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Consumer behavior toward virtual wine experiences as a technology-based sustainable transformation

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Introduction: This study examines the behavior of wine consumers toward virtual wine experiences (VWEs), which are innovative and resilient solutions adopted by actors in the wine and wine tourism sectors during the recent pandemic, with an inherent potential for sustainability. While the phenomenon is still evolving due to the digitalization megatrend and the marketing potential of VWEs for wineries, the literature on this topic is still limited.

Methods: We apply an extended Theory of Planned Behavior (TPB), relying on a large and representative sample of Italian wine consumers to analyze the effect of personal wine involvement, risk attitude, and future wine tourism intention in addition to attitude, subjective norms, and perceived behavioral control.

Results: The results confirm that attitude, subjective norms, perceived behavioral control, wine involvement, and future wine tourism intention positively influence intentions, while risk aversion negatively affects behavior.

Discussion: This first application of the TPB to technology-based wine experiences. It provides key insights for researchers, practitioners (such as wineries and wine tourism stakeholders), and policymakers for the development of VWEs.

KEYWORDS

theory of planned behavior, wine, structural equation modeling, consumer behavior, virtual experience

1 Introduction

Virtual wine experiences (VWE) can be a useful tool to the wine tourism industry, representing a technology-based sustainable strategy for the resilience of wineries in times of crisis and, potentially, beyond. This technological transformation opens the sector to new potential sustainable scenarios. For example, VWE can reduce people transfers for reaching a destination and the related carbon footprint (Ozdemir et al., 2023).

This sustainability potential can be particularly relevant in the context of wine as it is among the most consumed beverages worldwide. According to recent estimates, in 2021 people consumed over 236 million hectoliters of wine and the trend has been rather stable over the last 10 years (International Organization of Vine and Wine, 2021). Italy, the second largest EU wine market and the third globally, has an estimated consumption of 24.2 million hectoliters. In this country, wine consumption connected to tourism involves about 15 million tourists and generates a revenue of over 2.6 billion euros (Statista, 2023). In 2020, the lockdown measures and the mobility limitations following the Covid-19

pandemic have disrupted many consumption occasions but, at the same time, have also stimulated the diffusion of new ways to drink and experience wine. Internet-based experiences are one of them, which we further define as virtual wine experiences (VWEs). The basic idea behind VWEs is to entertain consumers by offering the possibility to virtually interact with winemakers or wine experts while tasting wine from the comfort and safety of their homes and discovering new brands or wine regions, also delivering educational content. Hence, VWEs were initially developed as an innovative strategy to overcome the imposed limitations (i.e., mobility restrictions and social distancing) and many wineries implemented various forms of VWEs in the aftermath of the pandemic (Garibaldi and Pozzi, 2020). To date, several wine actors like wineries and wine regions are still offering VWEs to interact with consumers all over the world and to attract potential visitors. Recent literature suggests that virtual reality can be used to stimulate onsite visits for wine tourism (Alebaki et al., 2022; Monaco and Sacchi, 2023). Studies on virtual tourism also indicate that participation in such experiences can positively influence the intention to visit the virtually browsed destination on-site (El-Said and Aziz, 2022; Lu et al., 2022). Therefore, virtual tours may have significant marketing potential. Moreover, VWEs provide several advantages for wine consumers as the possibility to receive wine from faraway wineries at home and taste it under the guidance of a knowledgeable person who provides them with comparable educational content to on-site visits (Szolnoki et al., 2021). This allows the lowering of the costs of both retrieving the product and gathering knowledge about it (Gastaldello et al., 2022). The virtual turn of wine consumption seems to be part of a longer-term strategy for wine operators, several of which are still offering these services. For instance, the governing body of the Conegliano Valdobbiadene Prosecco Superiore DOCG geographical indication is providing virtual tastings to introduce new producers from the region and highlight unique features of the local wines. Several wine producers are also offering pre-recorded or live-streamed guided tastings through different platforms like Wine.com or Divinea.it. Therefore, VWEs may represent a marketing tool for wine regions and their producers including smaller, unknown ones, which represent a conspicuous part of the winery population in Italy (i.e., 44%) (Nomisma Wine Monitor, 2022). Yet, to the best of the authors' knowledge, the scientific evidence around VWEs is still rather scarce, and little attention has been devoted to investigating the behavioral patterns of their main users, i.e., wine consumers.

