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Who Produces Natural Wine (and Who Would Like To)?

Magalie Dubois^{a,*}, Efi Vasileiou^a, Lara Agnoli^a, Nikolaos Georgantzis^a,
Jean-Marie Cardebat^b, Jeremiás Máté Balogh^c, Raúl Compés Lopez^d, Joao Fernandes Rebelo^e,
Luca Rossetto^f

^a Université Bourgogne Europe, Burgundy School of Business, CEREN EA 7477, 21000, Dijon, France^b Bordeaux School of Economics, University of Bordeaux & INSEEC Grande Ecole, Ave Leon Duguit, 33608 Pessac, France^c Corvinus University of Budapest, Fővám tér 8, 1093, Budapest, Hungary^d CIHEAM Zaragoza, Av.Montañana 1005, 50059, Zaragoza, Spain^e Universidade de Trás-os-Montes e Alto Douro Quinta dos Prados, 5000, 801, Vila Real, Portugal^f University of Padova, Department of Land and Agroforestry Systems (Tesaf), via Università 16, Legnaro (Padova), 35030, Italy

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ABSTRACT

In a world where wine markets are losing ground, the natural wine segment appears healthy and growing, gaining an increasing acceptance among consumers, the media and within wineries product lines. This dynamic category is broadly understood as wine crafted from organic or biodynamic grapes, made with minimal cellar intervention and no additives, with the rare exception of small sulfite doses. However, despite its growth and relevance for rural economies linked to viticulture, natural wine remains a largely debated product category, lacking universally agreed-upon standards or unified third-party certifications. This study tackles the crucial lack of definition clarity and disputes among producers regarding what constitutes natural wine and who genuinely meets the standards to be recognized as a natural winemaker by relying on wine producers' self-stated adscription to natural winemaking. We address producer profiles and motivations within this emerging agricultural niche. Using survey responses from 514 wine producers in six European countries, we first identify key socio-economic differences between natural wine producers and non-producers. Second, we analyze the key factors of producers' behavior towards natural wine production by applying a logistic regression model. Finally, applying a Partial Least Square Structural Equation Model (PLS-SEM) based on the Theory of Planned Behavior (TPB), we examine the behavioral factors influencing non-producers' intention to adopt natural wine production. The findings indicate that the intention to produce natural wine is primarily associated with pre-existing attitude mediated by subjective norm and perceived behavioral control. Furthermore, our results highlight divergent opinions among producers and non-producers concerning the motivations for natural wine production. These comprehensive insights are vital for designing effective institutional rural policies and management measures to foster the sustainable growth and economic viability of this unique viticulture segment in rural areas.

1. Introduction

The increased interest in sustainable wine production has led to a growing consumer demand for wines with specific environmental and social attributes. Within this landscape, the natural wine category - distinguished by its use of organically or biodynamically farmed grapes, minimal cellar intervention and use of no additives, with the rare exception of small sulfite doses - has rapidly emerged (Alonso González

and Parga Dans, 2025). While natural wine is often perceived as inherently sustainable, its sustainability credentials are a subject of ongoing academic and industry debate (Alonso González and Parga-Dans, 2023). Sustainability is a multifaceted concept that traditionally encompasses environmental, social, and economic dimensions. While natural wine practices often align with environmental goals like reduced chemical inputs and increased biodiversity, their social and economic implications can be more complex. Unlike organic and

* Corresponding author.

E-mail addresses: magalie.dubois@bsb-education.com (M. Dubois), effrosyni.vasileiou@bsb-education.com (E. Vasileiou), lara.agnoli@bsb-education.com (L. Agnoli), nikolaos.georgantzis@bsb-education.com (N. Georgantzis), jean-marie.cardebat@u-bordeaux.fr (J.-M. Cardebat), jeremias.balogh@uni-corvinus.hu (J.M. Balogh), raul.compes@iamz.ciheam.org (R.C. Lopez), jrebelo@utad.pt (J.F. Rebelo), luca.rossetto@unipd.it (L. Rossetto).

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biodynamic wines, which adhere to established certification standards, natural wine frequently operates without a unified legal or regulatory framework (Parga-Dans et al., 2023). Despite this ambiguity of definition and the almost complete absence of formal certifications, natural wine has been attracting significant consumer interest and media coverage over the past decade (Goldstein and Dubois, 2025). Consumers are often willing to pay a premium for wines perceived as natural (Vecchio et al., 2023), foretelling its increasing commercial significance in the market (Bazzani et al., 2024; Le Grand, 2024). Therefore, and partly due to its increasing acceptance by younger consumers (Asimov, 2024), this emerging segment is regarded as a source of hope for the wine industry.

The literature on natural wine predominantly focuses on the consumption side (Fabrizzi et al., 2021; Galati et al., 2019; Migliore et al., 2020; Palmieri et al., 2023; Vecchio et al., 2023). However, despite its emerging popularity and relevance, the definition of what actually is natural wine remains inherently vague, making it difficult for researchers, producers and consumers to fully assess the size and limits of the relevant market and its impact for the stakeholders involved and the economy as a whole. Vicelli (2021) and Pineau (2019) characterize natural wines as an elusive product category, notably lacking formal legal reference at national and European Union (EU) levels. This absence of a clear, legally defined category hinders the precise quantification of production and poses a significant challenge for academics and policymakers attempting to rigorously study this market.

The challenges of product category and market definition are fundamentally rooted in the diverse production philosophies that natural wine producers embrace, as highlighted by Vecchio et al. (2021). Natural wine producers fundamentally construct their identity in opposition to the use of artificial chemicals in winemaking. Crucially, for many, this oppositional identity extends to organic or biodynamic certification standards themselves (Goldstein and Dubois, 2025). Natural winemakers often choose not to be organized and certified due to a variety of reasons. Some hold an inherent philosophical reluctance towards external regulation, perceiving it as a compromise to their vision of a natural wine that often adheres to even stricter, self-imposed requirements (Le Grand, 2025). For others, the associated costs of formal certification can be prohibitive (Holland, 2016). Thus producers' philosophical stance, combined with practical considerations, lead to the proliferation of diverse, often conflicting, standards among different natural wine groups. The absence of a clear, universally accepted definition for natural wine, coupled with ongoing debate over who precisely meets the criteria to be considered a natural winemaker, remains a persistent source of controversy among producers (Alonso González et al., 2022; Alonso González and Parga Dans, 2025). This fundamental disagreement over acceptable processes, interventions, and practices directly undermines cohesion within the natural wine community, resulting in recurrent confrontations and internal divisions. This is evidenced by the consistently negligible uptake of formal self-certification schemes and, consequently, the limited reach and effectiveness of natural wine associations. For instance, despite significant efforts to obtain state recognition for private initiatives, French legally recognized "vin méthode nature" label, introduced in March 2020, has seen limited adoption, with only 300 cuvées from 192 European producers certified in 2023 (Vin Méthode Nature, 2023). This limited producer engagement persists even as a discernible consumer demand for natural wine certification exists (Parga-Dans et al., 2023), indicating that the sector is predominantly characterized by producers who do not pursue formal certification for their wines (Alonso González et al., 2022). The authors document the controversies surrounding this certification, including opposition from European wine industry associations and disagreements among natural wine producers themselves. These ongoing debates reflect fundamental tensions between different production philosophies within the movement.

Despite the consequences for rural economies linked to viticulture, and the opportunities presented for sustainable agricultural

development, there is notably scant research addressing natural wine production decisions (Sáenz-Navajas et al., 2024; Alampi Sottini and Menghini, 2025). The few existing studies have only begun to explore specific facets. For instance, Ballester et al. (2024) investigated French and Spanish winemakers' evaluation of the sensory attributes of natural wines, notably concluding a negative sensory perception among them. Sáenz-Navajas et al. (2024) explored Spanish winemakers' attitude towards natural wine through a survey, similarly reporting negative attitude towards their taste. This latter study, however, also reveals a compelling paradox: winemakers appear to simultaneously dismiss natural wine's taste profile yet acknowledge its significant potential as an important market niche. This complex dynamic, further complicated by significant production challenges identified in regions like Georgia (Svanidze and Costa-Font, 2022), underscores a profound lack of comprehensive understanding regarding the characteristics and motivations of natural wine producers. A comprehensive global perspective on the characteristics and motivations of natural wine producers remains elusive. Fully understanding and characterizing this emerging market requires identifying both who produces natural wine and who intends to produce it in the future.

