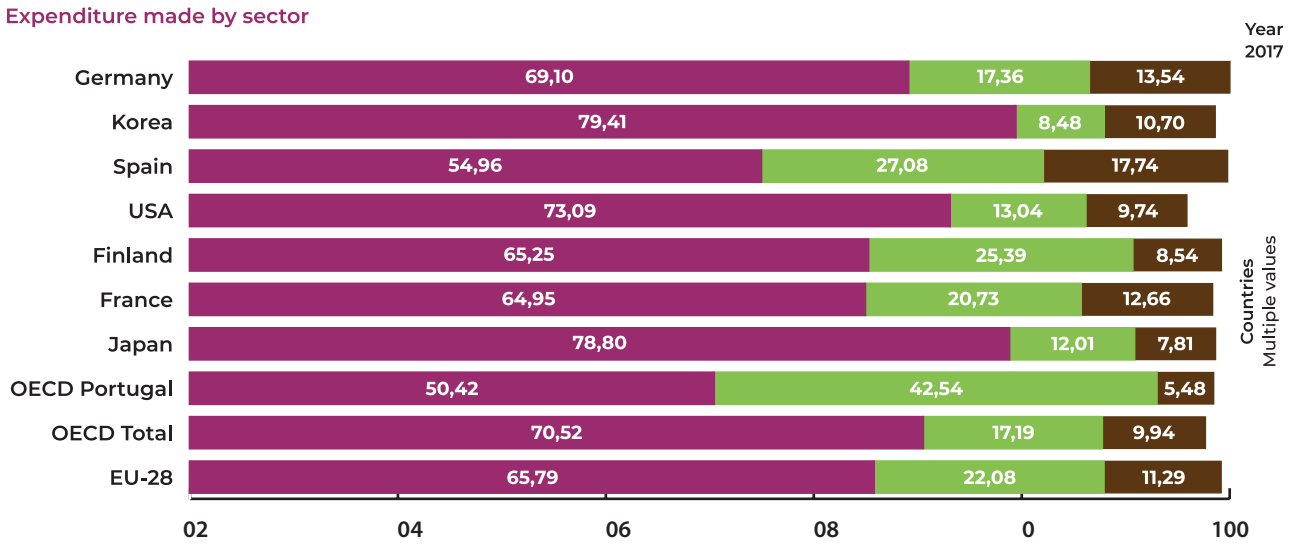
FIGURE 7. R&D EXPENDITURE/% GDP AND NUMBER OF RESEARCHERS (PER M INHABITANTS)



Source: UNESCO (2020).

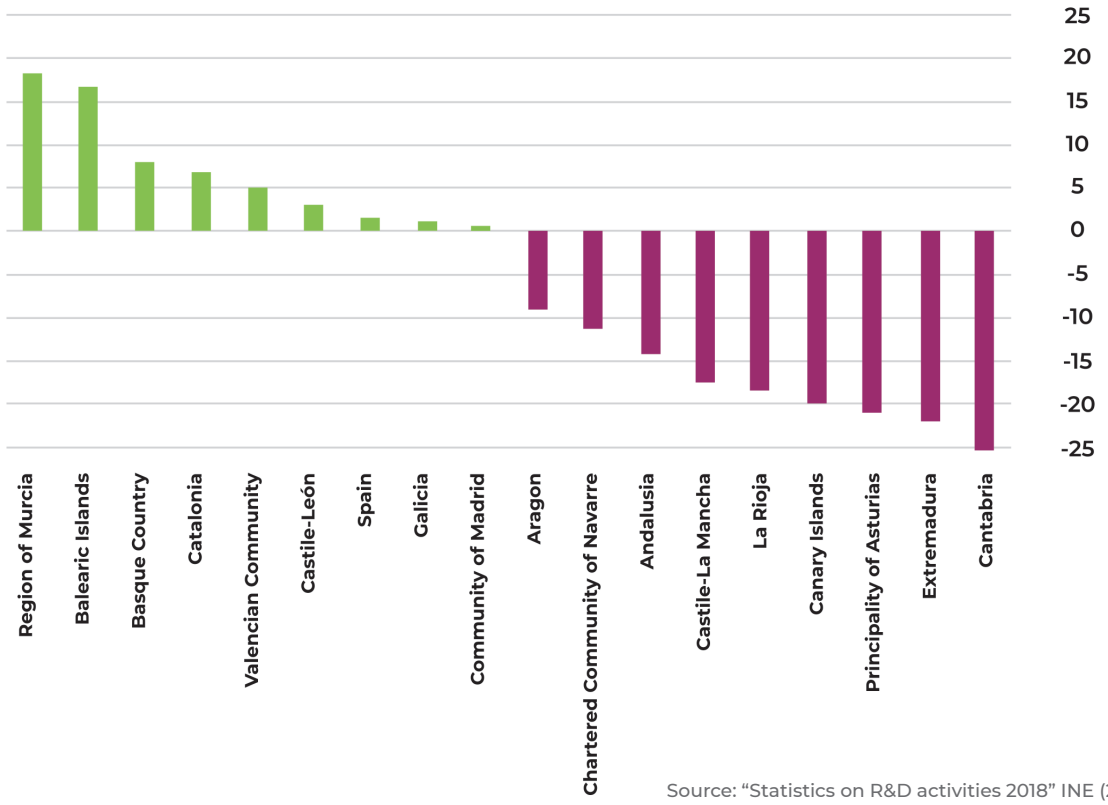
Furthermore, in general, the higher the sectoral R&D expenditure or investment by the business or academic sector to the detriment of the public sector, the higher the country's R&D investment ratio (see Figure 8). The countries with the highest R&D investment (Japan, Korea, USA) have a business R&D investment of more than 70% and a government R&D investment of less than 10% (in line with the OECD average). Business R&D investment in Spain stands at 55%.

FIGURE 8. R&D EXPENDITURE BY SECTORS (PRIVATE, PUBLIC AND GOVERNMENT) IN %



Source: COTEC Report (2020).

FIGURE 9. VARIATION ION R&D INVESTMENT IN %. 2008–2018 PERIOD



Source: "Statistics on R&D activities 2018" INE (2019).

Following the financial crisis that began in 2007, the growth of R&D investment by autonomous community (Figure 9) has been very uneven. In 2018, there was a total of eight autonomous communities that had exceeded pre-financial crisis R&D investment levels. These were Murcia, the Balearic Islands, the Basque Country, Catalonia, the Valencian Community, Castile-León, Galicia and the Community of Madrid (exceeding 15% in relation to expenditure in previous years). At the opposite end, still far from achieving this, we find Cantabria, Extremadura and the Principality of Asturias (more than 20% less in total R&D&I expenditure).

With regard to the last year with available data (2019), the autonomous communities that have invested more than the average (1.24%) are the following four: Basque Country (1.96%), Madrid (1.71%), Navarre (1.68%) and Catalonia (1.52%), while the rest have invested less, with some like the Balearic Islands and the Canary Islands investing less than 0.5% (Source: 2020 COTEC Report).

Furthermore, the recovery of business R&D expenditure in this period did not result from an increase in the number of innovative companies, as a drop in the number of companies that invest in R&D has been observed since 2008, with a 30% decrease to 10,175 companies in 2017 versus 15,049 in 2008. Bearing in mind this decrease in the number of companies, it is noteworthy that business R&D investment dropped by only 4% during this period. As a result, the average investment of companies with R&D activities have grown considerably by more than 40% (mainly in current expenses and the average salaries of their R&D staff). It is clear that a group of companies that consider R&D a vital and necessary part of their business has been consolidated at the national level.

This data is of particular significance if we take into account that the greatest R&D intensity (expenditure made as a percentage of GDP) was found among SMEs (29% between 2015–2016), unlike other countries such as Italy (18%), England (25%) or Germany (25%) where large enterprises are mainly the ones behind business R&D expenditure.

It is also worth pointing out the positive growth in the number of researchers and their weight in total employment, with almost 10,000 people and about 6,500 researchers more than in 2016, resulting in a total of 215,713 people (engaged in R&D activities), of which 133,195 were researchers. Hiring in the private sector (+7.4% since 2009) is faster and greater than the public sector (-4.5% since 2009), as is the case with R&D investment in general (2019 COTEC Report).

R&D&I FUNDING

The Spanish R&D&I system has shown strong stability in terms of its different sources of funding over time. These are split almost proportionally between the public sector (around 40%) and the private sector (49% and 48% in 2017 and 2018, respectively), with external sources accounting for around 8–10%.

The stagnation of private funding (around 46% since the beginning of the century) compared with other European countries (lower rate, together with the United Kingdom and Italy, below 55% of the average) stands out, and the contrast is clear when compared with the high contribution of Asian countries that are leaders in terms of investing in technology innovation (Japan, South Korea and China), where nearly three-quarters of R&D funding comes from the private sector or the United States and Germany, with private investment accounting for more than 60% of the total. This underlines the fact that both private R&D expenditure and funding are crucial to the innovative performance of countries.

In terms of public funding at the national level, budget adjustments over the past few years have affected R&D investment. Thus, the Spanish General State Budget fell by 32% compared with its highest level in 2009 (€7.07bn versus €10.375bn), and the budgets of the autonomous communities fell by 15% compared with the peak reached in 2010 (€2.335bn versus €2.742bn).

These funds are channelled through the different instruments and programmes for the direct funding of business R&D and innovation, which are managed at the national level by different ministerial departments (MICIN, MINCOTUR, MINECO, MITECO, MAPA, etc.), autonomous bodies, and state companies and agencies (e.g. State Research Agency, IDAE, RED.ES and CDTI), and at the regional level by the different autonomous communities. The different programmes for the direct funding of R&D&I

include funding lines in the form of grants, loans or the increasingly widespread combination of both (partially refundable aid).

Several factors have an influence on why implementation rates for R&D funding do not improve in our country. These include:

- ✓ Lack of demand for funding. Spanish companies fund most of their investment in R&D using their own resources, reaching a total of €5.723bn (INE 2018), meaning 80% of the total business R&D investment recorded in Spain (€7.717bn, 2017 data. Source: 2019 COTEC Report) in general.

- ✓ Lower supply. Public resources allocated to Spending Programme no. 46 in the General State Budget (PGE) have been cut by approximately 32% since the start of the financial crisis (2008: €10.383bn), until the current period of slow recovery with a fourth consecutive increase reaching €7.07bn in 2019 (Source: 2020 COTEC Report).

- ✓ Management of public funds. Steady decline of the rate of budget execution since 2007 (values greater than 90%) to a historic low of 46.6% in 2017. This means that talk that "one euro out of every two euros allocated to this spending programme is not executed" still remains true.

The low execution rate is not the same for all; it depends on the agency executing each budget item. Thus, while the ministerial subsector has experienced a drastic drop in its execution rate since 2007 (-60%) to 32% in 2018, the autonomous communities have recorded a considerable decrease (-42%), with their current rate standing at 66.8%. In contrast, the subsector of autonomous bodies and state agencies have maintained budget execution rates that are much more stable (90%), remaining high throughout the entire period (e.g. CSIC, 94.9%; State Research Agency (AEI), 85.3%).

All this means that R&D&I is once again one of the items with the lowest execution rates among the 25 main spending programmes of the public sector, standing well below 75% – specifically at 46.8% – with only the execution of the Trade, Tourism and SMEs spending programme actually worse off (43.4%).

In terms of R&D&I funding from abroad, particularly Horizon 2020, the Eighth Framework Programme for Research and Innovation (2014–2020), the excellent results obtained have made Spain as the fourth country with the most funding obtained in the form of grants behind Germany, the United Kingdom and France, surpassing the levels reached in the Seventh Framework Programme for Research and Innovation, in terms of the total amount, ranking and returns.

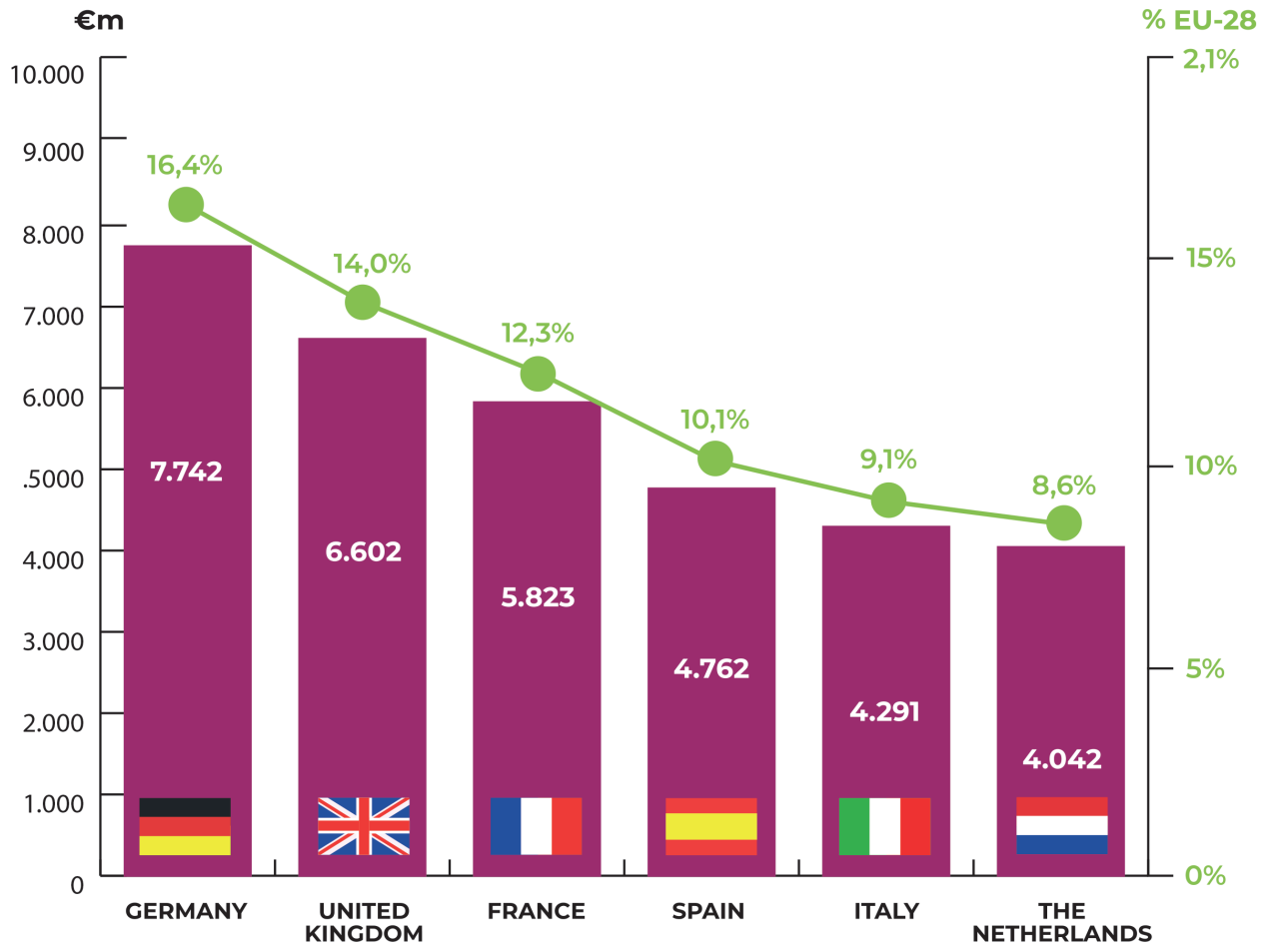
The EU's Horizon 2020 Programme has been the main source of funds from abroad with a total budget of €74.828bn for the 2014–2020 period. According to the latest update in 2019, Spain secured a total of €4.762bn for 6,719 projects selected for funding by the European Commission in all areas of the Eighth Framework Programme for Research and Innovation (Horizon 2020). This represents 6.3% of the Programme's total budget and makes us the fourth country that has received the most funding from H2020 (10.1%), behind Germany, the United Kingdom and France (Figure 10).

Overall, Spanish participation was balanced across all the pillars of H2020 and all its instruments. Spain participated in almost 25% of all projects funded by the Commission (one out of four) with more than 12,000 participations, involving a total of 3,140 different entities. This gives Spain third place in terms of participation, despite being an extremely competitive programme, with a very low success rate.

What's more, it ranked second for consortium/coordinated projects and led in the area of SME participation, both in terms of financing and the number of companies funded, consolidating its position as the main beneficiary country for the SME instrument.

With regard to future funding prospects, the positive trend of the support for innovation by the EU framework programmes stands out, with the budget for the new Horizon Europe (2021–2027) once again significantly increasing compared with H2020 (+124%), almost reaching the ceiling of €100bn (€95.5bn).

FIGURE 10. PROVISIONAL H2020 RESULTS (2014–2019).



Source: CDTI.

This programme was reinforced at the end of 2020 with increased funding obtained through the Next Generation European Recovery Instrument (NGEU 2021–2026), which provided an additional €5bn.

Furthermore, there are also instruments to support business innovation such as tax incentives, which entitle businesses to corporation tax deductions for carrying out research and development and/or technology innovation projects, and bonuses, which are applied to the employer's social security contributions for research staff.

R&D tax incentives have become a very important tool used by the public authorities to promote business R&D. Proof of this is that, in 2017, a total of 31 of the 37 OECD countries granted preferential tax treatment for business R&D investment (15 more than in 2000). In addition, it has been proven that Spain has one of the best tax incentive schemes, together with France and Portugal (although with less support than these two countries), and is the only country in the world that grants tax deductions for technology innovation (I) in the settlement of corporation tax.