To fill this gap, the present work builds on a sound methodology proposing an extended Theory of Planned Behavior (TPB) model to unravel the drivers of wine consumers' intentions and behavior toward VWEs, intended as virtual wine tastings, virtual winery tours and wine events. Moreover, the study supports the results' generalizability by making use of a large, nationally representative sample. Findings contribute to the theoretical development of TPB models and provide strategic information to understand consumers' behavior toward VWEs, highlighting avenues for future research.

The paper is structured as follows. Section 2 reviews the literature on wine tourism digitalization and describes the theoretical framework used and the hypotheses tested, and data and methods are outlined in section 3. Finally, results and discussion are presented, followed by the conclusions.

2 Literature review

2.1 The digitalization of wine consumption

During the recent pandemic, several wine actors worldwide have implemented VWEs to offer consumers a new way to interactively taste local wines. Recent statistics reveal that six in ten U.S. wineries conducted virtual tastings, and about three in ten Italian wineries declared performing them (Statista, 2023). After the Covid-19 restrictions' removal, some of them only kept providing VWEs as corporate or group activities upon request (e.g., see Amarendra and Das, 2022), while others have maintained them in their offer. Several examples can be found among Italian governing bodies of geographical indications known as Consortia (in Italy called *Consorzi di Tutela*), wine organizations (e.g., the German Wine Institute), and single producers. Since the pandemic, the Italian Consorzio of Conegliano Valdobbiadene Prosecco is organizing paid virtual wine tastings during the low season. More precisely, consumers receive Prosecco wine bottles from different producers at home and attend a virtual guided tasting where wine experts of Consortium explain the wine style, terroir, and history behind it. The pandemic has contemporarily played a role in fostering the diffusion of similar tools among consumers, leading them to a behavioral rethinking while acquiring familiarity with streaming platforms (Alaimo et al., 2020).

The phenomenon is gaining increasing attention among academics as well. Pre-Covid literature had already identified virtual reality (VR) as a strategic tool for developing multisensory wine tourism offers (Martins et al., 2017). More recently, researchers explored consumers' perception of virtual wine tastings via Zoom platform through the 4Es experience economy framework (Paluch and Wittkop, 2021), the virtual embodiment effect occurring in virtual wine tastings and purchase decisions (Wen and Leung, 2021), and the impact of context and tasting environment during in-presence and VR-simulated wine tastings (Torrico et al., 2020). A study done by Amarendra and Das (2022) qualitatively compared virtual and cellar-door wine tourism experiences considering different virtual wine tasting experiences (happy hours, Livestream, and personalized tastings) and tours. The authors highlight the potential of Livestream tasting activities in creating brand loyalty and virtual tours as a long-term destination marketing strategy. Additionally, Szolnoki et al. (2021) conducted a supply analysis for virtual wine tastings involving over 1,000 wineries in 40 countries. The authors identified virtual wine tastings as a valuable and profitable activity to attract new customers and to keep existing ones loyal. Lastly, Gastaldello et al. (2022) explored the drivers of interest in virtual wine tourism experiences on a sample of Italian wine tourists. They found that personal involvement with wine plays a crucial role as a long-term stimulus, jointly with consumers' willingness to support wineries and acquaintance with other wine digital tools. The authors argue that such experiences should not be seen as a substitute for regular wine tourism but as a separate product or marketing tool for wineries. Moreover, the authors found that the pandemic promoted interest in VWEs, particularly the resulting fear and anxiety, which might have pushed scared tourists to explore virtual options. Similarly, El-Said and Aziz (2022) found that hazard attributes, mostly related to the risk of Covid-19 infection, increased the intention to take virtual tours among individuals from Germany and the Sultanate of Oman.