Given the market's inherent ambiguity and the identified research gap, this study adopts a pragmatic approach consistent with Sáenz-Navajas et al. (2023), who addressed this definitional challenge by asking producers to self-declare their natural wine production. For the purpose of this research, a natural wine producer is defined as such if they self-declare their wine as *natural*. This methodological choice allows us to empirically investigate this phenomenon by encompassing the diverse interpretations producers themselves hold. In this context, we treat natural wine as both a set of minimal-intervention production practices, and, crucially, as a self-ascribed entrepreneurial identity, and a distinct marketing label adopted by producers. This study aims to fill the aforementioned critical gap by systematically assessing the differences between natural wine producers and other wine producers across a variety of business characteristics, and by modeling the behavioral factors influencing adoption intentions.

This paper presents econometric findings based on survey data collected in the summer of 2023 from 514 winemakers across six European countries (France, Germany, Hungary, Italy, Portugal, and Spain). Our objective was to address two key research questions: (RQ1) Who states to be producing natural wine in Europe? and (RQ2) Who would like to produce natural wine in Europe? We provide an overview of the characteristics of European wine producers responding to our survey and describe the differences in personal motivation between natural wine producers and non-producers. We analyze the key factors of producers' behavior towards natural wine production by applying a logistic regression model. Furthermore, we apply the Theory of Planned Behavior (TPB, Ajzen, 1991) using a Partial Least Square Structural Equation Model (PLS-SEM) to identify the drivers of intention to produce natural wines. By providing a better understanding of actual and prospective natural wine producers, the results of this research can be useful for designing institutional rural policies and management measures promoting the growth and sustainability of this unique viticulture segment in rural areas. To our knowledge, our study is the first to provide a systematic assessment of the differences between natural wine producers and wine producers who do not produce natural wine across a variety of business characteristics.

The remainder of this paper is structured as follows: Section 2 presents the theoretical background and a review of the relevant literature. Section 3 details the conceptual framework, and hypotheses grounding our investigation in the TPB. Section 4 outlines the methodology and data collection. Subsequently, Section 5 report empirical findings. Finally, Section 6 discusses the results before the paper offers its concluding remarks.

2. Background and literature review

The introduction of synthetic chemicals has had a large impact on global agricultural production (Carvalho, 2006). Since the 1970s, conventional agriculture has employed new techniques to increase yield and farm productivity, particularly through the use of chemicals (e.g. pesticides, fertilizers, etc.), mechanization and genetic improvements. Grapevines are pesticide-intensive crops that comprise 3.5 % of total agricultural land in the EU. They receive 15 % of the synthetic pesticides used in major crops, raising growing concerns about the associated health and environmental risks (e.g. Devi et al., 2022; Tripathi et al., 2020). In response, alternative approaches to conventional agriculture have emerged and been certified, among which organic and biodynamic practices merit special attention.

In contrast to the practices employed in conventional viticulture, organic grape production entails a significant restriction on the use of pesticides (Maykish et al., 2021). Since 1992, the EU defines and regulates organically grown grapes (Regulation EU848/2018), while organic wine was first certified in 2012 (Regulation EU203/2012). As part of the Green Deal farm-to-fork strategy, the EU Commission has invested 9 billion euros in research aimed at reducing the use of the most hazardous synthetic pesticides and to explicitly favor organic farming, in order to meet the 25 % target for agricultural land under organic farming by 2030 (Romanazzi et al., 2022; Negro et al., 2015). The viticulture sector in the EU is on its way to identifying and adopting more environmentally sustainable practices (such as the introduction of fungus-resistant grape varieties, namely PIWI, a German acronym for Pilzwiderstandsfähige Reben, or the proposal of a new regulation around the adoption of New Genomic Techniques), aimed at reducing chemicals while increasing environmental services (Pomarici and Vecchio, 2019), like soil fertility, biodiversity, etc. There is no doubt that the adoption of organic and biodynamic practices comes at a price (Mariani and Vastola, 2015), often counterbalanced by a premium price paid by consumers or financial subsidies offered according to the European Common Agricultural Policy (CAP). Likewise, producers reported several barriers to the adoption of new genomic techniques (NGTs), including ethical concerns, consumer acceptance influenced by misinformation, and legislative uncertainties, particularly within the EU framework (Agnoli et al., 2025).

Considering that biodynamic agriculture is the most restrictive of these processes, some considerations are in order. First, a double certification is required to produce biodynamic wines: one for being organic according to the EU regulation, and one for being biodynamic according to private rules fixed by a private body like Demeter or Biodyvin (Castellini et al., 2017). Producers must comply with both sets of such regulations to be allowed to display the eco-label on their bottles.

These alternative production practices are more labor-intensive, and come with additional production costs compared to conventional wine production (Delmas et al., 2008). If organic wineries are growing faster than their conventional counterparts, the necessary investments put a strain on their finance (Dainelli and Daddi, 2019). In a review study, Castellini et al. (2017) discuss the difficulty faced by wine producers in communicating the benefits of biodynamic wine production to consumers. Incentive-compatible experimental auctions have demonstrated that consumers are not willing to pay more for wines that are certified biodynamic, although such wines must comply with more stringent production requirements and carry a higher production cost than their organic counterparts (Scozzafava et al., 2021). Considering the cost and length of the certification procedure and the limited consumers' awareness concerning eco-labels, some wine producers make the decision to follow the guidelines without engaging in the certification process (Fanasch and Frick, 2020).

In contrast to organic and biodynamic wine producers, natural wine producers cannot make use of a third-party-certified eco-label as a signal to consumers. Eco-labels available are not certified by an external body, but by associations of natural wine producers (Wei et al., 2023).

Nevertheless, it can be reasonably inferred that the number of wine producers utilizing associations' eco-labels is considerably smaller than the estimated number of natural wine producers (Goldstein and Dubois, 2025). The Raisin natural wine app accounts for 2,663 natural wine producers in Europe (Raisin, 2024). This suggests that the vast majority of natural wine producers do not pursue certification for their wines. The effectiveness of the natural wine certification as a signal is therefore questionable (Connelly et al., 2011), since most natural wine producers do not view it as a reliable and valid indicator of the credence attributes they are attempting to convey.

The exact scale of natural wine production in Europe remains unclear. Sáenz-Navajas et al. (2023), in their work on natural wine, define natural wine simply by asking producers to self-declare as natural wine producers (as we do in this research). The absence of a clearly defined category hinders the precise quantification of production. Alonso González et al. (2022) postulate for example that natural wine represents 2 % of the total wine production in France. However, the lack of a discernible indicator of category signal (in the sense of Negro et al., 2015) for natural wine poses a significant challenge for academics willing to study natural wine production.

While there is a growing body of research on the demand side of natural wine markets, the supply side remains an under-investigated area. Some recent studies have focused on the natural wine phenomenon (Alonso González and Parga-Dans, 2023; Le Grand, 2024), physicochemical and sensory specificities of natural wines (Sáenz-Navajas et al., 2023; Wei et al., 2023) and the attitude of wine producers towards natural wines (Sáenz-Navajas et al., 2024).