The voluntary mechanism started in 2003 which legally guarantees the rating of the nature of the activities of business R&D&I projects through the request of Binding Reasoned Reports (IMV) reached almost 10,000 applications in 2019 (with SMEs

accounting for 61% of the applying companies), with a remarkable growth in reports on technology innovation activities compared with those for R&D, which mean more than €4.2bn (Source: MICIN 2021. Report on 2019 Applications).

Finally, the recent contribution of private capital (venture capital + private equity) is worth pointing out due to its importance as a financial mechanism to promote the different stages of the life cycle of innovative companies. According to the industry's business association, ASCRI[1], private capital investing in Spain amounted to almost €5,000 in 2017 (30% higher than in 2016), reaching a historic high in terms of investment. What's more, private capital investing in terms of GDP grew to 0.43%, matching the European average.

R&D&I IN THE WINEMAKING INDUSTRY

Faced with the downward trend of overall innovative activity in Spain, as shown by R&D&I investment in the agri-food sector amounting to only 0.47% of GDP[2], compared with other countries that reach 2% (Cajamar 2018), the wine industry has been increasing its commitment to innovation by increasing its annual R&D&I expenditure since 2011.

Unfortunately, there is no direct and consolidated data available at the national level on the investment of the winemaking industry in R&D&I, so it can only be estimated using the actual statistics provided by some of the state agencies and the autonomous communities that fund – using public funds – this type of investment, as well as correlating it with the figures from other sectors like the agri-food and beverage sectors, assuming similar investment rates.

Considering that the Spanish wine industry has a turnover of €6.5bn and the whole industry accounts for 1% of GDP (€11.2bn)[3] and 2.2% of national GVA (€23.7bn) , we can confirm that it has invested at least €130–150m per annum since 2018 in R&D&I activities.

These €130–150m per annum represents around 23–26% of R&D expenditure in the agri-food sector and 0.94–1.08% of the total national R&D&I expenditure. It is worth pointing out that it is above the national average for the rest of the agri-food sector (0.64%) and it is also higher than the 0.69% average for the EU-28 countries (in terms of GVA). Thus, it can be seen that the wine industry can account for approximately more than 5% of R&D expenditure in the food and beverage sector and 1% of total R&D&I expenditure in Spain.

It is useful to mention that no grouped and global data on R&D&I expenditure for the Spanish wine industry – either updated or historical – was found, and only the documentation provided by some public financial entities, both national (CDTI or AEI, MICIN, MAPA, INE, etc.) and regional innovation agencies, is available. This information is essential to understand the level of development of the Spanish winemaking industry and the results achieved by the Strategic Innovation Plans (national and regional) throughout the 2011–2020 period, coinciding with the PTV's activities. Therefore, it is very important to collect and unify this information today. It is actually a priority for the PTV itself, which it expects to improve throughout the new 2021–2024 period on the occasion of the implementation of the 4th Strategic Innovation Plan.

Through the different sources of information and agreements reached with national (CDTI or AEI, MICIN, MAPA, INE, etc.) or regional (regional innovation agencies) public financial entities, the PTV offers information on the projects facilitated by the winemaking industry in its annual Projects Special.

Thanks to the collaboration agreements signed by the PTV with four regional innovation agencies (AC-

1 ASCRI Report (2018). Report on the Venture Capital & Private Equity activity in Spain.

2 2018 GDP €1.202193tn. Total RDI expenditure in 2018 €565m. Agri-food sector is 3.8% of GDP (2020 Caixabank Agri-food Sector Report), 2020 GDP €1.119976tn, that is, €42.559bn.

3 Sources: FEV and the 2020 Report on the "Economic and Social Importance of the Winemaking Industry in Spain" (AFI-OIVE).

CIÓ, IVACE, ICE and ADER), it was possible to learn that the projects funded for the winemaking industry at the regional level during the 3rd Strategic Plan (2017–2020) of the PTV were mainly co-financed by ERDF funds (77%) and with an average budget of less than €100,000/project, for a total annual grant of almost €1,100,000 raised.

Furthermore, among the projects funded by the State Research Agency (AEI) in calls for business collaboration for the winemaking industry (Collaboration Challenges and Research Challenges) for the same period (2017–2020), we can see that 37 projects were funded with an average annual investment of €2.3m, of 41% had the support of the PTV.

With regard to business activity in R&D&I, the Centre for the Development of Industrial Technology (CDTI) acts as a barometer for this measure for a given sector and is commonly used by the Wine Technology Platform to evaluate the annual R&D&I expenditure in our industry. For the 2017–2020 period, the wine industry mobilised a total of €59.7m or 1.35% of the total R&D&I expenditure funded by the CDTI, with an average annual budget for the entire winemaking industry of €14,932,803, with the average annual joint support for this industry reaching €11,119,587. During this period, there were 118 projects presented by the wine industry to the CDTI (with 2020 as the year with the lowest number, with only 18 applications, in view of the sharp drop in R&D&I activity due to the COVID-19 crisis), with an average budget of €497,596 per project and an average of €370,392 in aid (CDTI data), below the average budgets for R&D&I projects in the agri-food sector (-19%) and in the rest of the sectors (-27%). As a result, it is estimated that the CDTI has funded approximately 10% of the R&D&I activity of the Spanish winemaking industry between 2017 and 2020, maintaining its hegemony in this regard compared with other ministerial departments and regional development agencies. However, there has been no increase in the industry's activity involving the CDTI compared with the immediately preceding period, so it is necessary to deepen the relationship with this Centre and encourage Spanish wineries to participate in individual and/or joint activities that can be funded by it.

Consistent with these figures, for the same period (2017–2020), the PTV supported 77 R&D&I projects, representing a total budget of €73.8m, with €56.2m of funding obtained. Therefore, an average of 19 projects were enabled per year, receiving more than €729,000 in annual funding on average. Nevertheless, these figures include the PTV's national and international activities. So, at the national level, the average budget per project for 56 initiatives was €460,000 while at the international level, this amounted to more than €2.2m per project for 21 projects. In summary, among the total number of projects facilitated by the PTV between 2017 and 2020, 73% were national, accounting for 35% of the budget, while 27% were international, accounting for 65% of the budget. This reveals the important "pull" effect of R&D activity within the framework of Horizon 2020 through the Multiannual Financial Framework 2014–2020, which should continue under the new Horizon Europe.

This data shows that in general, the PTV facilitates around 10% of the portfolio of innovation (R&D&I) projects launched by the Spanish winemaking industry per year. This support by the PTV varies depending on the public financial instrument, type of call and funding entity. For example, for the call by the Ministry of Science and Innovation-Collaboration Challenges (after reviewing those for 2017 and 2019), the PTV supported 66% of the approved projects (27% of the total approved budget), while for regional programmes, the PTV supported 15 projects (less than €2m of funding obtained) for all the regional calls, and only partial data is available from 4 agencies.

Finally, it is also important to point out that despite the decline in R&D expenditure, over the past decade, Spain has managed to maintain stable growth in scientific production, climbing from third to first place in the world ranking for scientific research on wine in 2020. With a total of 5,574 registered research publications, it is ahead of countries such as the United States, Italy, France and China. This leading position in terms of research offers the Spanish wine industry a great competitive advantage over new countries seeking to gain a foothold in the wine market and is, without a doubt, one of the biggest strengths that the wine industry can capitalise on.

CONCLUSIONS

In a context severely affected by the COVID-19 pandemic since the beginning of 2020, the analysis of the overall performance of the two strategic innovation plans that the PTV managed between 2011 and 2020, summarised in Section III of this Strategic Agenda, could provide enough information to assess the state of the Spanish wine industry in terms of its innovative efforts, as well as to point out present and future trends. In this regard, the main conclusions drawn from this analysis show that:

1 **The wine industry is a benchmark in the field of innovation within the food and beverage sector, as shown by its high percentage of R&D&I expenditure (5%) in the sector.**

2 **Faced with the downward trend in overall innovative activity in Spain during the series of crises experienced, the wine industry increased its commitment to innovation in the form of a rise in R&D&I expenditure from 2011 to 2016. Although it decreased slightly for the 2017–2020 period – mainly due to the current COVID-19 pandemic – its relative weight with respect to the agri-food sector grew.**

3 **The PTV has managed approximately more than 10% of the annual R&D&I expenditure of the Spanish wine industry, and based on its experience, it can suggest the following trends, and therefore, confirm that the wine industry supports:**

- ✓ R&D instead of IT
- ✓ Innovation projects involving inter-company cooperation as opposed to individual ones, and is capable of leading public-private consortia.
- ✓ Cooperation with research centres, promoting technology and knowledge transfer, encouraging the technification of processes in the vineyard and in the winery.
- ✓ Increasing R&D&I expenditure at a faster pace than other agri-food sectors.
- ✓ Increasing the size of its budgets and the duration of R&D projects (3 years on average)
- ✓ Increasing the level of internationalisation of its innovation activities, expanding the search for collaboration with foreign entities, and promoting its presence in the new Horizon Europe 2021–2027 as well as in demonstration programmes of the Multiannual Financial Framework 2021–2027, in order to maximise the chances of getting European funding.
- ✓ Seeking regional aid when R&D&I budgets are below €150,000–170,000 and national aid when they exceed this range.

- ✓ Strengthening its R&D&I activity within the framework of the financial instruments of the CDTI as the main financial organisation at the national level, as well as its IT activity with the new financial instruments of the MAPA through the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI).
- ✓ Seeking aid for technology investment through the MAPA and the Support Programme for the Spanish Wine Industry (PASVE).
- ✓ Encouraging the hiring of talent by companies in the science and technology field.
- ✓ Cooperation in the value chain.
- ✓ Cooperation in the field of innovation among wineries and the auxiliary industry.
- ✓ Hiring scientists in the academic and research fields as the main tool for the development of the industry and the search for public-private collaboration to take advantage of these resources, which are well-recognised internationally.
- ✓ Strengthening scientific and technical teams at the heart of companies.
- ✓ Creating technology-based companies in cross-curricular science and technological disciplines, promoting entrepreneurship activities with public support and encouragement.

> *"The wine industry continues to be one of the most active industries in the field of innovation within the national agri-food and beverage sectors"*

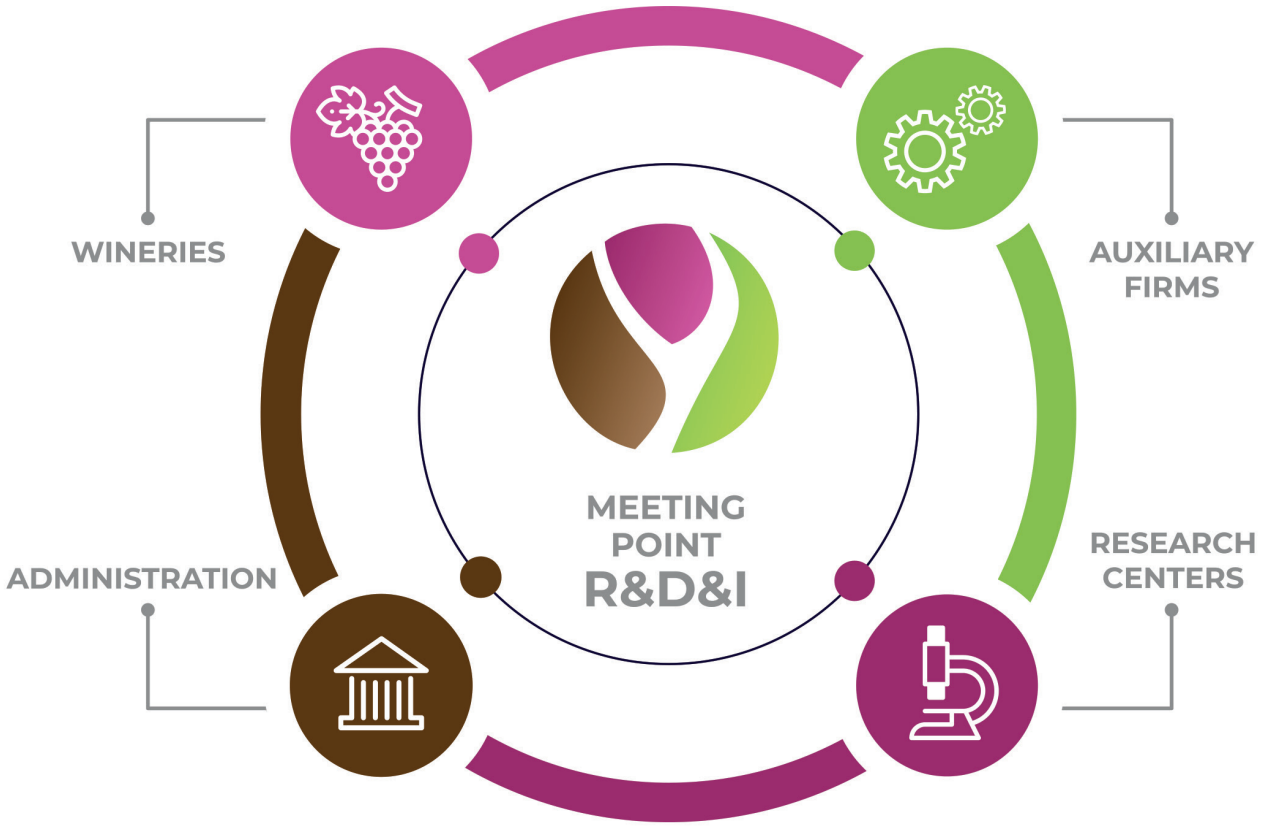
In conclusion, R&D&I expenditure in the industry was at its peak between 2017 and 2019 (around €130–150m per annum). But in 2020, innovative activity fell sharply and the magnitude of its effects is not yet known at the time of writing. R&D&I expenditure in the industry is not expected to exceed €120m (-20%) for 2020, a year marked by COVID-19. It therefore seems that compared with the figures for innovative activity for the 2013–2016 period, the industry has stagnated in terms of its growth in R&D&I investment and has not been able to grow beyond €150m per annum. Without a doubt, this is a reality that should force the industry to make every effort during the next three-year period (2021–2024), with its innovative strategy aligned with the policy levers of the Spanish Recovery, Transformation and Resilience Plan for 2021–2026. Nevertheless, it can be confirmed that wine industry continues to be one of the most active industries in the field of innovation within the national agri-food and beverage sectors.

3 ASSESSMENT OF THE 2011 - 2020 PERIOD

3 ASSESSMENT OF THE 2011 - 2020 PERIOD

THE PTV'S HISTORY

The Spanish wine industry came together in 2011 to create a network of public-private collaboration for the very first time in order to reach a consensus and define its R&D&I strategy as the path to the future. This network was set up with support from the Ministry of the Economy and Competitiveness under the name Wine Technology Platform (PTV), bringing together the winegrowing and winemaking industry (represented by wineries, associations, control boards, etc.), the auxiliary industry (represented by technology companies and auxiliary services) and the science sector (represented by universities and technology centres). Since 2013, the PTV acquired its current legal status as a nonprofit, nationwide association.



The creation of this Platform was in response to a highly dispersed and often poorly structured industry in terms of innovation, which has not always been able to promote an adequate technology and knowledge transfer.

Thus, the aim of the PTV is to serve as a lever between the public and private sectors, liaising between the Spanish and European public authorities to channel the interests of our winemaking industry and thus secure more human, economic and financial resources. What's more, the PTV acts as a catalyst for strategic projects that represent a significant technology leap and a competitive improvement that benefits the industry as a whole.

During its ten years of existence, the PTV has proven to be a key element in structuring the innovation of the Spanish wine industry after achieving important milestones. Examples of these are the two Strategic Innovation Agendas (2012–2016 and 2017–2020) that preceded this document, serving as a benchmark for R&D&I in the wine industry as they provided an in-depth look into the reality of this industry and its most pressing science and technology needs.

Another relevant milestone for the PTV, aside from its establishment as an Association in 2013, was its commitment to promote and improve its international presence, making every effort to bring this collaboration model to the European level.

Thus, in 2016, the PTV joined a European consortium for the first time, taking part as a partner of the Life Priorat+Monsant Project headed by the Wine Technology Centre (VITEC).