2.2 The TPB model and the hypotheses development

Ajzen's Theory of Planned Behavior Ajzen (1991) is one of the most widely applied and validated theory to predict consumer behavior. To date, a plethora of researchers in the field of economics and tourism used this framework or variations of it to explain, for example, consumers' purchase intentions toward planning or replicating a wine holiday (Sparks, 2007; Quintal et al., 2015). TPB postulates that the intention to behave in a particular manner results from the combined effect of subject's attitude toward that behavior, subjective norms, and perceived behavioral control. Moreover, a subject's behavior results from the intention and the perceived behavioral control.

Attitude (ATT) can be described as a positive (or negative) feeling toward a given action or, more generally, a behavior. For example, positive feelings toward VWEs can strengthen people's intention to partake in one, as many tourism studies found that attitude positively predicts travel intentions (Pratt and Sparks, 2014; Quintal et al., 2015; Han et al., 2016; Meng and Cui, 2020). Subjective norms (SN) embody the influence of significant others' beliefs on one's intentions to behave in a certain way: when SN is favorable, meaning that the subject's reference group of people feels the target action is the right thing to do, its effect on the intention is positive. Although the direction of the relationship between SN and intention is supported by empirical evidence, the significance of this effect is controversial. For example, Sparks (2007) applied the TPB to a large sample of Australian wine tourists and found that the effect of SN on the intention to plan a wine holiday was positive but not significant. Diversely, Quintal et al. (2010) proved that SN in the form of social pressure to engage in the target behavior positively affects the intention. Nevertheless, the authors found that the size of this effect differ among the three countries analyzed (Japan, Korea, and China), suggesting that context and culture may play a role in moderating this relationship. Similarly, Sogari et al. (2023) use an extended TPB model on a large international sample to explore consumer's attitude toward adopting a healthy diet. These authors found significantly heterogeneous positive effects of subjective norms on the intention. Looking at behavioral studies on Italian consumers, which is the context of this paper, the effect of SN tends to be positive and significant (Vesci and Botti, 2019; Caliskan et al., 2021; Wolstenholme et al., 2021), leading us to expect the same outcome.

The third predictor in TPB is the perceived behavioral control (PBC), which reflects the subject's belief of having the means to pursue a target behavior. Such means can be tangible, e.g., financial, or intangible, like time or season (Lam and Hsu, 2006; Sparks, 2007).

Alike the previous predictors, empirical evidence from past studies proved that the effect of PBC on intention tends to be positive and often of substantial size (Sparks, 2007; Giampietri et al., 2016; Tomić Maksan et al., 2019; Vesci and Botti, 2019; Meng and Cui, 2020). Nevertheless, the effect of potential behavioral barriers resulting in PBC, formally referred to as control beliefs (Ajzen, 2015), can be negative whenever the perceived costs of pursuing a behavior are high (e.g., Sogari et al., 2023).

Sparks (2007) found PBC to have the greatest effect size among all the predictors (0.40) of future wine tourism intentions, and Giampietri et al. (2018) obtained the same outcome regarding the intention to purchase in short supply chains. Other studies on regular wine consumption (Tomić Maksan et al., 2019), processed red meat consumption reduction (Wolstenholme et al., 2021) or bicycle tourism (Han et al., 2016), found that the path between PBC and intention was always positive and significant but smaller than the one generated by attitude and subjective norms. Hence, while the relative importance of PBC over other antecedents of the intention seems to vary across product categories, we expect PBC to positively predict the intention to partake in a virtual wine tasting experience.

The ultimate result of intention is the behavior, namely the observable response for a target action of interest. According to TPB theory, a subject behavior is the result of his/her intention to perform the behavior and his/her PBC. The relationship between intention and behavior (i.e., the so-called intention-behavior gap) has long been under debate (Sultan et al., 2020). Nevertheless, tourism literature mostly focuses on behavioral and loyalty intentions neglecting behavior, so we rely on the entire TPB as done by the research tackling food and wine consumption. Recent findings confirm the presence of the intention-behavior gap as the variance in behavior explained by the intention tends to be small (Sultan et al., 2020) or moderate (Tomić Maksan et al., 2019). Meanwhile, they also support the existence of a positive relationship between intention and behavior (Tomić Maksan et al., 2019; ElHaffar et al., 2020; Sultan et al., 2020). Moreover, there is evidence that attitude affects behavior through intention (Sultan et al., 2020; Caliskan et al., 2021).