Natural wine production offers significant benefits for rural economies, fostering both environmental sustainability and economic diversification. The shift towards less contaminating viticultural practices directly mitigates environmental externalities, thereby enhancing the natural environment surrounding vineyards. Concurrently, growing consumer acceptance and increased willingness to pay generate new market value, expanding the market beyond traditional classifications to create novel wine products and employment opportunities. Recognizing these multifaceted contributions, it is imperative for researchers, regulators, and market practitioners to identify the drivers and potential barriers to natural wine adoption, as well as producer profiles that can strategically reposition local economies and their output in national and international markets. Despite this recognized importance, a crucial gap remains in the literature regarding the supply-side factors influencing natural wine production, which our research aims to address.

The application of the TPB to farmer behavior has been critically reviewed and its methodological best practices outlined (Sok et al., 2021), highlighting its robust utility in understanding agricultural decision-making. Consistent with this recognized utility, the TPB has been employed in a variety of studies to assess farmers' intention to learn about sustainability in online contexts (Novak et al., 2025), to engage in agri-environmental schemes (Sander et al., 2024), to diversify their agricultural production (Senger et al., 2017), to engage in low carbon agriculture (Swallow and Barkemeyer, 2024) or to use green pesticides (Ataei et al., 2021). Although the TPB primarily theorizes that attitude, subjective norm, and perceived behavioral control predict behavioral intention, it is also plausible that interrelationships exist among these constructs. For instance, it may be argued that subjective norm directly predicts both attitude and perceived control. Concerning social capital, scholars contend that the values conveyed by others serve as a source of more favorable perceptions regarding attitude and perceived control (Castillo et al., 2021; Han et al., 2022; Ren et al., 2022). In their studies, Liñán & Santos (2007) and Liñán and Chen (2009) defined subjective norm as a form of social capital and demonstrated a causal relationship between the constructs. Furthermore, it is proposed that perceived behavioral control exerts a direct influence on attitude, while simultaneously acting as a mediator of intention. Prior research has also demonstrated that an individual's conceptualization of the human-nature relationship plays a critical role in shaping

pro-environmental attitude and values, which in turn influence intentions to engage in sustainable behaviors (Kim et al., 2023). Specifically, individuals with a robust eco-friendly identity are more prone to exhibit pro-environmental attitude and engage in green behaviors (Martin and Czellar, 2016). The current research posits that the human-nature relationship exerts a positive influence on attitude toward the production of natural wine. Finally, the literature highlights the role of business size on the perceived capability to adopt sustainable practices (De Oliveira et al., 2023; Sinkovics et al., 2021). This is primarily because larger wineries have generally easier access to financial, technological and human resources. All the above considerations lead to an extended version of the TPB which is presented in the next section.

3. Conceptual framework

The TPB is employed to organize our approach to the RQs and hypotheses addressed here. The standard model is composed of three constructs capturing attitude, subjective norm, and perceived behavioral control. These determine intention to produce natural wine and eventually stated behavior. Particularly, our RQs concern two different instances of the decision process. First, the decision of farmers to produce natural wine. Second, the intention among non-producers to produce natural wine in the future. The overall approach is illustrated by Fig. 1.

More specifically, a logistic regression is applied to address RQ1, “Who states to be producing natural wine in Europe?” (Section 4.2). This analysis identifies the explanatory power of attitude, subjective norm and perceived behavioral control on the probability of producing natural wine. Based on the TPB, RQ2, “Who would like to produce natural

wine in Europe?” is addressed applying Partial Least Squares Structural Equation Modeling (PLS-SEM) (Section 4.3) and adopting the three aforementioned constructs to predict intention to produce natural wine among respondents who are not yet producing it.

Concerning the intention to produce natural wine the hypotheses tasted using the standard TPB are the following:

- H1.** Wine producers’ attitude toward the production of natural wine have a positive effect on their intention to produce natural wine.
- H2.** Subjective norm has a positive effect on their intention to produce natural wine.
- H3.** Wine producers’ perceived behavioral control regarding the production of natural wine has a positive effect on their intention to produce natural wine.

In order to capture more complex relationships among the three main predictors of the TPB we address the following hypotheses (Fig. 2):

- H4.** Subjective norm has a positive effect on wine producers’ attitude toward the production of natural wine.
- H5.** Subjective norm has a positive effect on perceived behavioral control regarding the production of natural wine.
- H6.** Wine producers’ perceived behavioral control has a significant effect on attitude toward the production of natural wine.
- H7.** Wine producers’ attitude towards the production of natural wine mediates the relationship between subjective norm and the intention to produce natural wine.
- H8.** Wine producers’ perceived behavioral control towards the production of natural wine mediates the relationship between subjective norm and the intention to produce natural wine.
- H9.** Wine producers’ attitude towards the production of natural wine mediates the relationship between perceived behavioral control and the intention to produce natural wine.

Our extended TPB model is enriched to address the following two additional hypotheses:

- H10.** Wine producers’ relationship with nature exerts a positive influence on their attitude toward the production of natural wine.
- H11.** The size of the winery has a positive effect on wine producers’ perceived behavioral control to produce natural wine.

4. Methodology and data

4.1. Survey

According to the TPB, behavioral intention is associated with three factors: (i) *attitude*, namely an individual’s positive or negative evaluation of the behavior itself; (ii) *subjective norm*, which is the perceived social pressure to perform or not perform the behavior, based on the individual’s perception of what significant others expect or think about the behavior; and (iii) *perceived behavioral control*, representing individuals’ perception of how easy or difficult it would be to perform the behavior, considering factors such as personal skills, resources, and environmental constraints. Consistent with the TPB framework and to ensure methodological rigor, behavioral intention is defined precisely by its target, action, context, and time (TACT). In this study, the specific behavioral intention examined is “producing (action) natural wine (target) at their winery (context) in the future (time),” reflecting a clear operationalization to understand winemakers’ intent regarding future natural wine production.

Table 1 displays the TPB, together with the other variables analyzed in this paper.

The questionnaire measures *Attitude* through three items denoting

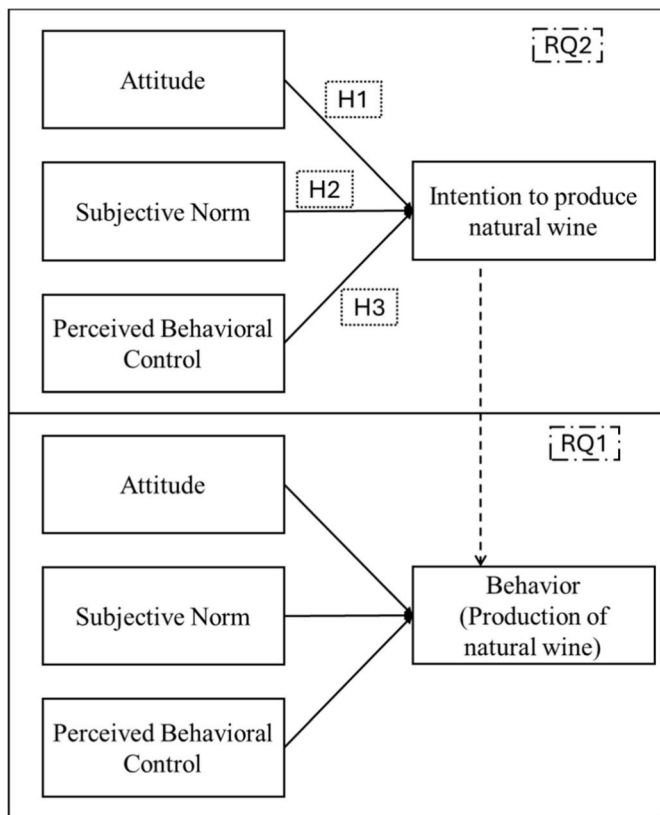


Fig. 1. Conceptual model

Note: RQ1 is addressed through an econometric model based on the full sample of respondents to predict production of natural wine; RQ2 is addressed through PLS-SEM based on the sample of non-producers to predict intention to produce natural wine. The dashed arrow indicates a causal relation not addressed in this paper.