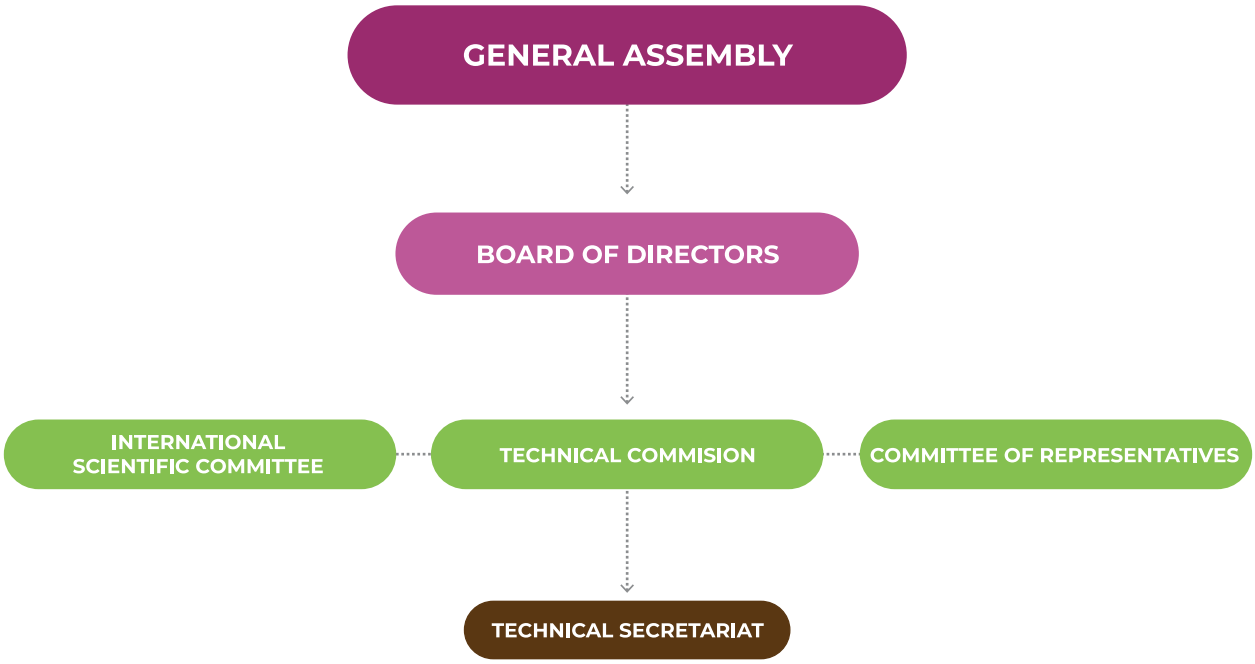
In 2018, the PTV launched a Strategic Internationalisation Plan based on three fundamental pillars: productivity, visibility and cooperation. As a result of its tireless efforts throughout the years, the PTV has managed to significantly increase the facilitation of international cooperation projects among its members, heading initiatives such as COPPEREPLACE.

What's more, in order to contribute towards boosting the international prestige of our winemaking industry, the Association has strengthened ties with strategic international entities such as ADVID, IFV o SIVE. In this regard, one of the PTV's major milestones is the start of an agreement to head a European cooperation forum for winemaking innovation within the framework of the CEEV through its R&D&I working group (CEEV R&D Committee).

STRUCTURE

At present, the PTV is made up of more than 190 entities, including wineries, companies in the auxiliary wine industry, universities, research centres, oenologists, innovation and technology centres, and even other associations.

In terms of its structure, the PTV is organised around two main bodies: the General Assembly of Members and the Board of Directors, whose roles in the organisational chart are as follows:



The General Assembly is made up of all the PTV's members and its main function is to examine and approve the PTV's social and financial management, while the Board of Directors acts as a mechanism for the overall management and administration of the Association.

BOARD OF DIRECTORS

- Association of Wineries for Quality (ABC)
- Galician Food Quality Agency (AGACAL)
- Agrovín S.A.
- Bodegas González-Byass S.A
- Bodegas Martín Códax S.A
- Bodegas Ramón Bilbao S.A
- Bodegas y Viñedos Pradorey
- Spanish National Research Council (CSIC)
- Spanish Wine Federation (FEV)
- Wine Technology Park Foundation (VITEC)
- Rioja Group of Wine Companies (Grupo Rioja)
- Grupo Matarromera
- Miguel Torres S.A
- Pago de Carraovejas S.A
- Rovira i Virgili University (URV)

The Chairpersonship of the PTV is linked to the Spanish Wine Federation, with Mireia Torres Maczassek, manager of Familia Torres's Innovation and Knowledge Department and manager of Jean Leon, representing it.

What's more, the PTV's science and technology activities are supported by an International Scientific Committee (CST) comprised of thirteen renowned experts in the wine industry:

INTERNATIONAL SCIENTIFIC COMMITTEE (CST)

- **Álvaro González**, director, *Centro de Investigación e Innovación en Viña Concha y Toro.*
- **António Rocha Graça**, *R&D&I director, Sogrape Vinhos.*
- **Arina Oana Antoce**, professor, *University of Agronomic Sciences and Veterinary Medicine of Bucharest.*
- **Cristina Carlos**, viticulture technician, *Associação para o Desenvolvimento da Viticultura Duriense (ADVID).*
- **Christophe Riou**, deputy director, *Institut Français de la Vigne et du Vin (IFV).*
- **Hans R. Schultz**, professor, *Hochschule Geisenheim University.*
- **Hernán Ojeda**, researcher, *Institut national de recherche pour l'agriculture, l'alimentation et l'environnement (INRAE).*
- **Mark Krstic**, managing director, *The Australian Wine Research Institute.*
- **Nathalie Ollat**, researcher, *Institut national de recherche pour l'agriculture, l'alimentation et l'environnement (INRAE).*
- **Pedro Ballesteros**, Master of Wine.
- **Peter Hayes**, executive director, *Grape and Wine Research and Development Corporation (GWRDC).*
- **Pierre-Louis Teissedre**, professor, *Université de Bordeaux.*
- **Vittorino Novello**, professor, *Università di Torino.*

The main functions of the PTV International Scientific Committee are as follows:

- ✓ Review the priorities of the Strategic Innovation Agenda in order to update them.
- ✓ Disseminate the PTV's activities. Depending on the interests of their entity/country, disseminate, promote and provide information about the activities of the PTV during their own events or those of the wine industry in each country (congresses, fairs, technical conferences).
- ✓ Participate as jury in the PTV Innovation Awards.
- ✓ Identify strategic projects. Annual follow-up meetings.

The overall management and facilitation of the PTV itself are functions performed by the Technical Secretariat, always in coordination with and under the guidelines of the Board of Directors. At present, the Technical Secretariat of the PTV currently managed by Artica Ingeniería e Innovación S.L, which has its headquarters in Madrid.

SERVICES

Among its functions, the Technical Secretariat focuses most of its efforts on improving the services that the PTV offers its members so that they can carry out their innovative activities in an easier and more collaborative way, while optimising their resources as much as possible. These services are structured into three main blocks:

BOOSTING R&D&I

- Initial technological diagnosis.
- Partner search for R&D&I projects.
- Discounts on Fiscal Project Certification.
- Intellectual Property advisory.
- Technical workshops to encourage networking.

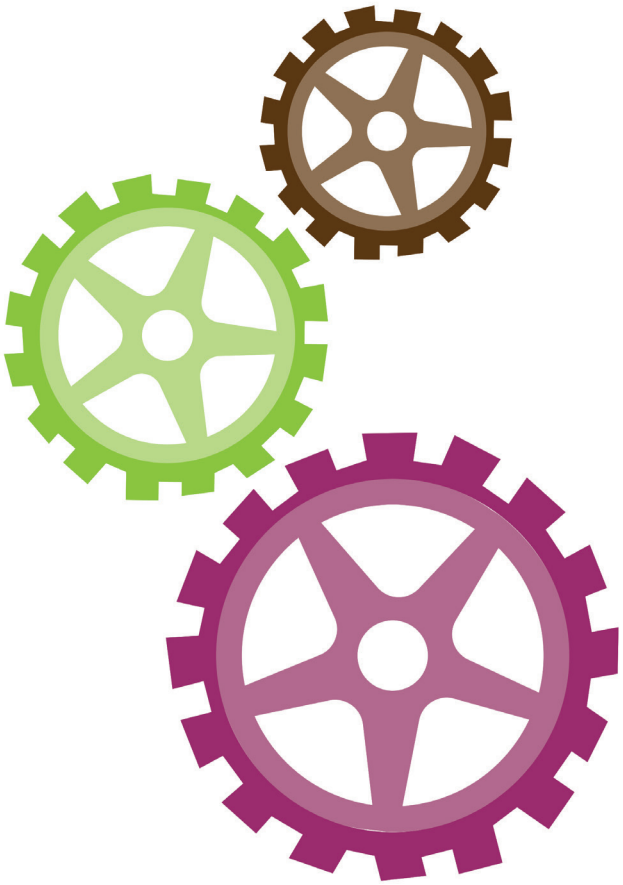
COMMUNICATION SERVICE

- Latest news about national and European funding programs, tax advantages, etc.
- Information about the latest technological innovations.
- Wine sector events dissemination.
- Communication support for R&D projects results.

DIALOGUE WITH THE PUBLIC ADMINISTRATION

- Support Letters for R&D&I projects.
- Intermediary communication channel between the Public Administration and the Spanish wine sector, in terms of R&D&I.

R&D&I PROJECTS PROMOTED



Since it was founded in 2011, the PTV has proven to be a key element in structuring the innovation of the Spanish wine industry after achieving important milestones, such as its establishment as an Association in 2013, its participation as a partner in its first international project in 2016 and the implementation of its three Strategic Innovation Plans.

One of the main indicators of the PTV's activity and the implementation of the Strategic Innovation Agenda itself is the achievement of its goals that take the shape of R&D&I projects promoted as a result of it. In this regard, the PTV creates its Strategic Innovation Plans every three years, constituting an estimate of the evolution of the PTV itself in terms of its visibility and the impact of its results.

With this, for the 2011–2020 period, the PTV has implemented a total of three Strategic Innovation Plans (SIP), mobilising 300 R&D&I projects – which is a testament to the Spanish wine industry's firm commitment to innovation.

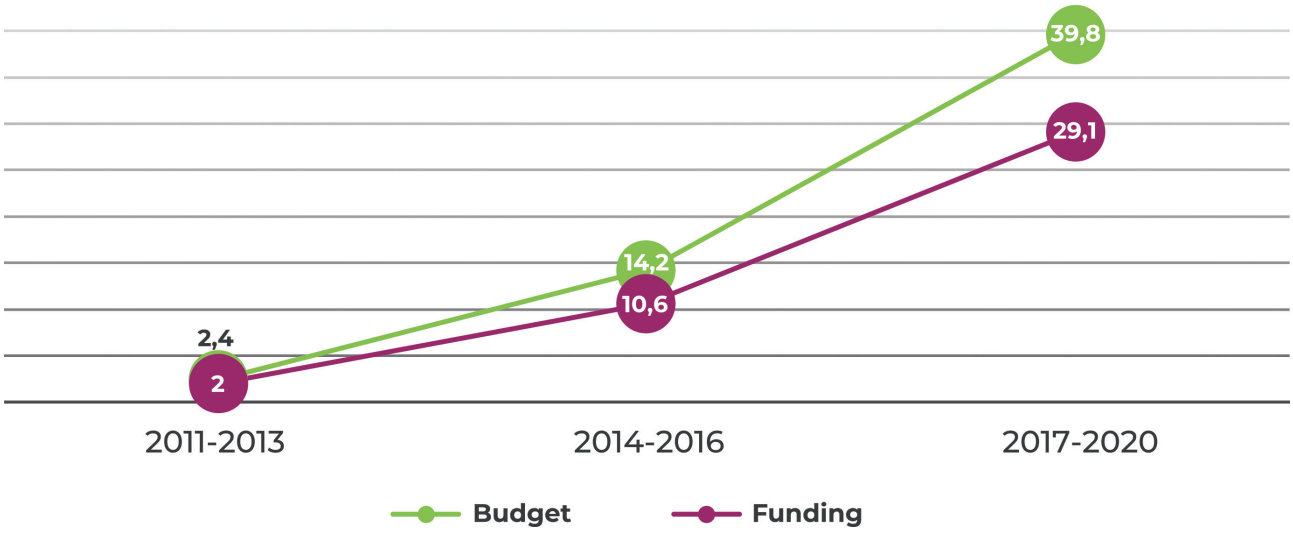
Of the total number of projects facilitated, the PTV has accounted for 159 R&D&I initiatives that were approved for funding during the 2011–2020 period, within the framework of several Spanish and European R&D&I public aid programmes. This data leads us to observe that, despite the high level of competition in certain public calls for applications, the PTV members successfully obtained funding for 53% of the initiatives undertaken.

Between 2011 and 2020, the PTV members have mobilised more than €157m through these 159 R&D&I projects and have obtained public funding amounting to €117.7m for their implementation.

INDICATOR	1st SIP (2011–2013)	2nd SIP (2014–2016)	3rd SIP (2017–2020)	TOTAL 2011-2020
NO. OF APPROVED PROJECTS	22	60	77	**159**
R&D&I INVESTMENT	€18.3m	€65.6m	€73.6m	**€157.5m**
FUNDING OBTAINED	€13m	€48.7m	€56m	**€117.7m**
% EUROPEAN FUNDS	15%	22%	52%	**35%**
NO. OF COMPANIES INVOLVED	36	101	110	**247**
NO. OF PROS INVOLVED	34	107	78	**219**

In a more detailed analysis of the nature of the projects approved throughout the history of the PTV, it is worth pointing out that there were 131 projects implemented at the national level, while 28 projects were carried out in collaboration with international winemaking entities. Nevertheless, although the difference between Spanish and European projects is quite significant, the exponential growth of the latter over the years is remarkable. This is made even clearer if we look at the evolution of the volume of European funds obtained for the projects promoted by the PTV, which increased from €2m during the 2011–2013 period to €29.1m granted during 2017–2020:

BUDGET AND FUNDING OF EUROPEAN PROJECTS
(MILLIONS OF €)



The 159 R&D&I initiatives approved during 2011 and 2020 involved 247 wineries and companies in the winemaking industry which have worked hand in hand with 209 research organisations, including universities and technology centres. Furthermore, another 29 sectoral entities such as wine organisations and associations, as well as control boards, directly participated in these projects. In short, the active involvement of all stakeholders in the wine industry clearly shows their unity to face the common challenges in the industry.

COMMUNICATING INNOVATION

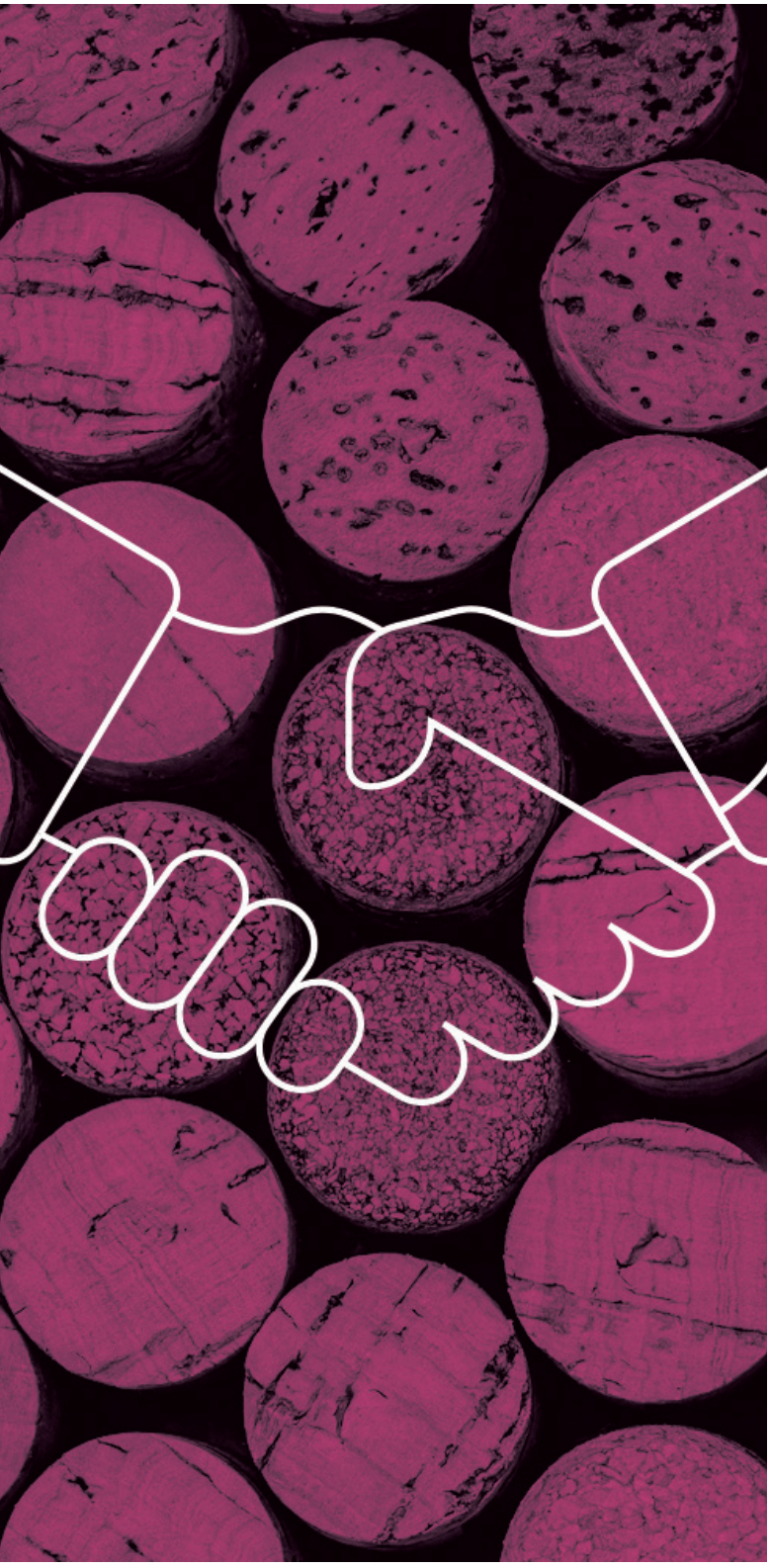
Among the key tasks of the PTV – in addition to facilitating the projects themselves – are disseminating and transferring the results of these R&D&I projects to the industry. In this regard, the PTV not only offers its members a service for the dissemination of R&D&I for their projects, but has also increased its direct participation over the past few years, either as a partner or as a subcontracted entity in R&D&I projects.