Instead, the effect of PBC on behavior tends to be positive (Giampietri et al., 2018; Sultan et al., 2020). Given the increasing diffusion of VWEs prompted by the pandemic and the relatively low time and financial investment required to join one, especially if compared to in-presence alternatives (i.e., winery visits), we believe that PBC would positively predict individuals' behavior in our research context as well.

Considering these arguments and the current literature on TPB, we postulate the following hypotheses regarding the base TPB model to explain VWEs-related intention (VWEINT) and behavior (VWEBEH):

> *H1*: Attitude toward virtual wine experiences (ATT) positively affects intention to partake in a virtual wine experience (VWEINT)
>
> *H2*: Subjective norm (SN) positively affects the intention to partake in a virtual wine experience (VWEINT)
>
> *H3*: Perceived behavioral control (PBC) positively affects the intention to partake in a virtual wine experience (VWEINT)
>
> *H4*: Perceived behavioral control (PBC) positively affects the behavior toward virtual wine experience (VWEBEH)
>
> *H5*: Intention to partake in a virtual wine experience (VWEINT) positively affects behavior toward virtual wine experiences (VWEBEH)

H6: Intention (VWEINT) mediates the effect of attitude (ATT) on behavior (VWEBEH).

Nevertheless, past research pointed out that the original TPB cannot predict consumer intention and behavior as it is, and thus needs to be enriched by including other dimensions (Lam and Hsu, 2004). This potentially explains why many studies apply TPB by including predictors to ATT, PBC and SN. Accordingly, we propose an extended version of the TPB model to test the effect of other potential determinants of VWE-related intention and behavior.

The literature shows the critical role of risk in assessing tourism consumer behavior (Luo and Lam, 2020; Villacé-Molinero et al., 2021). Indeed, risk has to be accounted when referring to virtual wine tourism experiences as these represent a novel way of experiencing win, especially when customers have a little experience and knowledge of wine. Hence, since consumer decisions are taken in a context of uncertainty, we consider the role of risk attitude. According to Bauer (1960), risk is connected to outcome unpredictability or undesirability when purchasing a product or a service. Whenever the perceived losses connected to a target action are high, subjects will adjust their risk-taking behavior (Sarin and Weber, 1993). Such behavior is lastly affected by their willingness to take risks, i.e., their risk attitude (Hillson and Murray-Webster, 2007), which is an inherent and stable trait of human beings. Thus, attitude toward risk can lead individuals to either be attracted by riskier options (i.e., risk lovers) or to avoid them (i.e., risk averse individuals) (Weber et al., 2002; Wu and Chang, 2007).

At first glance, VWEs may be thought to benefit from a safer perception compared to cellar-door wine experiences. For instance, during the Covid-19 pandemic VWEs were associated with lower perceived losses (e.g., virtual experiences did not expose people to uncontrolled contact with potentially sick individuals). Coherently, recent tourism research has highlighted the negative impact of risk perception (Villacé-Molinero et al., 2021) and risk aversion (Luo and Lam, 2020) on travel intentions. Hence, VWEs may be seen as a safer way to pursue one's interest in wine. Nevertheless, preliminary evidence suggests that this hypothesis may not be true as these two activities are not considered substitutes (Gastaldello et al., 2022). Contrary, a source of perceived risk may be the novel and virtual nature of VWEs. When tourism experiences are purchased, all people have at hand the product description (e.g., duration, location, etc.), pictures, past experience (if any) and consumer reviews (Weathers et al., 2007). Still, ultimately, they can fully evaluate the quality only after living the real experience. The same happens for VWEs, which are often sold through the same channels as other tourism products and services (e.g., virtual travel agencies). Accordingly, the literature stresses how innovation can bring as much economic rewards as risks when it comes to market acceptance (Colombo et al., 2017), and how such risks can increase for new products due to a combination between limited knowledge and difficulties to evaluate their utility (Colombo et al., 2017; Aboulnasr and Tran, 2020).