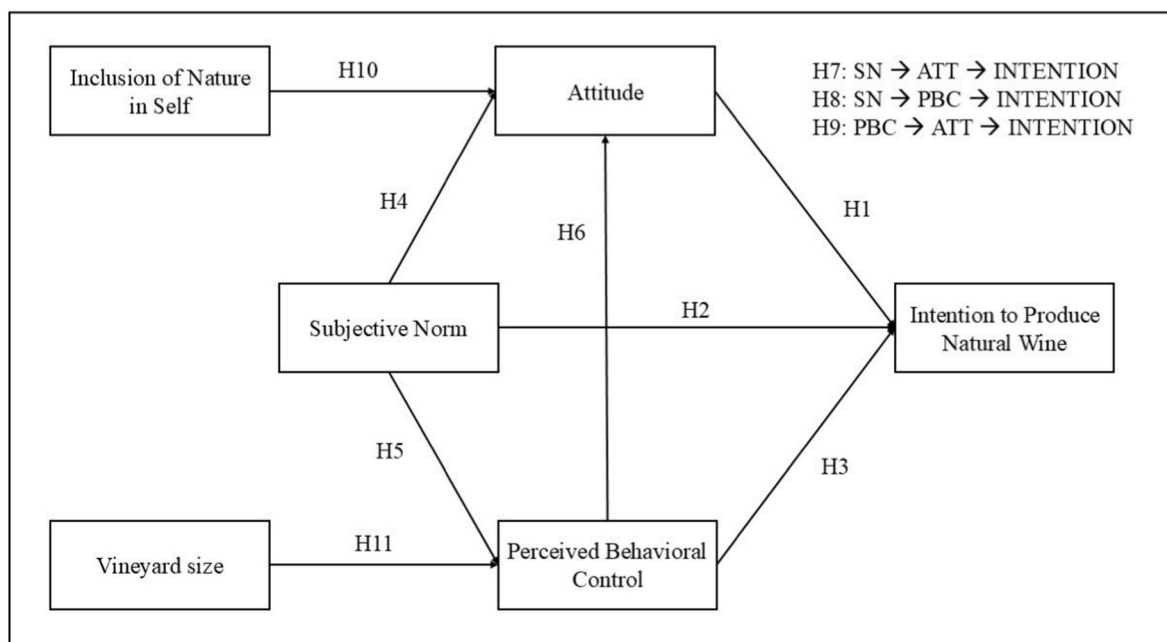


Fig. 2. Extended TPB model.

Table 1
Constructs and survey questions.

| Construct | Survey question | Measure | Respondents | Reference |
|------------------------------|---|-----------------------|-------------|--|
| Behavior | Do you produce natural wine? | Binomial (0/1) | P & NP | Tomić Maksan et al. (2019) |
| Subjective Norm | Other winemakers encourage me to produce natural wine | Likert Scale (1–5) | P & NP | Tomić Maksan et al. (2019) |
| | My friends are producing natural wine | | | |
| Perceived Behavioral Control | I have resources, time, and opportunities to produce natural wine | Likert Scale (1–5) | P & NP | Caliskan et al. (2021) |
| Attitude | For me production of natural wine is desirable | Likert Scale (1–5) | P & NP | Ajzen (2006) Verbeke & Vackier (2005) |
| | For me production of natural wine is healthy | | | |
| Intention | For me natural wine has a good taste | Likert Scale (1–5) | NP | Caliskan et al. (2021) Caliskan et al. (2021) |
| | I intend to produce natural wine | | | |
| Inclusion of Nature in Self | My willingness to produce natural wine is strong | Likert Scale (1–7) | P & NP | Schultz (2002) |
| | Select the picture that best describes your relationship with the natural environment | | | |
| Vineyard size | | Continuous (hectares) | P & NP | |
| | Turnover in 2022 | | | |

Note: P=Producers of natural wine; NP=Non-producers of natural wine; 1 (strongly disagree) to 5 (strongly agree) Likert scale.

whether the production of natural wine is desirable, healthy and whether it has a good taste (Ajzen, 2006; Caliskan et al., 2021; Verbeke and Vackier, 2005). Those items may not immediately seem to tap into a purely strategic and economic production decision. Nevertheless, for wine producers, attitude towards the product itself is a fundamental and direct driver of production behavior, often reflecting deeper philosophies and personal values beyond purely economic calculations (Goldstein and Dubois, 2025). For a winemaker, believing in the inherent desirability, taste, or health attributes of natural wine is a crucial personal conviction that directly shapes their attitude toward producing it. This aligns with the well-established understanding that farmers’ decisions, especially in niche or alternative agriculture, are significantly influenced by intrinsic motivations, values, and identity, which often complement or even precede purely economic considerations (e.g. Burton, 2004; Han et al., 2021; Li et al., 2025). These items therefore serve as valid indicators of the winemaker’s overall evaluation of natural wine, which then informs their intention to engage in its

production. *Subjective norm* was measured using two items capturing the encouragement by other wine producers, and the influence of friends in producing natural wine (Tomić Maksan et al., 2019). *Perceived Behavioral Control* was measured by whether farmers have the resources, time, and opportunities to produce natural wine (Caliskan et al., 2021). Finally, *Intention* was measured using two items assessing the winemaker’s perceived likelihood and willingness to produce natural wine (Caliskan et al., 2021).

Prior to the development of the questionnaire, we conducted preliminary research through interviews with natural wine producers at local and international trade fairs. Thus, given the research objectives and the anticipated complexity of data collection, a short (10-min) survey was developed to be accessible to both producers and non-producers of natural wine (see Table 1).

Adopting a pragmatic approach consistent with Sáenz-Navajas et al. (2023), who addressed the natural wine definitional challenge by asking producers to self-declare their production, the total analytical sample of

514 producers was categorized into two distinct groups based on their self-reported engagement in natural wine production. Respondents were asked: "Do you produce natural wine?" Those who answered *Yes* were classified as natural wine producers (n = 384), while those who answered *No* were categorized as non-natural wine producers (n = 130).

To facilitate the participation of wine producers in countries throughout Europe, the survey has been translated into six languages (French, German, Hungarian, Italian, Portuguese and Spanish). Next, the survey has been translated back to English to guarantee uniformity of translation across countries. According to data provided by the International Organisation of Vine and Wine (OIV, 2024), these seven languages, in addition to English, collectively represent a coverage of 92 % of native languages among wine producers in Europe. It may be reasonably assumed that this approach encouraged a higher level of engagement and contributed to an increase in the number of responses received.

4.2. Data collection and sample description

The first step in our data collection involved compiling a comprehensive database of environmentally sustainable wine producers across Europe. We manually extracted the contact details of European biodynamic wine producers from Demeter (Biodynamic Federation) and Biodyvin (International Union of Bio-Dynamic Winegrowers) lists of certified wineries (1,338 and 215 wineries respectively). Additionally, through a non-disclosure agreement with Raisin, we were able to access the comprehensive dataset of all natural wine producers listed on their platform (2,663 natural wine producers in Europe). The compiled data underwent a rigorous cleansing process to identify and remove duplicates. We also manually gathered available online information, including contact details for wineries without dedicated websites. This meticulous process resulted in a final list of 3,316 European wine producers, of which 2,205 had valid email addresses.

The survey was distributed via email between June and August 2023, with an initial mailing list and one reminder. To maximize reach, it was also sent to all identified natural wine associations in Europe, including Raw Wine (United Kingdom), ViniVeri and ViNatur (Italy), AVN and SAINS (France), APVN (Spain) as well as relevant Wine Advisory Boards. Furthermore, it was disseminated via the European Association of Wine Economists (EuAWE) network across Europe, as well as through Wineturism.com in Italy, and through the use of social media platforms such as LinkedIn to maximize reach and awareness. From this outreach, 820 wine producers completed the questionnaire. Following a thorough data cleaning process, our final sample comprised 514 producers from six EU countries, yielding an initial response rate of approximately 25 % of our broad target population (and 14 % of the number of European natural wine producers listed on Raisin). For the PLS-SEM estimation, we utilized the full sample of 514 observations. However, for the Logit model estimation, the effective sample size was reduced to 412 observations. This reduction was primarily due to missing data on the income variable. We opted to retain the income variable in the Logit regression despite the sample reduction, as its inclusion significantly improved the model's identification and overall robustness.