Thanks to its position in the innovation ecosystem of the wine industry, the PTV is the best ally for the definition of specific communication strategies for R&D&I projects. With this, we create differentiated communication strategies that not only highlight the outcomes of the initiatives but also contribute to greater visibility and recognition of the innovative activity of our partners.

Some success stories in which the PTV participated as a partner are the international

LIFE PRIORAT+MONTSANT projects and, more recently, the COPPEREPLACE and NOVATERRA projects, as well as national or regional initiatives headed by the association itself such as GOVALMAVIN or SISVITIMAD.

Furthermore, the PTV has put its knowledge and experience as a collaborating entity in R&D&I projects such as WINETWORK, GOPHYTOVID, SMART SUSTAINABLE WINE or REDVITIS 2.0 at the disposal of its members.



STRATEGIC ALLIANCES

With the aim of organising R&D&I in the winemaking industry from a common perspective, the PTV works hand in hand with the main institutions driving innovation in the wine industry.

Thanks to their combined efforts and their ongoing support for our Association, we will continue to work together to meet the challenges we face with this Agenda, as well as to better disseminate and communicate the scientific and technical breakthroughs in this industry.

Our collaboration with the Wine Technology Platform, (...) translates into an ongoing dialogue to promote an innovation strategy that truly reaches companies and results in greater competitiveness in the different areas of their activity.

The Spanish winemaking industry, just like society as a whole, is going through a period of great complexity and uncertainty. In this context, tools such as innovation go from being very relevant to being absolutely essential in the search for solutions that will allow our companies to emerge stronger and in a better position to face the future. The pandemic has reinforced the urgency and the need for innovation in our country and has also revealed our shortcomings in comparison with our neighbours.

It is precisely with this in mind that, year after year, we renew our collaboration with the Wine Technology Platform, which translates into an ongoing dialogue to promote an innovation strategy that truly reaches companies and results in greater competitiveness in the different areas of their activity.

Throughout these months, the collaboration between the FEV and the PTV has been made manifest through several meetings of the Joint Committee created between both organisation, resulting in actions such as the development of a procedure to promote R&D&I at the European level through the CEEV (European Committee of Wine Companies). In this task, the PTV will play a key role as the activity coordinator and project facilitator. Likewise, the transfer of the results of R&D&I projects to the wineries associated with the FEV has been promoted through its Technical Commission and other internal communication channels.

As a result of this collaboration, it is also a great honour to be part of a document as necessary these days as the 2021–2024 Strategic Innovation Agenda, and as the FEV, to help ensure that these pages reach as many wineries as possible and to continue to be – as in previous editions – a catalyst for our industry to continue serving as a benchmark for innovation in the Spanish agri-food sector as a whole. We are also confident that the lines identified in this Agenda will lay the foundations for the prioritisation of innovation strategies beyond our borders and give rise to collaborative projects at the European level that will represent a wonderful opportunity for companies and research groups in our country.

Mr. José Luis Benítez
General Director of the Spanish
Wine Federation (FEV)

(The PTV) brings together research efforts in grape and wine production, the improvement of process and product quality, and also economic aspects such as marketing or wine tourism.

The Spanish wine industry has shown – despite how difficult 2020 has proven to be – a great capacity for resilience and strength, thanks to the capacity of its companies and professionals, its innovative efforts, its great market diversification and level of internationalisation, a solid financial position and the regard of consumers, even growing in times of difficulties and amidst a pandemic. Our industry maintains a solid position, and despite the tough times for the economy as a whole, it has a great future ahead of it, with a great capacity for progress, both in terms of consumption in Spain and in the improvement of its value, image and distribution on a global scale, and a better balance and appreciation for its production.

There are many essential factors that can contribute to the success of the Spanish wine industry on this exciting road ahead, and it is enough to look back to the last ten years to see that this is not unfounded optimism. The sectoral organisation, structured for some years now around the OIVE, the importance of wine in the Mediterranean diet with the support of the health sector, the analysis and monitoring of economic, market and consumer information that we carry out at the OIVE, institutional support and support from the European, Spanish and regional authorities, the work done with regard to the quality of geographical indications, and of course, the scientific progress along the entire production chain. All this and many more contributions help professionals and companies that are the main protagonists and drivers behind the industry's progress, together with the brands.

It is in the area of R&D&I where the PTV plays a crucial role. Its founding was a great idea, as the natural outcome of the collaboration that was already taking place in some specific research projects. It brings together research efforts in grape and wine production, the improvement of process and product quality, and also economic aspects such as marketing or wine tourism. It plays and will play an increasingly relevant role in the close ties that the wine industry has with sustainability and the fight against climate change. It is, without a doubt, an essential tool of the industry.

As such, the OeMv is pleased to maintain a partnership agreement with the PTV since early 2014. An agreement that we will continue to develop in order to do more and more things together, particularly in the areas of market research, better consumer knowledge, economic analysis of the industry, marketing and wine tourism.

Congratulations to all the workers and members of the PTV's management and working groups for everything they've done up to this point and more power to the future strategic agenda, which we at the Observatory will give all possible support to.

Mr. Rafael del Rey
General Director of the Spanish
Wine Market Observatory (OeMv)

We at AgroBank (...) consider it particularly important to renew the collaboration agreement that we signed a year ago with the Wine Technology Platform in order to support the winemaking industry and promote innovation.

2020 will go down in history as an extremely tough year due to the COVID-19 pandemic. The situation experienced in recent months has highlighted the importance of the agri-food sector – a sector that plays an essential role in supplying food to the population. All stakeholders involved in the food chain, such as farmers, livestock farmers, winemakers or fishermen, as well as those working in the industry such as wholesalers, retailers, distribution and logistics, had to quickly adapt in order to ensure the supply of food to the population.

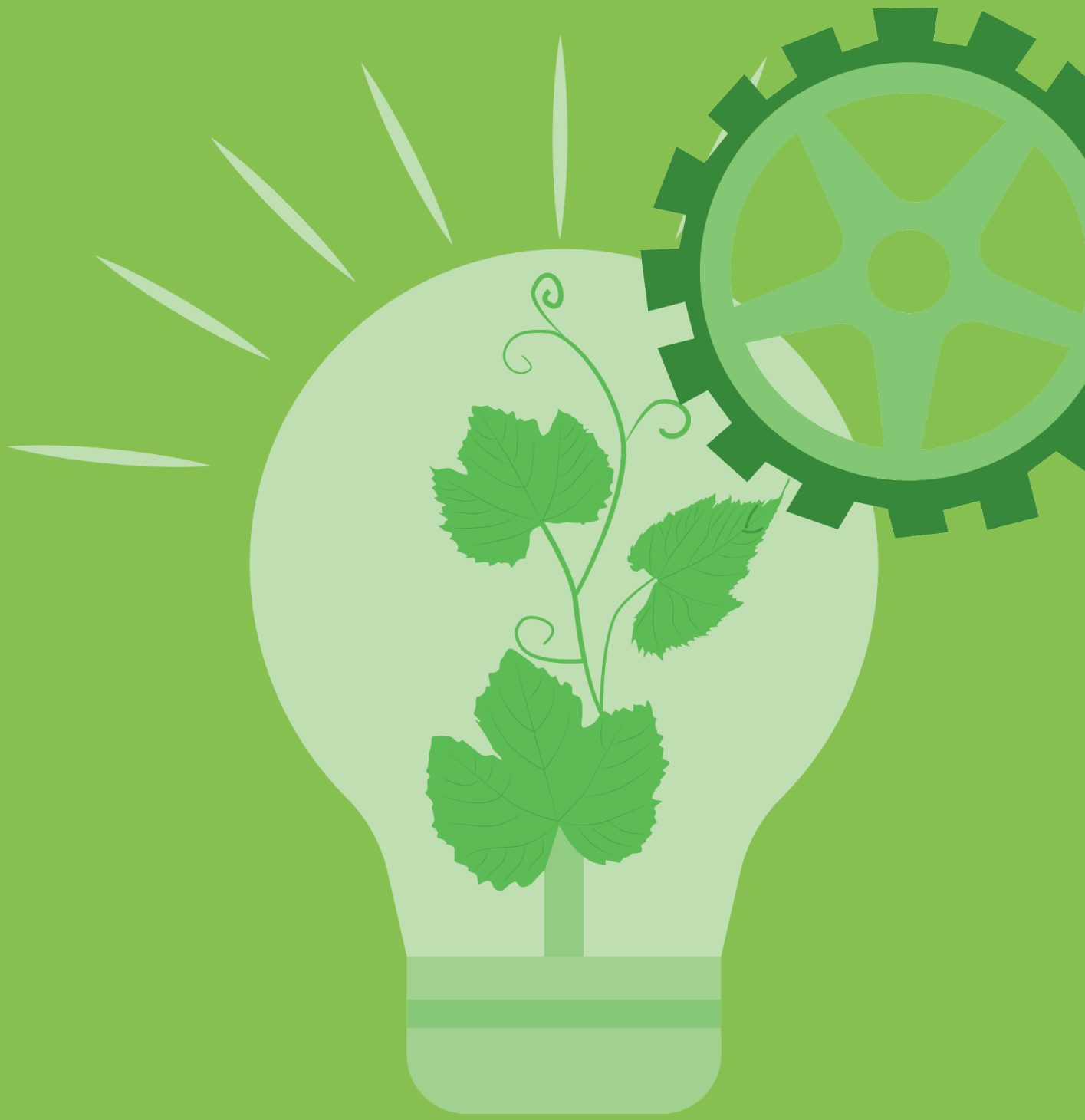
We at AgroBank – CaixaBank's line of business that specialises in the agricultural sector – consider it particularly important to renew the collaboration agreement that we signed a year ago with the Wine Technology Platform in order to support the winemaking industry and promote innovation. As a financial institution, our aim is to support the specific needs that the winemaking industry may have, especially given the circumstances we are currently experiencing.

We also want to work together to promote innovation as a driver of economic activity in the winemaking industry. The COVID-19 pandemic has shown the importance of innovation and digitalisation in the industry, as it is a fact that the future will bring us Food Chain 4.0, an ecosystem completely connected from farm to table.

In this regard, for AgroBank, it is a great honour to collaborate with the annual PTV Innovation Awards, which aims to give visibility and value to the innovative activity of the members of the Wine Technology Platform, by recognising their R&D&I projects, whether as a consortium or individual, carried out at both the national and international levels.

Finally, I would like to thank all the professionals comprising the PTV and express my wish for both entities to continue working together while supporting the wine industry.

Mr. Carlos Seara
Director of AgroBank



4 2021–2024 SPANISH R&D&I STRATEGY

4 2021–2024 SPANISH R&D&I STRATEGY

STARTING POINT AND METHODOLOGY

In response to the current needs of the wine industry – which has been severely affected by the COVID-19 health and economic crisis – and with a view to the future and its recovery, the PTV's Technical Commission has worked together with the Technical Secretariat during the process of renewing and updating the 2021–2024 Strategic Innovation Agenda. This process has called for the performance of a technology audit, resulting in an analysis and reflection to diagnose the new scientific and technological reality of the Spanish winemaking industry.

As a first step, during the first half of 2020, a technology audit was launched, involving the members of PTV in two consultations to learn the priorities and needs of the Spanish wine industry.

After analysing the data collected, the Technical Commission kicked off a series of meetings to identify, select, reflect on and prioritise the strategic goals for the industry for 2021–2024, constituting the science and technology diagnosis which is the backbone of this new 2021–2024 Strategic Innovation Agenda. Aside from this joint effort, the coordinators of each of the six areas comprising the Technical Commission met separately to delve into each of these science and technology fields and disciplines comprising the entire wine value chain, from the wine to the consumer.

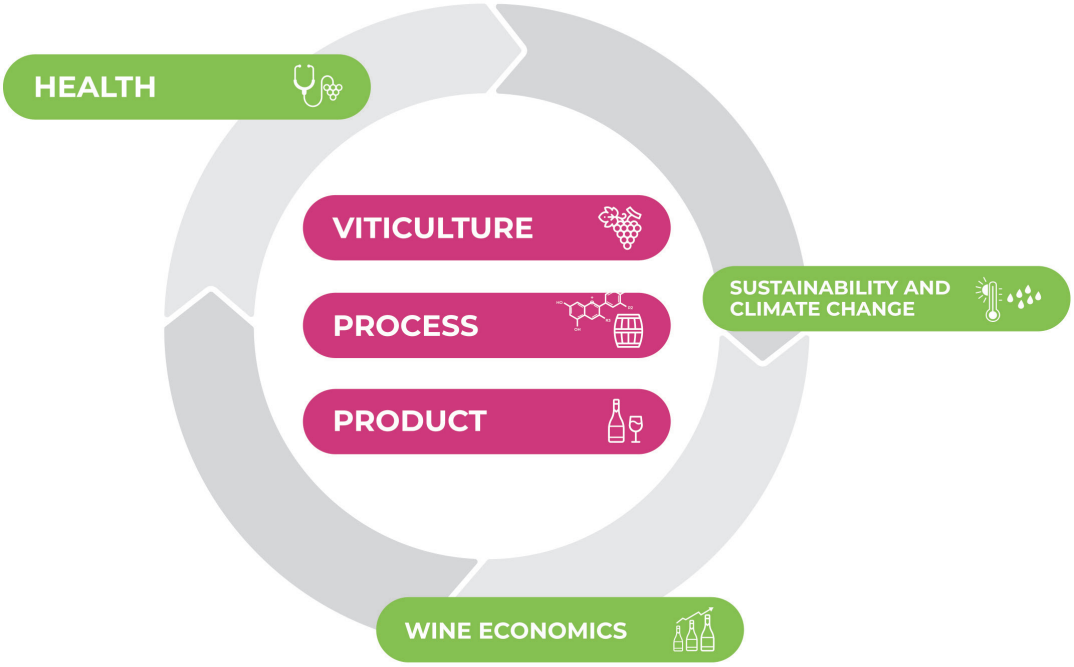
Once this reflection and drafting exercise was completed, the content of the SIA was presented and approved by the PTV Board of Directors. It will have to be ratified by the General Assembly of Members, which will be held in May 2021.

It should be noted that this document will be reviewed by the PTV's International Scientific Committee to obtain harmonised versions of the approved text in different languages (mainly Spanish and English), as well as to verify the alignment of its content with the science and technology landscape worldwide, especially in the industry's leading countries.

THE PTV'S TECHNICAL COMMISSION

Comprised of a group of experts in the business and scientific fields of the Spanish winemaking industry, the PTV's Technical Commission is the Association's most active hub for reflection and debate.

This body is structured into six areas of interest that make up its entire value chain. These include all the disciplines of science and technology linked to the world of winemaking.



Each of the six areas of interest operates under two coordinators – business and scientific (except in the area of Sustainability and Climate Change, which has 3 coordinators) – so the Technical Commission is currently made up of 13 coordinators including the Chairperson and Vice-chairperson, who perform representative functions, as well as liaising directly with the Board of Directors.

At the organisational level, the coordinators annually convene the so-called R&D&I Groups to different meetings in each area of interest, which are open to all members and whose purpose is to identify and launch strategic projects. In addition, the Technical Commission meets once or twice a year to coordinate and seek synergies among the different areas, as well as to review the status of the R&D&I projects identified by the R&D&I Groups.

DUTIES AND RESPONSIBILITIES

- ✓ Review the Strategic Innovation Agenda to update it.
- ✓ Define the priorities for temporary promotional activities.
- ✓ Review Spanish and European work programmes and submit suggestions to the public authorities.
- ✓ Represent the interests related to their area of interest at the PTV's own conferences and other external events.
- ✓ Identify and facilitate strategic R&D&I projects.
- ✓ Review the status of open R&D&I initiatives on the Association's intranet.

TECHNICAL COMMISSION OF THE WINE TECHNOLOGY PLATFORM

AREA OF VITICULTURE

Salvador Guimerá
Production director,
Bodegas González Byass

Jesús Yuste
Viticulture researcher,
Agricultural Technological Institute
of Castile-León (ITACYL)

AREA OF PROCESS

Sergi de Lamo
General Director of the Wine
Technology Centre (VITEC)

Pablo Ossorio
Director, Oenoconsulting

AREA OF PRODUCT

Juan Park
Director, Wine Intelligence
in Spain and South America

Antonio Palacios
Manager, Laboratorios Excell Ibérica

AREA OF SUSTAINABILITY AND C. CHANGE

Mireia Torres
Director of innovation
and knowledge, Familia Torres

José Ramón Lissarrague
Viticulture professor and consultant,
Polytechnic University of Madrid and
Gestión Integral de Viticultura

Robert Savé
IRTA emeritus researcher – Winemaking
and climate change expert

AREA OF HEALTH

Ángela García
R&D&I and quality technician,
Bodega Matarromera

Mª Victoria Moreno-Arribas
CSIC scientific researcher affiliated
with the Institute of
Food Science Research (CIAL)

AREA OF WINE ECONOMICS

Juan Vázquez
General director,
Bodegas Martín Códax

Raúl Compés
Director, International Centre for
Advanced Mediterranean Agronomic
Studies (CIHEAM-Zaragoza)

R&D&I GOALS AND PRIORITIES FOR THE WINE INDUSTRY

The goals included in the Innovation Strategy for the 2021–2024 period are divided into six areas of science and technology: Viticulture, Process, Products, Sustainability and Climate Change, Health and Wine Economics.