VWEs are considered new products as they have started to be systematically offered only after the Covid outbreak. Therefore, both own's and others' past experiences are likely to be scarce and the perceived risk of unpredictable and undesirable outcomes from the experience can increase dramatically. Since the underlying perceived risk of purchasing a new product as VWE is higher, we expect that risk-averse subjects are likely to show a lower intention toward VWEs as well as a lower likelihood to join one (i.e., the behavior). Based on the above, the following hypotheses are tested:

H7: Risk attitude (RISKATT) negatively impacts the intention to partake in a virtual wine experience (VWEINT).

H8: Risk attitude (RISKATT) negatively impacts the behavior toward virtual wine experiences (VWEBEH).

Another critical issue of VWEs is the subjects' involvement with wine (WI). WI is a form of enduring or personal involvement and, as such, it is connected to the presence of a long-term personal relevance for a given product or service (Lockshin and Spawton, 2001; Ogbeide and Bruwer, 2013). The consumption of hedonic products like wine and wine tourism experiences is connected to pleasure and enjoyment, and it is known to generate a greater involvement (Lesschaeve and Bruwer, 2010) which can ultimately affect many aspects of wine consumers' behavior (e.g., Sparks, 2007; Bruwer and Buller, 2013). Thus, it is not surprising to find WI as a common trait of wine consumers and visitors of wine regions (e.g., Brown et al., 2007). Researchers usually distinguish between low and high-involvement wine consumers. Low-involvement consumers drink wine occasionally and are less interested in the product itself while highly involved consumers are frequent drinkers and wine spenders (Nella and Christou, 2014), and wine is in their lifestyle (Lockshin and Spawton, 2001; Brown et al., 2007). Moreover, there is evidence that highly involved wine tourists exhibit stronger wine tourism intentions (Brown et al., 2007; Sparks, 2007; Gastaldello et al., 2023) and revisit intentions (Nella and Christou, 2014). Since VWEs fall between wine consumption and wine tourism, we suppose that people having a stronger wine involvement exhibit stronger intentions to join a wine-related virtual experience. Therefore, the following hypothesis is postulated:

H9: Wine involvement (WI) is a positive antecedent of the intention to partake in a virtual wine experience (VWEINT).

Beyond attracting (new) wine consumers, VWEs are an interesting tool to promote wine tourism destinations. Since some traits of regular wine tourism (e.g., the atmospherics of the vineyards and the winery) are missing in VWEs (Amarendra and Das, 2022), virtual and offline experiences (e.g., wine tastings) are not perfect substitutes (Gastaldello et al., 2022). Thus, consumers may conceive the virtual option as a way to discover new wineries that may be visited in the future while lowering time and costs. If so, possessing a strong intention to go on a wine holiday in the next future (e.g., in the next year) should explain the intention toward VWEs, as follows:

H10: Future wine tourism intentions (FUTWTINT) are a positive antecedent of the intention to partake in a virtual wine experience (VWEINT).

Figure 1 reports all hypothesized paths for the base TPB model (white ovals) and the extended TPB model, with new constructs represented as light-grey ovals.