4.3. Econometric modelling

The estimation of a logistic regression model allows us to infer the determinants of becoming a natural wine producer (RQ1). Analytically, we consider the production of natural wine, *NW*, as a dichotomous variable, assuming a value of 1 if the respondent declares producing natural wine and a value of 0 otherwise. Accordingly, we estimated a bivariate logit model using a maximum likelihood estimator (Aldrich and Nelson, 1984; Archer and Lemeshow, 2006), as follows:

$$L = \ln\left(\frac{P}{1-P}\right) = \alpha + \beta_1 \text{Att} + \beta_2 \text{SN} + \beta_3 \text{PBC} + \beta_4 \text{Turnover} + \beta_5 \text{Countries} + e \quad (1)$$

Where *P* is the probability to produce natural wine, $\left(\frac{P}{1-P}\right)$ is the odds ratio representing the probability that the winemaker declares producing natural wine, α is the intercept of the logistic regression, β_1, \dots, β_5 are the coefficients for the model predictors, and *e* is the error term.

In line with the TPB, we use as independent variables the resulting latent variable scores for Att (Attitude), SN (Subjective Norm) and PBC (Perceived Behavioral Control) which were generated by the SEM analysis. This ensures a consistent measurement strategy for both the intention and the behavior models. To account for firm-specific heterogeneity, the winery's annual turnover for 2022 was included as a logarithmic transformation, smoothing out skewness and reducing the influence of outliers. To capture the geographic breakdown of the data, country dummy variables have been introduced. We constructed four dummy variables reflecting the distribution of respondents across regions: France (47.7 %), Italy (16.3 %), Germany and Hungary (16.5 %), and Spain and Portugal (19.6 %).

4.4. Structural equation modelling

Structural equation modelling allows us to answer the RQ2. The research hypotheses of the extended TPB model were tested using PLS-SEM. This methodology offers robust results with small samples, without assuming data normality (Hair et al., 2014; Wong, 2013). The analysis was conducted using the software package SmartPLS 4 (Ringle et al., 2022). Once the reliability and validity of the measurements had been established (see the Appendix), an investigation into the relationship between variables was conducted, and the significance of the proposed hypothesis was evaluated accordingly. A bootstrapping technique was applied to estimate the structural models, using 5,000 iterations and a significance level set up at $p < 0.05$.

5. Results

5.1. Key differences between natural wine producers and non-producers of natural wine

This section identifies and presents the key statistical differences observed between natural wine producers and non-producers within our sample. Understanding these variations provides the foundational data for later interpretation regarding potential producer typologies, barriers to natural wine adoption, and pathways for future expansion within the viticulture sector. Our analysis reveals compelling differences across various factors, as summarized in [Tables 2 and 3](#).

Unsurprisingly, natural wine producers exhibit significantly more favorable attitude regarding the desirability, healthfulness, and taste of natural wines compared to non-producers ([Table 2](#)). Natural wine producers also exhibit greater confidence in their perceived behavioral control regarding natural wine production than non-producers. T-test results indicate that natural wine producers typically possess smaller vineyards and generate lower annual revenue compared to non-producers.

Beyond the TPB constructs examined above, we also explored a broader set of self-reported motivations for natural wine production. This exploratory analysis ([Table 3](#)) does not test the TPB framework nor directly address our research questions. However, it provides additional contextual insight into how producers and non-producers perceive various motivational factors differently. As the variables do not meet the assumption of normality, comparisons are based on non-parametric tests. Kolmogorov-Smirnov and Mann-Whitney U tests yielded

Table 2
Descriptive statistics for producers and non-producers of natural wine.

| Variable | Non-producers (n = 130) | | Natural wine producers (n = 384) | | Min-Max | T-test |
|--|-------------------------|-----------|----------------------------------|-----------|------------|---------|
| | Mean | Std. Dev. | Mean | Std. Dev. | | |
| Attitude | | | | | | |
| Desirable | 2.38 | 1.190 | 4.34 | 0.876 | 1–5 | 19.97** |
| Healthy | 2.78 | 1.213 | 4.33 | 0.928 | 1–5 | 15.19** |
| Good taste | 2.18 | 1.032 | 4.05 | 0.992 | 1–5 | 18.35** |
| Subjective Norm | | | | | | |
| Friends producing natural wine | 2.45 | 1.245 | 3.76 | 1.108 | 1–5 | 11.31** |
| Encouragement by other winemakers | 2.35 | 1.133 | 3.22 | 1.284 | 1–5 | 6.18** |
| Perceived Behavioral Control | | | | | | |
| Control on resources, time and opportunities | 3.00 | 1.419 | 4.29 | 0.833 | 1–5 | 13.89** |
| Control variables | | | | | | |
| Size of vineyards (in hectares) | 25.13 | 27.25 | 13.77 | 17.180 | 1–100 | 5.54** |
| ln total turnover (in euros) | 14.85 | 2.02 | 14.17 | 2.06 | 7.17–18.42 | 2.98*** |
| Inclusion of Nature in Self | 5.18 | 1.380 | 5.86 | 1.124 | 1–7 | 5.47*** |

Note: 1 (strongly disagree) to 5 (strongly agree) Likert scale, **p < 0.05, ***p < 0.01.

Table 3
Motivations for the production of natural wine, differences between producers and non-producers.

| | Natural wine Producers (n = 384) | Non-producers (n = 130) | Kolmogorov-Smirnov Test | U test |
|--|----------------------------------|-------------------------|-------------------------|-----------|
| | Mean | Mean | D | Z-value |
| What motivates production of natural wine | | | | |
| Own personal conviction and interest in the environment | 4.70 | 3.74 | −0.484*** | −10.59*** |
| Better market opportunities for wine | 2.77 | 4.01 | 0.487*** | 10.17*** |
| Develop export markets | 2.54 | 3.39 | 0.315*** | 6.95*** |
| Higher quality of natural wine | 4.06 | 1.87 | −0.615*** | −14.36*** |
| Owner's or shareholders' interest | 2.46 | 3.31 | 0.356*** | 6.12*** |
| It is what you/they want to drink | 4.50 | 3.30 | −0.512*** | −10.93*** |
| To create an alternative to standardized and technological wines | 4.12 | 3.59 | −0.296*** | −5.13*** |
| To try doing something new | 3.32 | 3.72 | −0.048 | 2.95 |

Note: 1 (strongly disagree) to 5 (strongly agree) Likert scale, **p < 0.05, ***p < 0.01.

statistically significant results, indicating that significant median differences exist between the groups across several motivation dimensions.

The analysis of motivations reveals compelling divergent views between the groups, highlighting distinct typologies. Natural wine producers are overwhelmingly driven by intrinsic motivations such as their *own personal conviction and interest in the environment*, a belief in *higher quality of natural wine*, and a desire to *create an alternative to standardized and technological wines*. They are also significantly motivated by producing *what they want to drink*. This defines a typology centered on values, authenticity, environmental stewardship, and a personal connection to the product.

In stark contrast, non-producers perceive the motivations for natural wine production largely through an extrinsic lens, believing it is driven

by *better market opportunities for wine*, a desire to *develop export markets*, and *owner's or shareholders' interest*. The only variable not exhibiting a statistically significant difference was the perception of natural wine as a source of innovation.

5.2. What predicts who becomes a natural wine producer?

Table 4 reports the results of the logit regression model. The production of natural wine is driven by positive attitude towards it, with an odd ratio 7.83 times higher than that observed among non-producers of natural wine. Subjective norm, and the opinion of other winemakers and friends have no influence over the production of natural wine. Conversely, the availability of resources, time, and opportunities to produce natural wine is associated with increased production (odd ratio 2.42 higher for producers than non-producers of natural wine). Finally, firms with higher annual turnover are less likely to produce natural wine than firms with lower turnover (odd ratio 0.83). These findings confirm that natural wine producers are different from the other wine producers.