Each of these areas of interest has an overall goal, some strategic lines and some specific objectives. Thus, the new Strategic Innovation Agenda is made up of 28 strategic lines, which represent the means to successfully overcome the major challenges in the industry though strategic cooperation and innovation, thanks to the development of the different specific objectives comprising them.

Among the strategic lines and specific objectives set out in each area, there are underlying ideas that define the general guidelines to be addressed by the PTV, as a result of the process of reflection and definition of this Strategic Innovation Agenda.

These general guidelines or key strategies are perfectly aligned with some of the 17 Sustainable Development Goals. Likewise, they have been developed along the same lines as other initiatives in the wine-making industry and innovation priorities, such as the R&D strategy of the European Committee of Wine Companies (CEEV) or the Strategic Plans of the Spanish Wine Federation (FEV), which include key challenges in the industry that are also addressed in these general guidelines.

SUSTAINABLE DEVELOPMENT GOALS

RELATED TO OUR ACTIVITY

This is why eight major key strategies were established, which include the scientific and technical goals of each area of interest and constitute a future roadmap for the competitiveness of the wine industry. These key strategies are committed to the resilience, stability and growth of the industry and are focused on improving the competitiveness of the winemaking industry, with innovation as the foundation.

With the development of these general guidelines, the industry will try to adapt to the changing environment, using innovation as the main differentiating tool, given that it has a consolidated scientific and business network at the technological level, while promoting its growth both nationally (improving domestic consumption) and internationally, in an increasingly globalised and accessible world.

KEY STRATEGIES

SUSTAINABILITY	Encourage and promote environmentally sustainable winemaking methods and systems, ensuring the socioeconomic viability of the industry and preserving the cultural heritage.
CLIMATE CHANGE	Contribute to the adaptation and mitigation of climate change in winemaking.
BIODIVERSITY AND GENETIC RESOURCES	Promote knowledge of existing biodiversity, characterising and promoting its functionality and integration into productive winemaking ecosystems.
PLANT PROTECTION, PESTS AND DISEASES	Minimise the impact of pests and diseases on the grapevines while prioritising vineyard sustainability.
CIRCULAR ECONOMY	Promote the circular economy in wineries for efficient management and increase the value of the by-products and derivatives of wine production.
HEALTH AND FOOD SAFETY	Promote scientific and technical studies and validate the beneficial effects of wine and/or its components, within a framework of responsible and moderate consumption, as food that is safe and is an integral part of a healthy and wholesome diet, promoting effective communication.
DIGITALISATION AND BIG DATA	Implement and assess the use of new emerging technologies such as big data, digitalisation, ICTs, IoT, HPC, genomics, etc. with the aim of moving towards a connected Industry 4.0 in the winemaking industry.
CONSUMER	Offer consumers products that meet their needs and expectations.

AREA OF VITICULTURE

Spain continues to be the world leader in terms of vineyard surface area, maintaining a great diversity of zones, soils and varieties, which allows for a wide range of differentiated products on the market.

This is combined with the tradition and know-how of our winemakers and the emerging innovations in the vineyard and in the winery.

The reality of the market requires the industry to join the path to innovation in order to adapt to the current and future situation of new competitors, new market demands, climate change, grapevine diseases, etc. This entails the development of new methods and new technologies by professionals with specific training in each field.

A major challenge that the industry must overcome is the poor economic performance in grape production, which greatly limits its progress. The small size of our plantations and the age of our winegrowers, combined in many cases with the lack of generational renewal, put at risk not only the progress of Spanish vineyards, but also the development itself of the rural , the landscape and the historical and cultural heritage of winegrowing. Likewise, there is also the risk of old varieties disappearing, which must be counteracted with strategies for the recovery and appreciation of the plant material of these varieties, while trying to embrace the adaptation of new vineyards and thus expanding the current range of wines on offer.

Climate change, and in particular, water scarcity, are realities that cannot be ignored, as they can jeopardise the balance of today's vineyards and cause their displacement from traditional zones to other zones at higher latitudes, higher altitudes, lower temperatures, etc. This matter, as well as pests and grapevine diseases, constitute challenges that the industry must jointly face in order to move forward.

An interesting path is opening up with new technologies (precision viticulture, *Big Data*, predictive models, drones) that the industry must face and embrace so as not to be left behind, taking advantage of what this means for quality improvement, cost reduction, sustainability, etc. and the advantages this entails to increase the challenge of competitiveness.

SWOT ANALYSIS: VITICULTURE

STRENGTHS

- Largest land area dedicated to vineyards in the world.
- Enormous potential associated with the diversity of zones, climates, soils, varieties, microbiomes, flora and fauna.
- Existence of climate variability that allows for a high level of sustainable viticulture.
- Spanish vineyards are a global powerhouse in organic farming.
- Great viticultural tradition, culture and experience.
- Availability of insurance against certain weather-related risks.
- Existence of innovation networks and sources for generating scientific and experimental results (PTV, GTEVE, SECH, RedVitis, etc.)
- Consideration of vineyards as a strategic crop by the public authorities.

WEAKNESSES

- Wine production normally exceeds domestic market demand. Lack of grape price stability. No value is placed on the impact of viticultural practices on grape quality and price.
- Lack of awareness of the concept of grape quality for wine differentiation and the relationship with the terroir.
- Lack of training of winegrowers in specific agronomic techniques.
- Lack of predictive and/or projective indicators of grape yield and quality.
- Problem of genetic and biodiversity conservation, as well as the differentiation of genetic material.
- Lack of knowledge on the use of climate change adaptation techniques to maintain the typicality of the different wines. Low capacity to adapt to situations with little available water.
- Uncoordinated management of varietal regulations: insufficient and poorly managed clonal selection, lack of varietal planning criteria, shortage of available rootstocks and difficulty in creating new plant material.
- Low development and high cost of specific technologies according to the type of crop and wine (e.g. organic, biodynamic, vegan agriculture, etc.).
- Excessive dependence on subsidies and external policies. Low investment (public and private) in R&D&I.

SWOT ANALYSIS: VITICULTURE

OPPORTUNITIES

- Promotion of local grape varieties.
- Inclusion of vineyards as a key element of the landscape and heritage.
- Modernisation of plantations (integration of available and developing technologies), enhancing and adding value to their ecosystem services.
- Use of genomics to increase biodiversity.
- Engaging qualified staff and increasing support in vineyard management by public and private scientific and technical services.
- Recovery of by-products from viticulture to promote the circular economy, as a differentiated value proposition. Efficient waste and biomass management.
- Creation of synergies and compatibilities between organic production (largest land area dedicated to vineyards in the world) and sustainable production.
- Possibility of expansion to specific growing zones as a consequence of the effects of climate change.

THREATS

- Surplus supply which, together with the high level of competition in the international market, accentuates the problem of the vineyard's economic profitability (a very globalised market).
- Risk of abandonment of vineyards, disappearance of small winegrowers due to the lack of competitiveness and continuous drop in grape prices.
- Risk of disappearance of old and minority commercial varieties.
- Increased demands in organic phytosanitary control and the need to deal with new or emerging pests in the context of climate change.
- Negative effect of the extent of climate change in most of the current winegrowing areas.
- Loss of efficiency due to low worker training and job insecurity (temporary employment, lack of generational renewal, etc.).
- More demanding production according to current initiatives and regulations (e.g. limitations on the use of pesticides and fertilisers as a result of the European Green Deal, the Water Framework Directive 2013, *EU 601/2012 rules about CO_2 emissions reduction, EU 828/2013 on pesticide use*).

OVERALL GOAL

"Drive the profitability of vineyards, promoting their quality, differentiation and typicality".

STRATEGIC LINES

1. Minimise the impact of pests and diseases on the grapevines.

- Deepen knowledge on and improve the **prevention of grapevine trunk diseases**.
- Improve **propagation techniques and management of plant material** to improve hygiene **in nursery and planting**.
- Study pathogens and pests at the organism and species level and their interaction with the environment (including **emerging pests and diseases**).
- Promote **early detection and control methods for pests and diseases**, favouring the use of sustainable methods (e.g. biological control).
- **Genetic improvement of varieties** and rootstocks, considering the use of wild grapevine material.
- Development of crop techniques that enhance **the plant's defence** mechanisms.

2. Develop, demonstrate and apply indicators to monitor and manage cultivation.

- Deepen the **physiological analysis and the evolution of** the composition of **grape berry ripening** in the main grape varieties.
- Development of new tools for **yield estimation and control**.
- Promotion of **new technologies** to develop more precise viticulture, as well as indicators (climate variables, soil properties (CE), leaf area indices, NDVI, water potential, etc.) and **new tools** (weather

stations, remote sensing, drones and unmanned aerial vehicles, global navigation satellite systems, geographical information system (GIS), robotics systems, etc.).

- Development of methods to optimise the **efficient use of resources** in the vineyard (vineyard water management, minimisation of plant protection products, etc.).

3. Optimise the winegrowing potential of the plot and vineyard performance using different crop techniques.

- **Map vineyard soils** and add them to common databases for public access.
- Improve knowledge on **plant-soil interactions** and their influence on wine quality.
- Study the impact of **crop techniques** (irrigation, fertilisation, amendments, etc.) on the vineyard's response.
- Analyse the **physiological** and **genetic bases** of the production and qualitative effects of different crop techniques.
- Progressive adaptation and implementation of techniques to **new crop strategies**.

4. Conserve and enhance the plant material in the vineyard. Improve the selection methods to enable grapevine cultivation to adjust to different circumstances or goals.

- Selection of native or traditional plant material (cultivated and wild) in an attempt **to prevent the loss of genetic heritage** of old vineyards (at high risk of being uprooted). Coordination and rationalisation of material prospecting and harmonisation of procedures across all regions.
- **Genetic, phenotypic and oenological characterisation** of grapevine material for the creation of an extensive database, with traceability and analysis of existing clonal variability. Standardisation of collections of varieties, clones and rootstocks.
- Develop **new selection programmes** or make them specialised (clonal, polyclonal, massal, etc.) according to production goals and specific parameters of oenological interest.
- Develop a standardised interregional network for varietal adaptation trials (different climatic conditions) and **collection maintenance**. Facilitate the transfer of material to nurseries, winegrowers and winegrowers' associations.
- Creations of **new disease-resistant grape varieties**.

AREA OF PROCESS

The great driving force behind winemaking technology is to achieve the overall goal of improving the transformation processes, increasing their efficiency and quality, as well as the wine's added value.

Specifically, one of the main development challenges is to improve the sensory, chemical and microbiological quality and stability of wines to facilitate their marketing, both in the domestic and export markets, outside the production areas and to increase their optimal time for consumption.

This is possible thanks in large part to the improvement of knowledge generated by the research groups and the ongoing investment in knowledge and technology by the wineries.

Another priority challenge for improvement and market adaptation is the reduction of the use of products containing allergens, such as sulphite. The wine market is increasingly demanding healthy and environmentally sustainable wines, and the reduction and/or replacement of sulphites is one of the main challenges as there is no alternative product that does everything that SO2 does for wine.

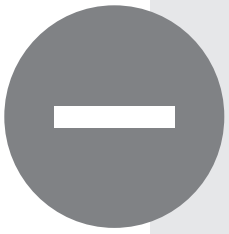
It is also worth pointing out that the effects of climate change on wine and the need for wineries to mitigate its impact due to the increase in the pH of wines and the decoupling of technological maturity from phenolic ripeness.

SWOT ANALYSIS: PROCESS

STRENGTHS

- High investment in winemaking technology in wineries.
- Many universities and professional training centres teach Viticulture and Oenology, so there are more and more professionals trained as oenologists.
- High production and recognition of our scientific sector, with research groups specialising in Process.
- Great differentiation and diversity of types of wines produced in Spain compared with international producers.
- Concentration of production: 90% of national production is in the hands of 400 wineries (approximately 10%).
- Existence of quality raw material, with plenty of fruit flavours and a profile with sweet tannins.

WEAKNESSES



- Lack of connection between the research groups and wineries.
- A marked absence of an information network with all the research carried out within the industry.
- Insufficient product adaptation to transport routes and stress.
- New technologies from other countries/technical limitations in solving problems.
- Insufficient knowledge on the microbiological conditions of the product.
- Insufficient knowledge on the winery's environmental conditions.
- Lack of models to predict the evolution of chemical compounds during ripening, winemaking and ageing.
- Lack of instrument calibration models for sensory evaluations.
- Adjustment of the maximum yield limits for the Spanish wine industry to improve the quality of table wines.

OPPORTUNITIES

- Market opportunity: growing demand for wine derivatives such as low-alcohol wines and organic wines.
- Growing demand for sparkling wines.
- Development and application of new winemaking technologies (process control, filtration and stabilisation, non-conventional fermentation, new ageing techniques).
- Opportunity to produce wines designed for young consumers who must be gradually introduced to the world of wine (e.g. all kinds of sparkling wines).

THREATS

- Trend towards polarisation in consumer preferences from low to high-alcohol wines.
- Short shelf-life and poor age-worthiness of wines, particularly sulphite-free wines.
- Very strict regulations that reduce competitiveness, allergens, GMO, enzymes.
- Insufficient microbiological analysis and standards.
- Winemaking legislation not aimed at facilitating process and product innovations, particularly in terms of quality schemes.

OVERALL GOAL

"Improve transformation processes in order to increase the efficiency, quality and added value of wine".

STRATEGIC LINES

1. Develop new techniques and strategies for knowledge on and the improvement of oenological biotechnology processes.

- Characterise the **microbial biodiversity** of the winery's environment (e.g. environmental pollution, trichloroanisole precursors, fungal environment, spoilage microorganisms, etc.).
- Study the **selection and impact of microorganisms** on wine (e.g. yeasts that improve the organoleptic profile of wine – visual, olfactory and gustatory –, microorganisms other than conventional ones with good winemaking properties, selected strains of lactic acid bacteria with enzymatic activities, acidifying yeasts and bacteria, native yeasts and bacteria as a differentiating element of the vineyard in wine).
- Carry out further studies on the **microbial stress response** (e.g. study the resistance of strains to heat shock, osmotic, pH, high alcohol, nutritional stress, etc.).
- Promote the study of **genomics, hybridisation and genetic modification** (e.g. global genotypic analysis of wine yeasts and their relationship with oenological characteristics, etc.) and phenotypic expression from the same genotype.
- Increase knowledge on analysis techniques for **microbial interaction**: synergies and antagonisms between, for example, "*Brettanomyces* (lactic and acetic acid) bacteria, *Saccharomyces*, other non-*Saccharomyces* bacteria, etc."
- Predict and **control *Brettanomyces*** and other spoilage microorganisms in the winery (methods to keep them from appearing in the winery, rapid detection techniques, and curative techniques for the elimination of contaminating microorganisms and derived metabolites).

2. Develop new production process and control technologies, focusing on improving quality and stability.

- Develop predictive techniques and models **to control the production, evolution and composition** of wine during the process, in order to ensure its stability.

- Develop **new techniques** to improve the extraction (mechanical, physical and/or chemical) and colour stability of wines.
- Develop new strategies **to regulate the pH** of wine.
- Develop **new technologies** (ultrasound, UHPH, pulsed electric field processing, anionic membranes, etc.) **to control and improve colour**, possible **microbial alterations** and the oxidation reduction potential of wines.
- Improve **foam** quality and stability **in cavas** and quality **sparkling wines**, **increasing** their **shelf-life**.
- **Manage gas** during production and bottling.
- Fine-tune the different **packaging** options, as well as **closures** to improve **wine preservation** (control of oxygen transfer, study of cork and wine interaction) to enhance its positive effects and remove undesirable effects.

3. Optimise the use of oenological additives and processing aids.

- Develop and validate **alternative methods** (physical, chemical and biological) alternatives to SO2 in grape must/wine, containers and barrels.
- Study and assess different technologies, additives and techniques **to reduce and/or do away** with the presence of **allergens** in wines, ensuring product quality.
- Optimise the production process, quality and stability of **new wines** according to **market demand** (e.g. vegan wines, clarification, etc.).

4. Develop new strategies for the sensory and chemical evaluation of wine.

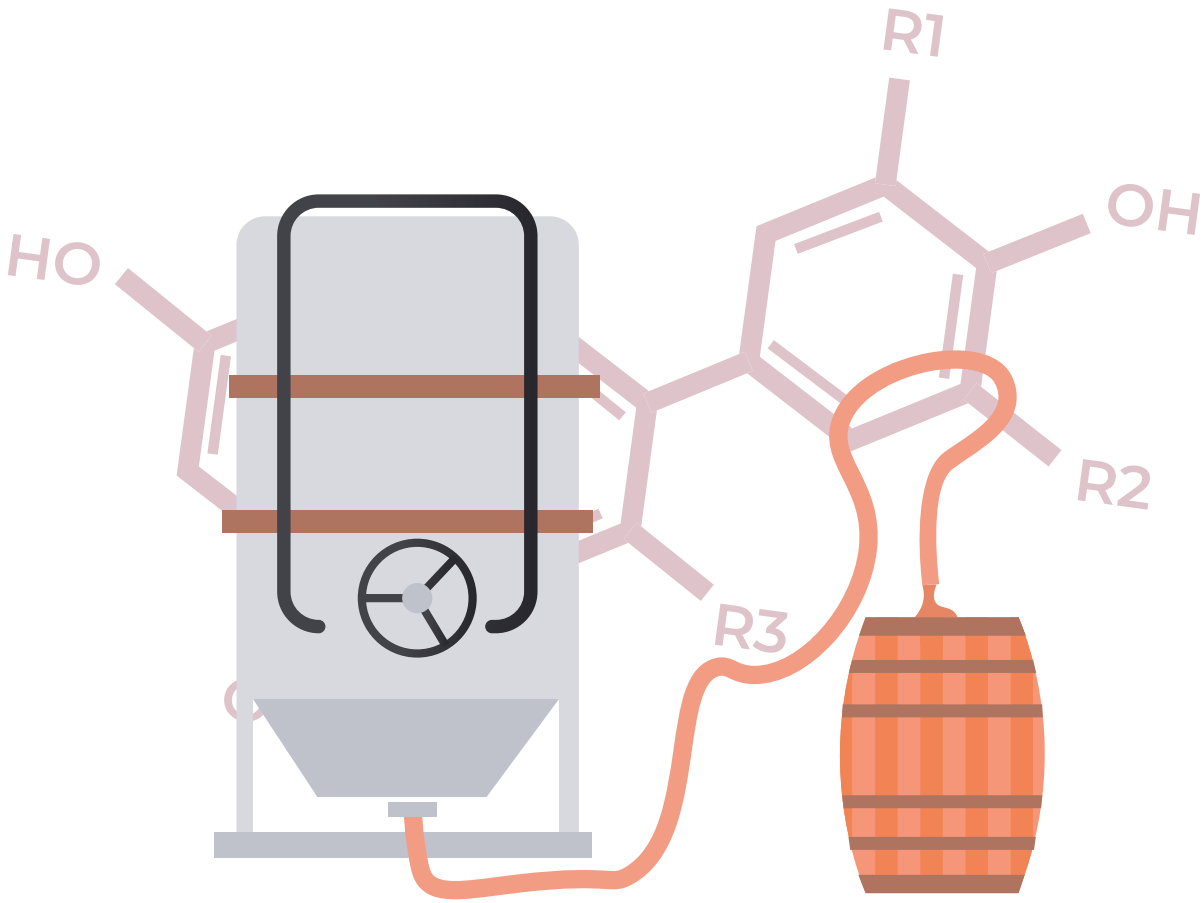
- Develop **predictive models** to understand the relationship between the chemical composition of a wine (study of the interactions between volatile and nonvolatile fractions, synergies and antagonisms) and its **organoleptic qualities**.
- Develop **instrument calibration and validation models for sensory evaluations** (electronic panel and standardised tasting panels).

5. Promote research into a line of low-alcohol wines.

- Develop **new methods** (physical and biological) for the production and preservation of **wine** profiles **with lower alcohol content**.

6. Improve vitivinicultural sustainability.

- Development of **more sustainable technologies** (e.g. cation exchange resin, energy optimisation, water reuse, etc.) in line with the current sustainability policy framework (e.g. *Green Chemistry*).



AREA OF PRODUCT

A product is that which has been manufactured or produced with the intention of satisfying the needs or desires of a consumer. In this regard, the product transcends its own physical attributes (chemical and sensory characteristics of wine such as colour, aroma, taste or appearance) and includes what the consumer values or recognises (brand, source, sensory expectations, social, symbolic, psychological considerations, etc.). These are the so-called intrinsic and extrinsic attributes of the product.

Its relevance lies in its ability to give each of us what we want. The elements characterising it are: design (what makes it recognisable and/or attractive for consumers), style and quality (intrinsic properties of the product itself).

The combination of product design, style and quality is crucial for the survival of most companies, both existing companies and companies that will emerge in the future. In the case of wine, the update of existing wines and the introduction of new products is fundamental. Product design is not the sole responsibility of the industrial process; it also falls under financial, marketing and quality control management. Product definition is the outcome of the development of a holistic business strategy. Product design should be a prerequisite for production and not the other way around.

The product represents the company's image and commitment to quality – always with the aim of satisfying the needs of consumers. In the world of wine, the product can also be defined from a psychosocial or aspirational standpoint, where the consumer can improve their image, status and exclusivity through the consumption of certain products.

Market trends can change in unexpected ways. It is therefore necessary to adapt and try to anticipate by monitoring markets and designing new innovative products that can meet the changing needs and expectations of consumers.

SWOT ANALYSIS: PRODUCT

STRENGTHS

- Spanish wines offer great value for money – the best at the international level (to be proven or quantified).
- Significance of the wine industry in the food sector; well organised.
- Entry into the winemaking industry of young winegrowers, winery owners and technicians with an innovative and quality-focused mindset, aside from a more holistic and global mentality more accustomed to working in export positions.
- Highly productive and multidisciplinary community of scientists in RDI thanks to university research groups and private centres.
- Concentration of production in large wineries and groups at the European level.
- Production of bulk wine of good quality at competitive prices for export and by prestigious wineries.
- Capacity to produce a wide variety of products (red, white, rosé, sparkling and fortified wines), some of which are well known.
- A large number of native varietal wines and wines from wine-producing regions recognised in international markets.
- Positive perception of Spain as a country in international markets, albeit not very deep.
- Use of highly advanced technological development in product control.

WEAKNESSES

- Product not oriented to the demands of domestic and international consumers.
- Few technical and economic connections between winegrowers and wine-makers and between winemakers and distribution channels.
- Lack of product adaptation to transport routes and stress.
- Product: low homogeneity due to harvest and batch effects. Low aromatic potential and shelf-life of white wines. Little attention to rosé wines according to trends.
- Lack of regulation by the public authorities of new classification so biodynamic (currently regulated by a private entity), natural and sulphite-free wines.
- Lack of definition of models for the olfactory and gustatory attributes of wines.
- Lack of awareness by the consumers in international markets of the vast majority of Spanish varieties, regions and brands.
- International consumer perception of Brand Spain that has not been given a refresh or is outdated.
- Product that is constrained by the process, which is not focused on market needs.
- Bulk wine sold very cheaply to competitor countries.
- Only a small fraction of “new products” maintains the value chain status for which they were designed.

SWOT ANALYSIS: PRODUCT

OPPORTUNITIES

- Growing demand for alternative wines to the traditional ones and for new packaging types.
- Relate soil/viticulture/geography with the sensory properties of wines.
- Diversification: wine-based derivatives.
- Marketing of high value-added bulk wines bottled at their destination.
- New intelligent packaging and development of new logistics networks and packaging to avoid transport stress.
- Generate by-products and derivatives in all production stages.
- Development of emerging markets and new wine consumers.
- Development of wine tourism in Spain and the wonderful landscapes and rich ethnological heritage associated with wine (human and cultural value).
- Growth of local tourism and new virtual wine tourism experiences.
- Importance of new moments and trends of consumption.
- High environmental awareness on the part of society, the sustainable environment and the circular economy.
- Possibility to make different types of wines designed for different types of end consumers from the same vineyard.

THREATS

- Unknown long-term effects caused by the COVID-19 pandemic or similar.
- Lack of adequate means of acquiring information on the requirements and demands of international consumers.
- Competitor countries gaining a foothold in emerging markets before we do.
- Competitor countries with a greater brand focus than us.
- Lack of flexibility due to the weight of identity and tradition on product definition.
- Position of other competing beverages versus wine in Spain.

OVERALL GOAL

"Offer consumers products to meet their needs and expectations"

STRATEGIC LINES

1. Develop new market adaptation strategies for wine.

- **Define chemical maps and markers** (aromatic and gustatory) according to wine styles and commercial success in the markets.
- Expand **new product offerings tailored to the demand** of new and potential consumers.
- **Promote** the true **viticultural and oenological potential of grapes** that are marketed very little (including native varieties), increasing the biodiversity and supply of wines at the national and international levels.
- **Improve online communication and facilitate semiotics in wine** (most of all, in the descriptions of tasting notes).
- **Study tasting panels at the national level** for the sensory analysis of wine (experts or consumers), with the aim of homogenising training and education procedures and applying sensometric techniques, particularly in the case of studies on consumer preferences and emotions. Create a consumer panel management body

2. Develop new wine packaging and product traceability control strategies.

- Develop **new materials and packaging** for the preservation, transport and distribution of wine which increase **product** shelf-life and **sustainability** (e.g. glass of different colours, PET, aluminium against different stresses or conditions: protection against light, heat, fluctuations in temperature and storage time, transport, packaging with antimicrobial activity, etc.).
- Develop **new intelligent and sustainable packaging** that allows **traceability** throughout the entire production chain and provides information on the value of the product (e.g. ICTs for the monitoring

of stress during transport and marketing, thermochromatic indicators, authenticity indicators, blockchain, intelligent labels with QR codes, etc.).

3. Promote the circular economy in wineries and increase the value of by-products and derivatives of wine production.

- **Develop** food **products** from **grape, grape must or wine derivatives** (e.g. truffles, jellies, flavoured wines and soft drinks, varietal musts, cooking and confectionery spices, jams, wine blended with other beverages, etc.).
- Develop **new distillates, hydroalcoholic solutions and** specific **vinegars** from surplus raw materials.
- Identify the **barriers** and **opportunities for non-alcoholic wine** in Spain.

4. Wine Tourism.

- **Create** strong links between **wine and the winery and food and cultural tourism** depending on the historical or artistic nature of the wine industry in the area as industrial heritage.
- **Link wine tourism** with other well-known **ethnological and nature activities** in each region (e.g. Camino de Santiago, hiking in natural areas such as rivers and mountains, itineraries and synergies with sporting events, etc.), offering tour operators comprehensive packages.
- **Understand the motivating factors for wine tourists** in relation to the product they seek, based on their emotions and their purchase decisions. Promote virtual tours, 3D tours and remote tastings.

AREA OF SUSTAINABILITY AND C. CHANGE

The effects of climate change on the global winemaking industry are an inevitable reality for the scientific and business world. Its consequences began to be felt some time ago and are now unmistakable in the different ripening stages or processes, in the susceptibility to certain diseases and pests, in the dryness of soil and ecological drought, in changes in the phenological stages of crops, etc. All these factors can affect the quality and typicality of our wines, including the viability and biodiversity of vineyards.

Faced with this reality, in recent years, environmental awareness has increased among the public authorities and the industry itself, as shown by projects such as CENIT-DEMÉTER, VINOVERT, GLOBALVITI or VINySOST, among others. In this regard, Spanish winemaking has an important scientific and technical knowledge base that makes it possible to develop strategies to adapt to the specific climactic conditions of our vineyards with technologically sustainable agronomic practices suited to the great plasticity of the varieties and clones.

There is also enough objective baseline information available to deepen knowledge and/or adapt winegrowing practices in the development of climate change mitigation strategies, such as carbon sequestration in soils and perennial woody structure species.

Thus, real climate change adaptation and mitigation strategies must be developed through environmentally sustainable methods and systems, ensuring the socioeconomic viability of the industry. To this end, it is important to have impact indicators in order to assess the implementation of technologically sustainable methods and systems in our winemaking, with a special emphasis on water and energy use, soil management and the microbiota of the continuous crop/grape/winery/wine system.

SUSTAINABILITY AND CLIMATE CHANGE

STRENGTHS

- Adaptation to hot and dry climate conditions, favoured by the experience acquired and the great intravarietal and intervarietal diversity available.
- A significant proportion of Spanish vineyards have low fungal disease pressure levels thanks to favourable climate conditions in most of the crops. Effectiveness of biological pest control in vineyards.
- Precedents of joint strategies in the industry (DEMÉTER, EcoSostenibleWine, PTV, GLOBALVITI, etc.).
- A high and broad level of proprietary knowledge, with technological challenges similar to those of European, American and Australian wine producers, both in the field of viticulture and sustainability, ecology, physiology, agronomy and environmental technology.
- Proximity and cooperation with auxiliary industries (glass, cork, paper, graphic industries, oenological products, logistics, etc.).
- Having strategic agricultural sectors producing quality products (olives, pork, milk, etc.) with significant RDI in food technology in Spain, which can favour strategic changes in the relationship of wine/cava with consumers.

WEAKNESSES

- Lack of consideration of vineyards as carbon sinks.
- Lack of knowledge of some key indicators in the LCA of wine estates (carbon storage in vineyard soils, low GHG emissions in rainfed vineyards, etc.).
- Water availability shortfall. Overexploitation of aquifers in Spain.
- Low level of integration of scientific and technical knowledge to meet the challenges of sustainable production.
- The marked seasonality of production processes limits the profitability of some technological solutions on an industrial scale (carbon capture from fermentation, biomass, etc.) and makes it difficult to scale wastewater treatment facilities.
- Small and medium-sized wineries find it more difficult to implement sustainability actions and invest in environmental technology, so they should develop new paradigms of cooperation and the use and management of natural resources and waste.
- Complexity in sending a clear message about sustainable policies to the end consumer.
- Little use of tools that can help the industry rise to the challenge of climate change (study of resistant/tolerant and hybrid varieties, use of predictive management models, etc.).
- Lack of awareness of the importance of the wine industry for the maintenance of the rural population and its economic, social, environmental and cultural benefits.
- Need to assume that climate and environmental uncertainty is more important than one-off climate events that may occur, as these do not allow for unchangeable strategies and create the need for ongoing monitoring of the crops together with the use of tools for short-term and medium-term forecasting of the limiting factors to crops (drought observatory, EEMET, SMC, COPERNICUS, etc.).

SUSTAINABILITY AND CLIMATE CHANGE

OPPORTUNITIES

- Activation by the European Commission of a package of measures to deal with the climate emergency through the European Green Deal.
- Promotion of innovation in biodiversity and sustainability by the EU.
- Approval of a Climate Change and Energy Transition Bill by the government to push Spain to be carbon neutral by 2050.
- Implementation of the National Recovery, Transformation and Resilience Plan by the government in response to the economic crisis caused by the COVID-19 pandemic.
- Development of environmental legislation and taxation.
- Voluntary agreements for the mitigation and compensation of greenhouse gas emissions.
- Circular economy. Recovery of agricultural and winery waste and by-products.
- Development of renewable energies and energy efficiency in vineyards and wineries.
- New organic materials and the development of ecodesign under the life cycle analysis approach, always from the perspective of their actual functionality.
- Increased awareness of the importance of sustainability by consumers (particularly younger consumers).
- Growth in the consumption of organic products.
- Need for last-mile transport optimisation.
- Increasingly restrictive regulations in the EU regarding the application of plant protection products.
- Opportunity to create a new winemaking model in the face of the COVID-19 crisis, which considers what's essential, maintains what's traditional and creates something new (the current situation shares many similarities with the phylloxera infestation).

THREATS

- Lack of unanimous commitment at the international level (COP 25) in the fight against climate change (Madrid 2019).
- Most of the environmental impacts are generated outside the scope of vineyards and wineries.
- Overexploitation of natural resources (water availability, soil erosion, imbalance in the landscape, etc.).
- Unfavourable long-term climate scenarios (a temperature increase of more than 2° C by 2050, more frequent droughts, etc.) may lead to the displacement of viticulture to other zones, the need to replace varieties and/or for new agronomic management strategies.
- Increased environmental impact of logistics due to the displacement of the market to exports, unless low-carbon transport systems are used (train, wind-powered ships, etc.).
- Regulatory heterogeneity among different autonomous communities and among different countries in relation to sustainability and existing certificates (problem of organic products, etc.).
- Major crisis in consumption caused by COVID-19: a drastic decrease from the 80m tourists received in 2019, low domestic economic availability, etc.

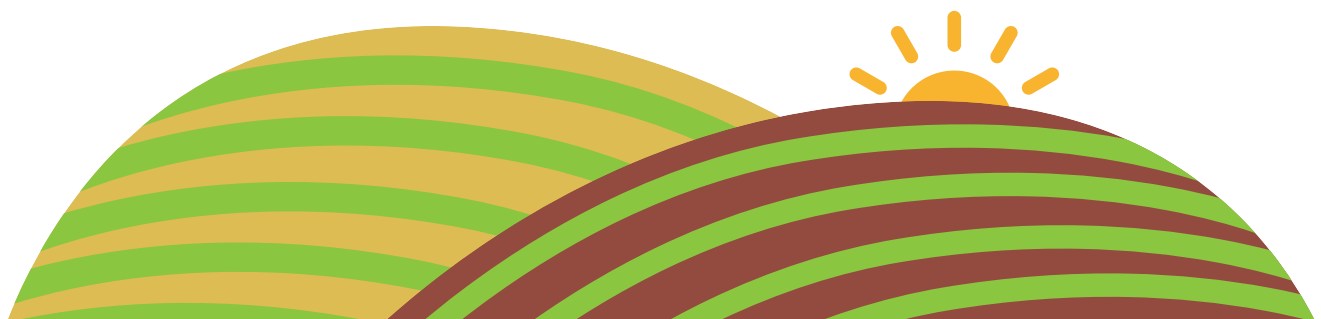
OVERALL GOAL

"Contribute to the sustainability of winemaking, developing adaptation and mitigation strategies related to climate change in the context of the circular economy"

STRATEGIC LINES

1. Review, select, validate and unify agreed indicators and methods of measurement in order to evaluate the winemaking industry's environmental impact.