5.3. Winemaker motivations to produce natural wine

The preceding findings indicate that perceived behavioral control and attitude are the primary factors influencing wine producers' decisions to produce natural wine. It thus becomes pertinent to ascertain the factors that motivate winemakers to produce natural wine, by responding to the following question: What would make you a natural wine producer?

After evaluating the measurement model (including reliability and discriminant validity) using PLS-SEM in SmartPLS (see the Appendix), we first estimate the standard TPB model to identify the predictors influencing natural wine production intentions. This baseline model

Table 4
Logit estimates on the production of natural wine.

| Variables | Production of natural wine | |
|------------------------------------|----------------------------|----------|
| | Odds ratio | Z-stat |
| Attitude (Att) | 7.83 | 6.88*** |
| Subjective Norm (SN) | 1.01 | 0.04 |
| Perceived Behavioral Control (PBC) | 2.42 | 5.05*** |
| ln Turnover 2022 (in euros) | 0.83 | −2.16** |
| Constant | 2.68 | 0.70 |
| Log Likelihood | | −109.077 |
| Pseudo R ² | | 0.545 |
| Number of obs. | | 412 |

Notes: **p < 0.05, ***p < 0.01. Including countries dummies as control variables. Hosmer-Lemeshow goodness of fit test indicates a good fitting model (X² = 4.58, with p < 0.01). Overall rate of correct classification 88.1 %, sensitivity 94.02 %, specificity 72.07 %.

provides a fundamental understanding of the direct relationships between attitude, subjective norm, perceived behavioral control, and the intention to produce natural wine. The standardized path coefficients and their significance levels for the PLS-SEM are presented in Fig. 3.

Results show that the only construct affecting intention to produce natural wine is attitude, with a positive sign ($\beta = 0.293, p < 0.001$). However, subjective norm and perceived behavioral control result to be not significantly driving intention.

The standard model explains 10 % of the variance in Intention ($R^2 = 0.10$). The extended model explains 43.5 % of the variance in Attitude, 13.2 % in Control, and 9.6 % in Intention. Although the R^2 for Intention remains low, the extended model accounts for more variance in key constructs, thus offering greater overall explanatory power. We then explore the extended version of the TPB to further confirm the stability and validity of our conclusions, as well as to gain additional insights into winemaker behavior. Fig. 4 presents the standardized path coefficients and their significance levels obtained from the PLS-SEM analysis.

Wine producers' strong Inclusion of Nature in Self has a significant positive effect on wine producers' attitude toward producing natural wines (H10, $\beta = 0.114, p < 0.001$; Inclusion of Nature in Self→Attitude). The size of the vineyard was found to be negatively and significantly connected to Perceived Behavioral Control (H11, $\beta = -0.082, p < 0.001$; Vineyards Size →Perceived Behavioral Control).

Attitude is positively associated with intention (H1, $\beta = 0.351, p < 0.001$; Attitude→Intention to produce natural wine), suggesting that a positive attitude towards the environment and personal conviction drive intention to produce natural wine. The influence of subjective norm on intention is not significant (H2, $\beta = -0.021, p > 0.05$; Subjective Norm→Intention to produce natural wine) leading us to reject H2. A similar pattern is observed in the relationship between perceived behavioral control and intention (H3, $\beta = 0.013, p > 0.05$; Perceived Behavioral Control→Intention to produce natural wine), leading us to reject H3.

Subjective norm (influence from important people) have a significant positive direct effect on Attitude ($\beta = 0.551, p < 0.001$) and on Perceived Behavioral Control ($\beta = 0.378, p < 0.001$), indicating that social influences play a crucial role in shaping wine producers' individual attitude and perceived behavioral control with regards to the production of natural wines. These results lend support to the acceptance of H4 and H5.

Finally, Perceived Behavioral Control has a significant positive direct effect on Attitude ($\beta = 0.268, p < 0.001$), emphasizing its crucial influence in shaping wine producers' attitude towards the production of natural wines. This finding lends support to H8.

Table 5 assessed the mediation effects and H7, H8 and H9. Mediation was assessed in SmartPLS using bootstrapped indirect effects. The results (Table 5) indicate that all three indirect effects are statistically significant, confirming the presence of mediation. More specifically, subjective norm exerts a significant positive mediation effect on attitude, which in turn influences the intention to produce natural wines ($\beta = 0.193, p < 0.001$). This indicates that subjective norm exerts a significant indirect effect on wine producers' intentions to produce natural wine through

their attitude, thereby supporting H7.

Subjective norm also exerts a significant positive mediation effect on the control of resources, time and opportunities, which subsequently influences wine producers' intention to produce natural wine ($\beta = 0.35, p < 0.001$). This underscores the role of subjective norm in determining perceived behavioral control, which subsequently influences intentions. This finding lends support to H8.

Finally, perceived behavioral control (resources, time, and opportunities) has a significant positive indirect effect on intention through attitude ($\beta = 0.094, p < 0.003$). This indicates that perceived behavioral control influences the intention to produce natural wine indirectly via attitude (i.e., perceiving natural wine as healthy, desirable, and having a good taste), thereby supporting H9.

6. Discussion

This study contributes to the nascent literature on natural wine production by applying the TPB to this unique agricultural segment. Our findings reveal distinct typologies between natural wine producers and non-producers, providing crucial insights into the behavioral and social barriers to adoption, as well as the potential pathways for future expansion within the viticulture sector.

A fundamental typology emerges from the marked differences between natural wine producers and non-producers, particularly concerning their stated intrinsic motivations. Natural wine producers consistently demonstrate a deep personal conviction regarding the inherent qualities and benefits of natural wine. This is notably absent among non-producers, for whom a less favorable attitude toward these core attributes represents a significant barrier to adoption. This attitudinal divergence is not surprising and aligns with existing literature on winemakers' perceptions of natural wines. For instance, a survey of Spanish winemakers by Sáenz-Navajas et al. (2024) found that producers often hold negative attitude toward the flavor and quality of natural wines. Critically, Spanish winemakers' positive attitudes toward natural wine were significantly correlated with their overall environmental awareness in everyday life. Those with the highest ecological consciousness scores showed the most positive attitudes toward natural wine despite sharing quality concerns with other producers. This perspective is further supported by Ballester et al. (2024), who demonstrated that both French and Spanish winemakers perceive natural wines to be of lower overall quality, a perception that persisted regardless of whether they were given production information. This suggests that non-producers primarily view the natural wine category from a conventional, quality-driven perspective, often lacking the deeper intrinsic motivations and understanding of product value that characterize natural wine producers. This is consistent with the findings of Cullen et al. (2013) who argue that environmental innovations are often not adopted because they provide limited commercial benefits and a lack of marketing benefits for businesses. The study found that the costs associated with these innovations tend to outweigh the benefits gained by the wine businesses. This interpretation of motivations is also in line with contemporary research highlighting the critical role of non-economic factors, such as personal conviction and environmental interest, in sustainable agriculture adoption (e.g., Ataei et al., 2021; Novak et al., 2025; Swallow and Barkemeyer, 2024). Furthermore, the Van Dijk et al. (2016) study on unsubsidized agri-environmental measures provides a direct parallel to our findings, demonstrating that self-identity is a dominant predictor of a farmer's intentions, often outweighing extrinsic factors like financial compensation. This strongly supports our observation that pro-environmental attitude and personal conviction are key drivers of intention among natural wine producers, a group that engages in practices that are often unsubsidized and more personal than economic.

Our results further contribute to the TPB framework by showing a nuanced, indirect pathway through which subjective norm (e.g., encouragement from other winemakers and friends) and perceived

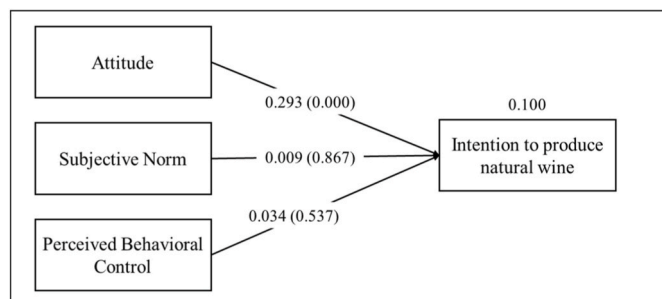


Fig. 3. Estimations from the standard Theory of Planned Behavior.

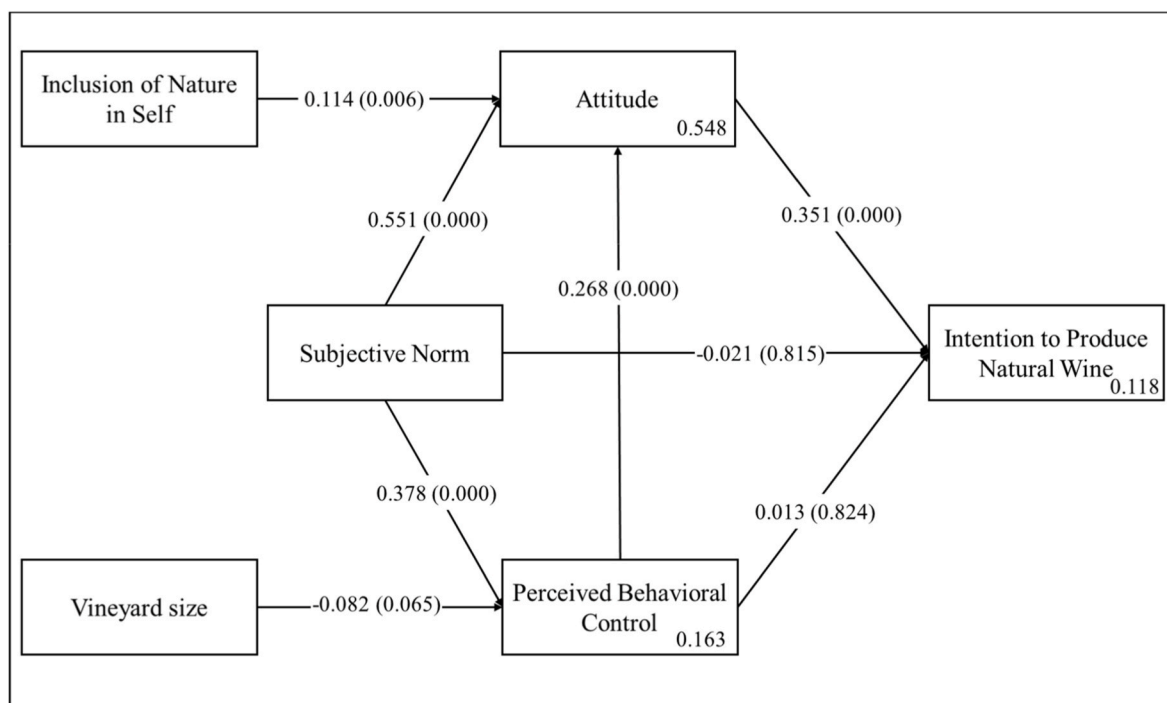


Fig. 4. Structural Equation Model results for non-producers of natural wine.

Table 5
Test of mediation effects.

| Indirect Paths | Indirect effect (β) | t-stat | P values | Hypothesis |
|--|---------------------|--------|----------|---------------|
| Subjective Norm → Attitude → Intention | 0.193 | 3.36 | 0.001 | H9: accepted |
| Subjective Norm → Perceived Behavioral Control → Intention | 0.035 | 2.81 | 0.005 | H10: accepted |
| Perceived Behavioral Control → Attitude → Intention | 0.094 | 2.96 | 0.003 | H11: accepted |

behavioral control (e.g., access to resources, time, opportunities) do not directly predict intentions to produce natural wine, but rather exert a strong indirect influence via attitude. This is particularly salient for natural wine: the absence of a universally unified certification or regulatory body likely means that social norm diffuses differently than in industries with less fuzzy technical and structural boundaries. Instead of direct peer pressure immediately translating into an intention to produce, encouragement from other winemakers or friends appears to gradually shape a producer's underlying beliefs about the "desirability," "healthiness," or "good taste" of natural wine. This evolving positive attitude then become the direct drivers of intention. Similarly, perceived resource availability (whether a producer feels they have the knowledge, time, or equipment) does not instantly lead to action. Instead, it first appears to strengthen their confidence and refine their overall positive evaluation of natural winemaking, thereby fostering a more favorable attitude that subsequently predicts their intention. This pattern highlights that in a specialized, values-driven, and less regulated field like natural wine, social and practical factors are foundational to a producer's internal conviction and evaluation of the practice, rather than immediately dictating their actions. These findings on the significance of subjective norm parallel studies highlighting the importance of social networks and community influence in sustainable adoption (see Rizzo et al., 2024). They also resonate with the work of Zeweld et al. (2017), who demonstrated that for smallholder farmers, social capital and training are significant predictors of attitude and normative issues

toward sustainable practices. The informal peer networks and knowledge sharing within the natural wine community are a form of social capital that, as our results suggest, play a crucial role in shaping attitude and intentions.

The analysis also points to a typology where natural wine producers feel more empowered and confident when it comes to navigating the complexities of non-conventional production. For non-producers, a lower sense of behavioral control likely represents a significant barrier, stemming perhaps from a perceived lack of specific knowledge, resources, or time. This perceived difficulty is consistent with findings from Ballester et al. (2024), which noted that natural wines tend to have higher levels of volatile acidity and turbidity, sensory attributes that can be perceived as defects and contribute to the perception of production difficulty. Ghali et al. (2022) similarly identified that the perceptions of technical complexity and a lack of knowledge are significant barriers for grape growers adopting agroecological practices. This resonates with recent work underscoring how educational interventions and access to relevant information are crucial for fostering sustainable farming practices (e.g., Novak et al., 2025).

Furthermore, the findings suggest a typology where natural wine production is more prevalent among smaller-scale, potentially more artisanal or niche operations. For these producers, a lower volume or a distinct business model might be more feasible or desirable. In contrast, for larger, more conventional producers, the perceived economic implications (e.g., lower immediate revenue, challenges in scaling up non-conventional production methods) could represent a significant barrier. The observed differences in business characteristics, such as smaller vineyard sizes and lower revenue among natural wine producers (Table 2), combined with their intrinsic motivations for quality and creating alternatives (Table 3), suggest a distinct entrepreneurial typology.

Finally, this study significantly contributes to the TPB literature by applying the framework to the novel context of natural wine production, offering crucial insights into the predictiveness of its constructs in non-conventional farming decisions. While the TPB has been widely utilized in agricultural adoption studies (e.g., Rosário et al., 2022; Sok et al., 2021), its application to a nascent, values-driven segment like natural

wine provides unique theoretical and practical contributions. Our operationalization of the attitude construct represents a deliberate departure from standard TPB formulation. Informed by prior qualitative research (following Ajzen's (1991) methodological recommendations), our attitude items focus on producers' beliefs about the product's attributes (e.g., taste, healthiness) rather than on a direct evaluation of the production behavior. We acknowledge that this approach risks conflating product preference with production intention and may limit the comparability of our findings with other TPB studies. However, given the value-driven nature of natural winemaking, where producers' personal consumption preferences and production decisions are deeply intertwined, we argue this operationalization captures the specific attitudinal dynamics relevant to this context. Our findings reveal that producers' favorable attitude towards natural wines play the primary role in predicting intentions to adopt natural wine production, aligning with TPB literature emphasizing the centrality of attitude in volitional behaviors, especially those driven by personal values or beliefs (e.g., Tama et al., 2021). This attitude is, furthermore, strongly shaped by the producer's bonds with nature, underscoring the influence of environmental identity and intrinsic values on pro-environmental agricultural practices (e.g., Udall et al., 2021).