- Harmonise, unify and transfer indicators, management, evaluation and communication tools, and the **life cycle analysis** (LCA) methodology applied to the industry.
- **Include sustainability in the final product** as an added value.
- Establish the **emission factors** for the cultivation of grapevines in Spain.
- Develop the **sustainability innovation ecosystem** in the Spanish wine industry (generation of knowledge and an available database).
- Study and **optimise agronomic practices for the soil and promote methodologies to offset emissions** through the "carbon sink effect" of permanent woody structure species in vineyards as carbon sinks (COP 21, 22 and the 4 per 1000 initiative) and through process by-products (biomass, surplus electrical energy, etc.) with the goal of reducing GHG emissions.
- Study the **molecular biomarkers in vineyards** (genomics, transcriptomics, proteomics, metabolomics) to further the study of grape ripeness, understanding the biosynthetic pathways of compounds related to grape quality which help to understand the physiology of the vineyard in situations of biotic and abiotic stress.
- Study the **microbial biomarkers** (metagenomics and metatranscriptomics) to better understand the functioning of pathogenic microorganisms to define new treatment strategies and **to characterise the ecosystem to see which beneficial practices and microorganisms help** preserve the ecosystem.

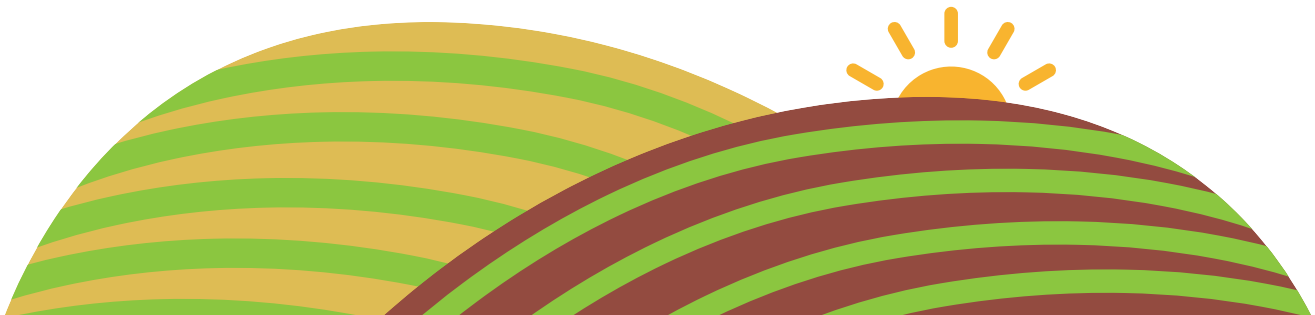


2. Process optimisation (inputs and winegrowing, winery and related products).

- **Improve the efficiency and sustainability of winegrowing practices** by acting on soil preparation and crop management (rational use/reduction of plant protection products and fertilisers, development of new products that are less aggressive/toxic, reduction of fossil fuels, disease prediction models, etc.).
- **Improve the efficiency and sustainability of the production process**: more efficient climate control systems, zero waste strategies to minimise the volume of waste generated during the production process, packaging materials that pollute less, optimisation of transport and distribution routes, reuse of packaging, reduced use of plastics, etc.
- **Optimise water use** in vineyards and wineries, taking into account the entire water cycle. Develop and/or apply existing methodology and systems for procurement, distribution, use, recycling and storage.
- Promote the use of **renewable energies** in processes.

3. Promote winegrowing and winemaking strategies and methods to combat global warming (adaptation and mitigation).

- Winegrowing strategies for **vineyard adaptation to the effects of climate change**: development of techniques for vegetation management and synchronisation of glycocidic and phenolic ripeness, integrated decision and action systems in vineyards and generation of new functional patterns.
- Winemaking techniques **to reduce the adverse effects of climate change in the winemaking process** while preserving wine quality: development of techniques to reduce pH, correct phenolic ripeness, minimise organaleptic deviations and reduce alcohol content.
- Quantify the **reality of climate change on each viticultural area** and its varieties/clones. Establish forecasting scenarios based on the concentration of GHG, ozone, aerosols and dry deposition, temperature, water availability, UV radiation, etc. to study the response of the plant and grape/wine quality to these scenarios.
- Strategies **to analyse and promote functional biodiversity** in vineyards.

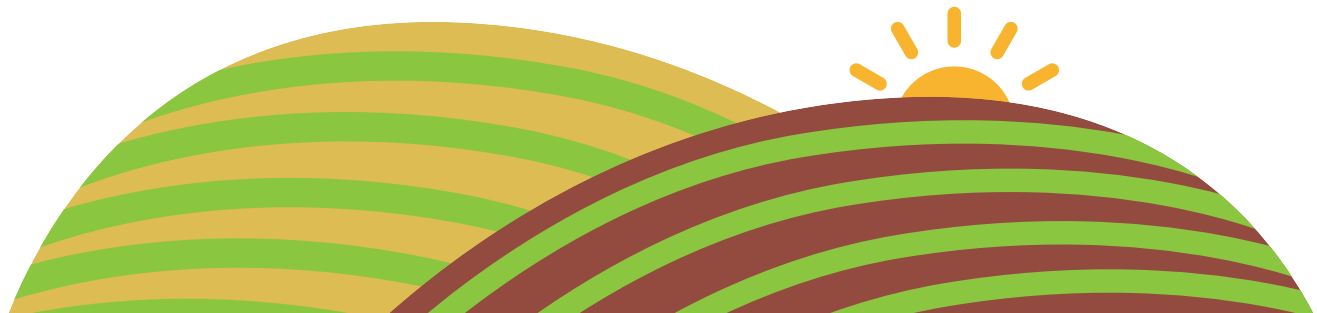


4. Develop strategies to promote the circular economy, prioritising and rationalising the use of any by-products produced in the winegrowing and winemaking processes.

- **Obtain high value-added inputs or compounds** from grape skins, sewage sludge, vine pruning residue, load reduction and other by-products wholly or partially.
- Develop **new products that can be used** by the human and/or animal food sector **from winemaking by-products**.
- Develop **new non-food products** (cosmetics, medicines and/or health supplements, dyes, colourants, fibres, etc.) **from** winemaking **by-products**.
- Obtain **bioenergy from by-products** of the manufacturing process.
- Create **traceability mechanisms along the value chain** and involve all stakeholders in environmental impact assessment.

5. Promote the adoption of good winemaking practices that have a positive impact on vineyards and wineries, maintaining and improving environmental, economic and social sustainability.

- Promote **good sustainable agronomic practices** (e.g. "Viticulture field guide" developed by the Red-Vitis network of excellence).
- Promote **good sustainable practices in wineries**.



AREA OF HEALTH

Wine is considered to be part of the framework of a healthy and wholesome diet such as the Mediterranean diet. For many years, wine has been part of the gastronomy of southern Europe, with particular relevance in countries such as France, Italy and Spain. And it has become a part of the diet and lifestyle of countries outside the Mediterranean area such as Nordic countries, Asian countries, etc.

In this context, there are several scientific studies on the protective effects of wine and its main components (e.g. polyphenols) on total mortality and the main chronic diseases such as cardiovascular diseases, diabetes, dementia and some types of cancer, thus showing that moderate consumption provides important health benefits.

It is important to point out that wine – despite its low alcohol content – does contain alcohol and heavy alcohol consumption can cause harmful effects, as highlighted in many studies. Moderate and responsible alcohol consumption for adults is always the best recommendation for a positive effect on the body. This is why we are considering holding information seminars on wine consumption in Spain, focusing on consumption among young adults (from 18 to 35 years old) with the aim of educating and promoting responsible wine consumption as a sociocultural norm in order to prevent and reduce heavy alcohol consumption and the collateral damage related to it, as well as bring young people closer to the wine culture and tradition.

SWOT ANALYSIS: HEALTH

STRENGTHS

- Food associated with traditional gastronomy in southern European countries and the well-known "Mediterranean" diet.
- Epidemiological, clinical and basic research studies associate moderate wine consumption with beneficial effects on health and wellbeing.
- Strong and consolidated research groups in the field of health and safety. Reinforcement through foundations.
- Inclusion of wine as a part of the diet and lifestyle of countries outside the Mediterranean area: Nordic countries, Asian countries, etc.
- Unlike other alcoholic beverages, wine has a high and diverse content of phenolic compounds, which scientifically support the concept that wine is more than just alcohol.
- Products derived from wine that may prove attractive to consumers: "non-alcoholic wine", grape extract, grape seed oil, etc.
- Food safety and interaction with other areas where technological innovations (oenology) have been included.

WEAKNESSES

- Adverse effects derived from the presence of alcohol. Difficulty in defining safe levels of alcohol consumption and potentially healthy levels.
- Lack of reliable statistics on consumption by product, type and origin.
- Associating the consumption of wine only as an alcoholic beverage and not considering responsible consumption of a foodstuff with components with healthy properties.
- Lack of international harmonisation on the content of substances (allergens, amines), which is a barrier to foreign trade.
- Lack of harmonisation in the methods of analysis of bioactive compounds present in wine and responsible for its health benefits, as well as microbiological standards.
- Lack of epidemiology and population studies specifically designed to analyse populations exposed to moderate wine consumption and in the context of diet.

SWOT ANALYSIS: HEALTH

OPPORTUNITIES

- Improve the culture of responsible wine consumption and its integration in the context of a balance and healthy lifestyle.
- Diversification of products focused on health. Existence of innovative technology for this purpose.
- Promotion of scientific and technological breakthroughs motivated by the attractiveness of wine as a complex food.
- Create a solid scientific basis to support agencies in establishing clear policies in relation to moderate wine consumption. There are few scientific studies on the subject.
- Collect relevant data to detect and analyse trends and the main factors that determine consumption habits.
- Evaluate the use of microorganisms, their biodiversity and their role in biological protection, taking into account the technological interest (fermentation monitoring, nutrients) and the effects on the safety and quality of wine products.
- Implementation of the winemaking industry network in the face of rural depopulation.
- CAP reform that includes the regulation of dealcoholised and partially dealcoholised wine, which may be called wine and found under this product umbrella.
- The role of wine in promoting healthy ageing.

THREATS

- Increasingly restrictive food safety legislation and regulations (marketing, advertising and labelling).
- Lack of scientific support in certain consumer communication actions superficially addressed by the media, which leads to consumer confusion.
- Application of policies imposed by international organisations on public health and alcohol-related issues, which call for an ongoing review of scientific breakthroughs.
- Advice against moderate consumption by nutrition professionals.
- Increased impact of social media outreach promoting the risks moderate alcohol consumption poses to health.
- The consideration of alcohol (any manner of consumption) as a risk factor to health (particularly for cancer) in EU policies (e.g. “Europe’s Beating Cancer Plan”).
- Uncertainty in relation to possible labelling and ingredients list on wine.
- Certain types of wines are poorly regulated without taking into account food safety criteria.

OVERALL GOAL

"Study and validate the beneficial effects of wine and/or its constituents on health and promote its effective communication"

STRATEGIC LINES

1. Contribute to the expansion of scientific knowledge on the effects of wine, its constituents and/or derivatives or by-products, on health and wellbeing.

- Determine the **compounds responsible** and elucidate the **mechanisms of action** involved in the **beneficial effects** (*in vivo* and *in vitro* tests).
- Conduct intervention studies **to evaluate the effect of wine consumption and low alcohol content on health**, facilitating the integration of data through new massive tools (e.g. *high-performance computing*, *Big Data*, genomics, breakthroughs in the study of the microbiome, artificial intelligence), which is of growing interest for studies on the impact of food on health.

- Evaluate the **interactions between wine and other foods** with an influence on their potentially beneficial effects.
- Evaluate and develop **new winemaking practice** and/or review existing ones, taking into account their **environmental/sustainability impact and impact on consumer health**, in light of **technological innovations** and in line with the **Sustainable Development Goals (SDGs)**, making it possible to review/do away with certain practices (e.g. lowering sulphite content, potential allergens and use of plastics/microplastics in vineyards and wineries).
- Search for **new by-products from winemaking for their recovery** (e.g. lees extracts, grape skins, seeds, pomace, etc.).

2. Promote studies for pre-regulatory purposes: Develop appropriate methodologies to establish clear and reliable limits in food safety specifically relating to wine

- Develop appropriate methodologies **to establish clear and reliable limits** in food safety specifically relating to wine.
- Develop and **standardise** sensitive, robust and reliable **methods of analysis** through **the establishment of interlaboratory study circuits**.
- Contribute to the **harmonisation of the parameter and variable limits relevant to food safety** applicable to grape-based products, wine or by-products.
- **Study** – in the context of food safety – **potential allergens, their origin and the possibility of minimisation**.
- Propose studies for the implementation of **harmonised standards for microbiological analyses**.

3. Promote the responsible and moderate consumption of wine as part of a healthy diet.

- Increase **institutional and business support for current initiatives** in this field (e.g. "Wine in Moderation", "The Science of Wine and Health", "Knowing How to Drink is Knowing How to Live", etc.) **and develop new initiatives in this area**.
- Promote **the communication and image of wine as an important part of a healthy diet (**Mediterranean, Atlantic, etc.). Use of digital marketing tools for dissemination.
- Promote **studies that compare fermented beverages** (e.g wine and wine-based drinks) **and spirits** to steer clear of their potential risk.
- Support a framework that transcends territories and institutions **to promote – at the national level and with an international impact – the concept of responsible consumption** that, through an interdisciplinary perspective with the support of all social strata (winegrowers and scientists, public and private sectors, civil society, etc. – all stakeholders), all of them will work on together **to combat harmful alcohol** consumption in order to be part of the solution.
- **Emphasise the relationship between moderate wine consumption with a more active social life**, which is considered to positively contribute to our wellbeing and health.

AREA OF WINE ECONOMICS

The Spanish winemaking industry has undergone important changes in its production characteristics that have led to an improvement in competitiveness. Spanish wines clearly enjoy a better position now than they did before in a very globalised and highly competitive market.

With the decline of the domestic market, the industry has oriented its growth strategy towards exports, with overall positive results in the different markets. Nevertheless, important challenges remain, such as increasing value, which requires continuing on the path towards improving competitiveness.

It is necessary to undertake actions to increase domestic demand. And it also essential to improve its competitiveness in foreign markets. The model based on bulk wine at low prices should be replaced by one involving higher-value wines. The opportunities for differentiation in a product as complex as wine are very diverse. As the market is very dynamic and heterogeneous, wineries are obliged to make ongoing efforts to adapt and innovate.

The future of the wine market is growing in complexity as domestic and international supply increases and demand becomes more diverse. These important conditioning factors lead to needs for change that include different levels of innovation in companies, both for products and their organisation. These changes pose a major challenge for companies in the industry, particularly for SMEs, which often lack the scale and resources to deploy certain investment strategies. This renewal must be ongoing and requires combining the positive values of tradition with knowledge of new customers and competitors. The result should be an offering based on the strengths of territorial marketing, the link between gastronomy and wine, the relevance of history, etc.

The strengths arising from these synergies translate into competitive advantages that together allow better market positions based on greater marketing efforts (identifying segments and positions that can be differentiated, knowing the size and product offering of competitors and coordinating marketing actions better within the company to address target markets).

These actions make it possible to develop product strategies that combine the coexistence of collective brands and private brands, which have different values for customers. In addition, prices can be set different and adjusted according to the quality levels demanded by the target markets or alternative distribution channels.

Distribution strategies should make it possible to reach all markets and consumer segments, both through the on-trade channels and through retailers. The chosen channels must fit the market requirements, both in the domestic market and in the distribution to countries that have traditionally imported Spanish wine and in emerging wine-consuming countries as well.

SWOT ANALYSIS: WINE ECONOMICS

STRENGTHS

- The industry's large size, with a great diversity of supply and the capacity to give rise to industrial districts.
- High number of economic stakeholders with the capacity to innovate.
- Broad territorial, historical and cultural environment.
- Good value for money, high value and international recognition of Protected Designation of Origin wines.
- Commitment to quality and improvement of facilities.
- Modernisation of the industry and improvement of quality by increasing investments.
- Dispersed industry but well structured with technical knowledge.
- Good support for the industry (OIVE).
- Job creation and increase of local and social value of the wine industry.
- Use of emerging new technologies (*Big Data*, digitisation, etc).
- Growing wine tourism offerings, with diversified services provided by wineries and auxiliary companies and entities.

WEAKNESSES

- Lack of stable and transparent systems in the relationships between the different stakeholders in the chain.
- Predominance of companies that are too small to sustain internationalisation strategies over time.
- Dependence on traditional distribution channels.
- Great weight of bulk wine market.
- Scant training and professionalisation of the industry. Shortage of qualified personnel in the areas of organisation, management, commercialisation/marketing.
- Absence of advanced techniques in business innovation strategies.
- Difficulty in positioning Premium and Super Premium products in the market.
- Lack of an entrepreneurial and evaluative culture, deficient business models.
- Difficulty in attracting new consumers (young people).
- Little or no marketing. Predominance of price as a marketing/commercial tool.
- Low development of wine tourism in some areas.

SWOT ANALYSIS: WINE ECONOMICS

OPPORTUNITIES

- Increase in global consumption (especially quality wines) with the addition of non-traditional wine-consuming countries.
- New consumer sectors (young people, women, etc.).
- Promotion of innovation through a coordinated development by the PTV itself.
- Promote continuous training in exports.
- Growing consumer interest in concepts such as wine and health, low and non-alcoholic wines, the Mediterranean diet, the environment and sustainability.
- New information technologies and their importance in promotion (e-commerce), opinions and trends, as well as directly in marketing.
- Leverage Market-Pull and Technology Push synergies. Flexibility and adaptability.
- Innovate in packaging, closures and product presentation.
- Leverage synergies with gastronomy and tourism.
- New Horizon Europe programme.
- New CAP for the 2023–2027 period.

THREATS

- Regulatory change on labelling.
- Concentration of distribution. Domestic market shift to off-trade channels with a decrease in margins.
- Policies and campaigns aimed at restricting alcohol consumption.
- High competition due to the strong presence of wines from other countries in the market.
- Differences in institutional arrangements between countries.
- Fragility of international trade relations and proliferation of bilateral agreements.
- Narrowing of markets: snob effect, interests of opinion leaders. Disaffection of new generations.
- Domestic consumption seems to have stabilised. However, it shows no signs of recovery for the time being and it is important to continue to promote it.
- Development, innovation and growth of other substitute products such as beer, which is more closely linked to the lifestyle of young people and with strong promotional campaigns.
- Population ageing.
- New trends in logistics that favour bulk wine sales.
- Impact of climate change on vineyard profitability and viability.
- Global health situation (COVID-19) and its socioeconomic effects on the industry.

OVERALL GOAL

"Promote the professionalisation, integration, resilience and internationalisation of the industry"

STRATEGIC LINES

1. Improve knowledge and technology transfer in the industry.

- **Cooperation with other organisations** in the winemaking industry (OIVE, FEV, FIVIN, OeMV) **and use of joint information in relation to new emerging technologies** (*Big Data*, digitalisation, etc.) and technological challenges that arise.
- Create specific channels for dissemination and transfer to industry, making use, among others of **information and communication technologies (ICTs)**.
- Encourage the **teaching of courses and seminars** by multidisciplinary teachers, focusing on the different types of stakeholders involved in the industry (winegrowers, foremen, technicians, etc.).
- Create **specific master's degrees within the winemaking industry** focused on professional activity and/or research.
- Encourage wine institutions and organisation to play a greater **advisory** role for **winegrowers/winemakers**.
- **Professionalisation and training** of the industry in **marketing, commercialisation, quality, productivity and management.**

2. Promote the internationalisation of the sector and improve the positioning of Spanish wines in the world market.

- Use **restaurant and commercialisation networks of other Spanish products to disseminate information on Spanish wines**.
- **Associate specific promotions with other events**, for example, sports, gastronomic or major events to promote the image of Spanish wine.

- Promote the **implementation in wineries of systems based on international standards** (ISO 9000, ISO 22000, ISP/BRC protocols, etc.) to obtain internationally recognised certification that facilitates entry into these markets.

- **Drive and improve product differentiation through the collective or national brand (brand SPAIN)**, promoting its own enduring values (health, gastronomy, culture) associated with the wine industry and seeking complementarities with other Spanish products. Enhancing the value of brand SPAIN, promoting dialogue with local, national and global management agencies, collaborating with the public authorities in the development of a plan for the creation of a Spanish wine brand, and encouraging training for the industry's stakeholders.

3. Foster intra- and inter-sectoral cooperation through joint innovation and marketing actions.

- Promote the **development of strategic collaborative R&D&I projects**.

- Promote the holding of **conferences and events** for the **exchange of knowledge and identification of common interests**.

- **Back sector support organisations** such as the OIVE, the sectoral technology platforms and other clusters.

- Encourage vertical integration of the industry **to improve its distribution capacity** and **sales** force.

4. Modernise and improve business management.

- Promote **strategic business planning**.
- Implement **prediction and simulation models** (financial stress test) in companies in the winemaking industry.
- Use of ***Big Data*, new ICTs and digitalisation towards** Industry 4.0.
- Implementation of an **integrated process management system** through IT tools.
- Orientation towards **productivity**, efficient **competitiveness** at all stages of **production, transformation and distribution**.
- Facilitation and **promotion of technology-based start-ups**, *spin-offs*, etc.

5. Improve knowledge in marketing and communication.

- Use of **new knowledge technologies** (*Big Data*, new technologies, etc.).
- Monitor **new consumption trends and implement appropriate technological tools** (e.g. canned wine, dealcoholised wines, etc.).
- Increase **knowledge of consumer needs**. Neuroscience, sensory marketing, etc.
- Promote **virtual wine tourism** though emerging and existing technologies.
- Design **communication campaigns in line with new consumer values and trends**. Strengthen and improve communication through the informed dissemination of wine culture.
- Design **specific campaigns for young people** in the domestic market (wine festivals, tastings at universities), encouraging the use of a suitable and friendly discourse.
- Promote the relationship between **Spanish gastronomy and wine** through joint campaigns with the participation of top Spanish chefs.
- Promote **public and private support** for economic investment in **marketing and communication**.
- Foster the **development of new projects and market studies** by existing organisations (OEMV, MAPA, ICEX).
- Creation of **price observatories** to bring transparency to the relationship among traders.
- Promote **private collaborative initiatives** oriented to **market and consumer knowledge**.

6. Increase/foster the resilience of companies in the wine industry using innovative technological tools.

- Implement new sales channels based on new technologies **(online sales)**.
- Promote the study of **tools** and technologies that increase sustainability and corporate social responsibility.

5 CONCLUSIONS AND FUTURE PROSPECTS

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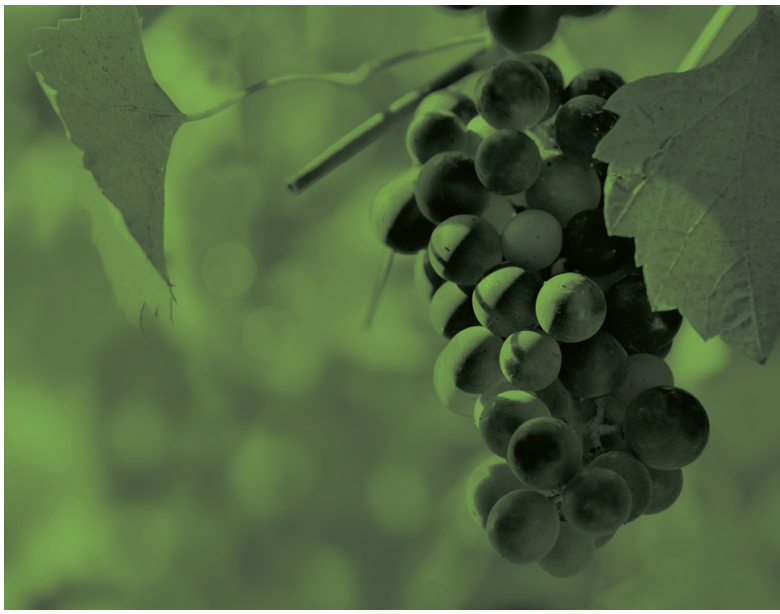
Throughout these 10 years of history, the PTV has grown in parallel to the R&D&I activity of the Spanish wine industry. Today, we know that 10–15% of it is done by the working groups of its Technical Commission and its members. Its role as a catalyst for this public-private activity called for the integration and prioritisation of the R&D&I strategies and goals in its Strategic Innovation Agenda, which has been the vehicle for identifying the scientific and technical needs of the industry, prioritising them and conveying them to the regional, national and European public authorities to date. The materialisation of these needs and the study of solutions in individualised R&D&I projects has enabled the PTV to promote multi-year strategic plans that have mobilised more than €157m across 159 projects, both individual and collaborative, during the 2011–2020 period. They received €117.7m in public aid with a clear incentivising effect, with this agri-food subsector deploying the greatest innovative activity at the national level. What's more, the promotion of the PTV's innovation dissemination and communication service is facilitating the necessary technology transfer of the R&D&I results, sharing it among the stakeholders of the Spanish winemaking industry.

However, 2020 has meant a significant slowdown for our industry in all areas: economic, commercial and innovation. There is no doubt that it has been severely affected by the COVID-19 health crisis by the economic crisis that followed. This is a reality that has been made quite clear in different section of this Agenda, which expects a very volatile and highly unstable first half of 2021, without the longed-for recovery getting off to a strong start, and therefore, with low consumer confidence, the on-trade channels practically closed and the export markets the only reason for any celebration. All of this has made private R&D&I activity grind to an almost complete halt, which significant public support has not been able to offset.



Faced with this situation, Europe has reacted with the promotion of a financial programme to reinforce the new 2021–2027 Multiannual Financial Framework, known as Next Generation EU for the 2021–2026 period, approved by the European Union in July 2020, and which aims to help member states and companies to recover after the pandemic and its effects, through the funding of the National Recovery, Transformation and Resilience Plans known in our country as ESPAÑA PUEDE ("SPAIN CAN").

This, without a doubt, is a great opportunity for all business sectors and therefore, for the Spanish wine industry. In this regard, our industry has done its homework well and has carried out an active dialogue with the public authorities though the different Expressions of Interest that, in case of success, should become key elements of recovery, with a clear focus on innovation, digitalisation, sustainability, social inclusion and support for the industry across the entire Spanish territory. In some of these Expressions of Interest, the PTV has joined the FEV and Agri-food Cooperatives Spain in their formulation and facilitation efforts, supporting strategic,

unique projects that will exert a "pull" effect, which will undoubtedly – in case of their approval by the Government of Spain first and then by the European Council afterwards – represent a significant boost for the recovery, transformation and resilience of the Spanish and European winemaking industries.

This is a historic moment, a period of great challenges for the industry, in which, for the very first time, new and important financial instruments for R&D&I are coming together with:

- The launch of the new Multiannual Financial Framework for the 2021–2027 period.
- The launch of the new R&D&I framework programme Horizon Europe for the same period.
- The reinforcement of this Framework with the European Recover Instrument-NGEU, which should help EU member states to recover and make their economics more competitive, digital, innovative, sustainable and resilient.
- The launch of the new National R&D&I programme for the 2021–2024 period and its annexed programmes, as well as the regional plans of the autonomous communities aligned with the new smart specialisation strategies of each autonomous community in which innovation unquestionably plays a predominant role.

This set of strategies, both European and Spanish, will give the industry a selection of important economic and financial resources never seen before that the PTV must try to help channel – using all its mechanisms and resources – through the direct funding of the major scientific and technical goals included in the new 2021–2024 Strategic Innovation Agenda described in this document. To do this, collaboration with other entities in the industry's value chain, such as the FEV, OIVE, specially involved entity with which the PTV has collaborated since 2018 through a joint action plan, OEMV and the CEEV at the European level, as well as with European, national and regional public authorities, is a key element in achieving the ultimate goal of this Agenda: to turn the Spanish wine industry into a benchmark for innovation and competitiveness within the European agri-food sector, thereby favouring its growth in alignment with the Digital Spain 2030 and Sustainable Spain 2030 strategies, the 2030 Agenda and the Sustainable Development Goals and in its struggle to strengthen our SMEs and the collaborating industrial subsector based on collaborative, inclusive and structuring supporting innovation that ensures social and territorial cohesion.

In this task, the new version of the PTV's Strategic Innovation Agenda constitutes one of the pillars on which the firm takeoff of the Spanish winemaking industry over the 2021–2024 period will rest, cementing the necessary growth in R&D&I investment, its expansion to a larger number of wineries and collaborators and its presence and leadership at the international level.

6 LIST OF PTV MEMBERS

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WINERIES

- ADEGA PONTE DA BOGA, S.L.
- ADEGAS MOURE, S.A.
- ADEGAS VALMIÑOR, S.L.
- AGROPECUARIA VALLEFRÍO NUEVA, S.L. (BODEGA DEHESA DE LUNA)
- ARRIEZU VINEYARDS, S.L.U.
- BERROJA, S.L.
- BODEGA CUATRO RAYAS S. COOP. AGROALIMENTARIA
- BODEGA MATARROMERA, S.L.
- BODEGAS BARBADILLO, S.L.
- BODEGAS COVIÑAS COOP. VALENCIANA
- BODEGAS ENGUERA S.A.
- BODEGAS FUNDADOR, S.L.U.
- BODEGAS GRUPO YLLERA, S.L.
- BODEGAS JOSÉ L. FERRER (FRANJA ROJA, S.L.)
- BODEGAS JOSÉ PARIENTE, S.L.
- BODEGAS LUIS CAÑAS, S.A.
- BODEGAS MARTÍN CÓDAX, S.A.U.
- BODEGAS PALACIOS REMONDO, S.A.
- BODEGAS RECTORAL DE AMANDI, S.A.U.
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- BODEGAS TERRAS GAUDA, S.A.
- BOSQUE DE MATASNOS, S.A.
- CELLER DEL ROURE, S.L.
- CODORNÍU, S.A.
- COMENGE BODEGAS Y VIÑEDOS, S.A.
- COMERCIALIZADORA LA RIOJA ALTA, S.L.
- COOPERATIVAS AGROALIMENTARIAS
- COOPERATIVA VINÍCOLA SAN VALERO
- COOPERATIVA VITIVINÍCOLA AROUSANA (BODEGAS PACO Y LOLA)
- DOMINIO DE LA VEGA, S.L.
- DOMINIO DE PINGUS, S.L.
- ECOVITIS, S.L.
- EGUREN UGARTE, S.A.
- EL CUMBRÓN S.L. (CARABAL VIÑEDOS Y BODEGA)
- FINCA ANTIGUA, S.A.
- GONZÁLEZ BYASS, S.A.
- GRANDES VINOS Y VIÑEDOS, S.A.
- GRUPO BARÓN DE LEY (EL COTO DE RIOJA, S.A.)
- GRUPO BODEGAS FAUSTINO, S.L.
- GRUPO FÉLIX SOLÍS AVANTIS, S.A.
- GRUPO FREIXENET, S.A.
- GRUPO OSBORNE, S.A.
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- JUVE&CAMPS, S.A.
- LUIS CABALLERO, S.A.
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- PAGO DE LA JARABA S.L.
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- UNITED WINERIES, S.A.U.
- VICENTE GANDÍA PLA, S.A.
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- ASOCIACIÓN DE BODEGAS POR LA CALIDAD (ABC)
- ASOCIACIÓN DE GRUPOS DE INVESTIGACIÓN ENOLÓGICA (GIENOL)
- COLEGIO OFICIAL DE ENOLOGÍA DE CASTILLA-LA MANCHA
- FEDERACIÓN ESPAÑOLA DE ASOCIACIONES DE ENOLOGÍA (FEAE)
- FEDERACIÓN ESPAÑOLA DEL VINO (FEV)
- GRUPO DE EMPRESAS VINÍCOLAS DE RIOJA (GRUPO RIOJA)
- SEA EMPRESAS ALAVESAS

OTHER ENTITIES AND FREELANCERS

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- CONSEJO REGULADOR DE LA DENOMINACIÓN DE ORIGEN CALIFICADA RIOJA
- DENOMINACIÓN DE ORIGEN UCLÉS
- DEPARTAMENTO DE DESARROLLO RURAL Y MEDIO AMBIENTE DEL GOBIERNO DE NAVARRA
- IGNACIO DE MIGUEL - CONSULTOR ENOLÓGICO (COSECHA 62, S.L.)
- JAVIER CRIADO (UPWINE SMART TASTING)
- JOSÉ LUIS HERNÁNDEZ
- JULIÁN PALACIOS MURUZÁBAL
- MERCEDES SUÁREZ GONZÁLEZ
- PABLO GONZÁLEZ OSSORIO - CONSULTOR ENOLÓGICO (OENOCONSULTING)
- SERVICIO REGIONAL DE INVESTIGACIÓN Y DESARROLLO AGROALIMENTARIO DEL PRINCIPADO DE ASTURIAS (SERIDA)
- UNIÓN DE PEQUEÑOS AGRICULTORES Y GANADEROS (UPA)

7 ACKNOWLEDGMENTS

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On behalf of our Board of Directors, the PTV's Technical Secretariat would like to extend our sincere gratitude to all the members of the Association for their contributions and reflections, which have been absolutely essential for the drafting of this new Strategic Innovation Agenda, which will remain in force until 2024. Their participation has been crucial in the prioritisation of goals and update of this document, aside from being those directly responsible for the successful implementation of the previous Agendas through the 159 R&D&I projects approved since the PTV was founded in 2011.

All the members of our Technical Commission deserve a special mention, as it is thanks to their involvement and great dedication that you now have this document, which constitutes an R&D&I roadmap for the wine industry, in your hands. Likewise, we would like to acknowledge their efforts in promoting and communicating this Agenda – and the PTV itself – as well as the facilitation and monitoring of R&D&I projects in the industry.

Special mention to the Interprofessional Wine Organization (OIVE) for the support they provide day after day to the very structure of our Association, as well as their commitment with the dissemination and communication of technological innovations and scientific and technical breakthroughs in this industry. All this, within the framework of our collaboration agreement to promote technological innovation in the wine sector.

We would also like to emphasise the very important role of the institutions that directly collaborate with the PTV, such as AgroBank, the Spanish Wine Federation (FEV) and the Spanish Wine Market Observatory (OeMV) for their commitment to R&D&I in the Spanish wine industry and our Association.

We would like to take this opportunity to highlight the work done by the Ministry of Science and Innovation, the Ministry of Agriculture, Fisheries and Food and the Centre for the Development of Industrial Technology, in their ongoing support of the agri-food sector and particularly, the Spanish wine industry. This support is shown not only in the aid and funds allocated to the different R&D&I initiatives promoted by companies and research centres in the industry, but also in their support for the PTV itself since its beginnings.

Finally, our deepest gratitude goes to the International Advisory Committee for their participation during the revision and translation of this Agenda, as well as for their role as the PTV's ambassadors beyond our borders.

To everyone, thank you very much!

PTV Team

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TECNOLÓGICA
DEL VINO

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MINISTERIO DE CIENCIA E INNOVACIÓN

AGENCIA ESTATAL DE INVESTIGACIÓN