Our measurement of subjective norm also diverges from Ajzen's original TPB formulation, as our items reflect descriptive norm ("what others are doing") rather than injunctive norm ("what others think one should do"). This choice reflects the informal, peer-driven nature of the natural wine movement, where adoption decisions are more influenced by observing respected peers' practices than by explicit social pressure or approval. While this operationalization captures the specific social dynamics within natural wine networks, we acknowledge it limits direct comparability with standard TPB studies that focus on injunctive norm. Future research could benefit from incorporating both descriptive and injunctive norm measurements to provide a more comprehensive understanding of social influence in natural winemaking adoption decisions. Our results show that subjective norm (e.g., encouragement by peers) and perceived behavioral control do not directly predict intentions; however, both subjective norm and perceived behavioral control predict attitude, thereby indirectly influencing intentions. This nuanced pattern offers a significant theoretical contribution to the TPB. The absence of a universally unified, third-party certification for natural wine is particularly salient here, as it shapes the environment in which these factors operate. In such a less formalized context, social influence and perceived capabilities may not directly translate into immediate behavioral intentions. Instead, they appear to primarily work by shaping an individual's internal evaluation of the behavior (attitude) before directly translating into an intention to act. This is in line with research indicating that the relative strength of the TPB pathways can vary, based on the specific behavior and population studied, with attitude often mediating the influence of other constructs in complex decision-making scenarios where external validation or clear pathways might be absent (e.g., Xu et al., 2024). Furthermore, that attitude is also predicted by external factors such as access to resources, opportunities, and time availability, provides empirical support for extending the TPB framework to incorporate broader contextual determinants (e.g., Price and Leviston, 2014). This comprehensive understanding of how intrinsic and extrinsic factors collectively shape attitude, and subsequently intentions, provides a detailed understanding of the decision-making process in this unique agricultural context. These insights are crucial for understanding the applicability and potential adaptations of the TPB framework in nascent, values-driven agricultural segments like natural wine production.

7. Conclusion, limitations and future research

Our study addresses two main questions. First, we identify the differences between wineries producing any amount of natural wine and those not producing natural wine at all. Second, focusing on the latter

and using the Theory of Planned Behavior, we model the underlying decision-making process enhancing a non-producer of natural wine's intention to engage in natural wine production in the future.

Regarding the first question, *access to resources, time, opportunities* and *encouragement by peers* favor the decision to produce natural wine. Turning to the intentions model, we mostly confirm the main results obtained from the adopter/non-adopter juxtaposition. Some of the results are further explained through the patterns identified by the structural model estimated. First of all, we find that the producers' favorable attitude towards natural wines play the main role and that such attitude depends on the producer's bonds with nature. There is a positive effect of running a small vineyard on a producer's intention to produce natural wine and this effect is found to be linked to the farmer's perceived behavioral control. Subjective norm, in the form of encouragement by peers, and perceived behavioral control does not directly predict intentions. Nevertheless, both subjective norm and behavioral control predict attitude and, thus, indirectly, intentions. Interestingly, attitude is also predicted by access to resources, opportunities and time availability. That is, attitude predicts intentions, but a series of intrinsic and extrinsic factors shape attitude and thus intentions.

To understand the practical implications of our findings, some non-technical comments are in order. We are in the presence of small-scale production and there are differences between natural wine producers and non-producers. Contrary to a selfish, profit driven perception by non-producers, natural wine producers associate their production decisions with their convictions regarding health consciousness, environmental awareness, willingness to consume natural wines, and desire to create alternatives to conventional wine production. This association between pro-environmental attitude and natural wine production must be taken into account, pointing to policy measures based on trust in the selfless, intrinsic motivation of natural wine production. Excessive regulation may crowd out such motivation. Thus, measures of certification, and policies favoring innovation, mitigation of environmental impacts and the promotion of cooperative strategies between the sector's stakeholders must support and complement the intrinsic foundations of natural wine production decisions. From a business perspective, marketing strategies that emphasize the specificities of natural wine and of the producers themselves, through storytelling, an emphasis on terroir and messages related to the environment and health, are important.

Like any other study, ours has limitations. Due to our data collection strategy, our sample is biased in favor of environmentally sustainable wine producers. While our modelling approach is minimally affected by this feature, it would be useful to obtain similar survey data from a more general public and for a broader range of countries, beyond the EU. In any case, as the stakes behind sustainable rural development, agriculture and viticulture loom larger, our study will hopefully be a modest beginning rather than the end of the inquiries needed to understand the motivations of natural wine production.

CRedit authorship contribution statement

Magalie Dubois: Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Investigation, Conceptualization. **Effrosyni Vasileiou:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis. **Lara Agnoli:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis. **Nikolaos Georgantzis:** Writing – review & editing, Writing – original draft. **Jean-Marie Cardebat:** Writing – review & editing, Resources, Investigation. **Jeremiás Máté Balogh:** Writing – review & editing, Resources, Investigation. **Raúl Compés Lopez:** Writing – review & editing, Resources, Investigation. **Joao Fernandes Rebelo:** Writing – review & editing, Resources, Investigation. **Luca Rossetto:** Writing – review & editing, Resources, Investigation.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendices.

Table A and B present the relevant items used to assess the reliability and validity of the constructs. In our model, Cronbach’s alpha coefficients exceed 0.7 for all the variables, and the composite reliability of the constructs is also higher than 0.7, indicating high-scale reliability, in conformity with the recommendations of Hair et al. (2014). In terms of convergent validity, the factor loadings and average variance extracted (AVE) for the items exceed the acceptable thresholds of 0.7 and 0.5, respectively, as proposed by Henseler et al. (2009). It was thus determined that the constructs exhibited convergent validity and discriminant validity.

Table A
Measurement model

| Constructs | Items | Outer loadings | Cronbach Alpha | Composite reliability | Average variance extracted (AVE) |
|-----------------|---|----------------|----------------|-----------------------|----------------------------------|
| Attitude | For me production of natural wine is desirable | 0.954 | 0.880 | 0.892 | 0.714 |
| | For me natural wine has a good taste | 0.778 | | | |
| | For me production of natural wine is healthy | 0.795 | | | |
| Subjective Norm | My friends are producing natural wine | 0.622 | 0.717 | 0.784 | 0.597 |
| | Other winemakers encourage me to produce natural wine | 0.899 | | | |
| Intention | I intend to produce natural wine | 0.904 | 0.926 | 0.928 | 0.864 |
| | My willingness to produce natural wine is strong | 0.954 | | | |

Table B
Discriminants validity (Fornell-Larcker criterion - (Fornell and Larcker, 1981))

| | Attitude | Control | Intentions | Subjective Norm |
|-----------------|----------|---------|------------|-----------------|
| Attitude | 0,898 | | | |
| Control | 0,485 | 1,000 | | |
| Intentions | 0,309 | 0,179 | 0,965 | |
| Subjective Norm | 0,572 | 0,350 | 0,187 | 0,880 |

In PLS-SEM, the standardized root means square residual (SRMR), the normed fit index (NFI), and the root mean square error of approximation (RMS theta) are common metrics for evaluating the overall model fit. A model is deemed to exhibit an optimal fit if it exhibits an SRMR value within the range of 0–0.08, as recommended by Hair et al. (2014). These metrics facilitate the evaluation of the model’s suitability and accuracy, as illustrated in Table C.

Table C
Model fits

| Statistics | Saturated model | Estimated model |
|------------|-----------------|-----------------|
| SRMR | 0.022 | 0.045 |
| d_uls | 0.027 | 0.112 |
| d_g | 0.028 | 0.041 |
| Chi-square | 80.612 | 112.294 |
| NFI | 0.965 | 0.951 |

Data availability

Data will be made available on request.

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