10.3389/fsufs.2024.1384011

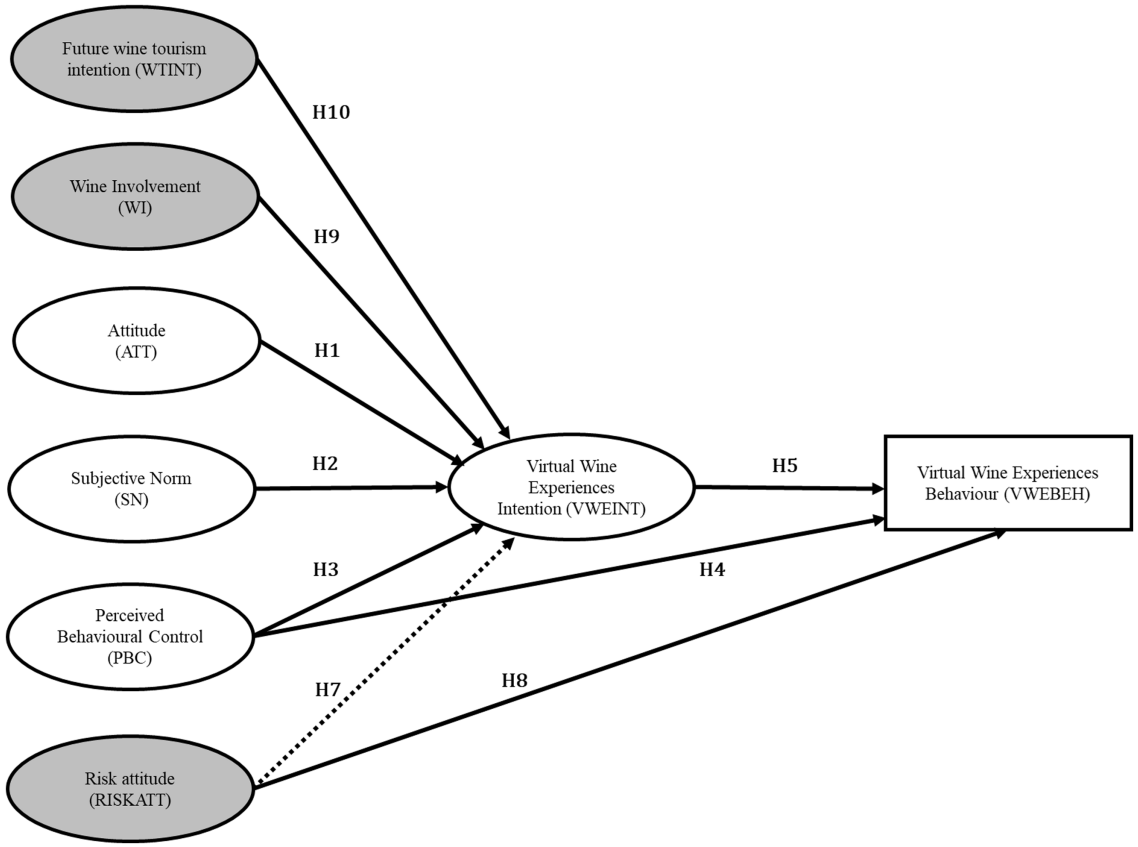

FIGURE 1
Hypothesized base and extended TPB paths. Note: Extended TPB constructs are represented as light-grey ovals; white ovals represent constructs from Ajzen's original TPB theory. VWEBEH is depicted with a rectangle as it is an observed variable. H6 = mediation effect: RISKATT ➔ VWEINT ➔ VWEBEH.

3 Materials and methods

3.1 Data collection

The study was carried out in Italy in January 2022 through a virtual survey distributed among wine consumers, which constitute the target population. Specifically, respondents had to be wine consumers with past wine tourism experience. People drinking wine less than once a month or purchasing wine less than once per year, and those who had not experienced wine tourism in the last 5 years were screened out through some initial filtering questions. This choice was made to ensure the responses' reliability as well as to involve consumers with a potentially longer-term interest in wine and wine experiences. Data collection was conducted by a professional online panel provider according to the quota sampling method to obtain a nationally representative sample in terms of age, gender, and geographic area of residence. All participant were Italian residents. A pilot study on a sample of 30 respondents was performed before the data collection to test the clarity and correctness of the questionnaire. The final sample includes 559 complete surveys. The study received ethical approval from the University of Padova in January 2022, and the research fully followed the principles stated by the Declaration of Helsinki.

3.2 Questionnaire description

The structured questionnaire consists of 4 separate sections. The first one includes the above-mentioned filter questions (i.e., past wine tourism experience, wine purchase and consumption frequency). Here, respondents were also provided with an example of a virtual wine experience, described as follows: "A virtual wine tasting involves the home delivery of a number of wine bottles and a tasting experience guided by wine professionals (producers, sommeliers, etc.), which allows you to learn about the wine, the winery, and the wine-growing region without the need to reach it physically." Other VWE examples mentioned to respondents are virtual winery tours and food and wine events. The second section includes questions to measure the TPB variables measured through several 7-point agree/disagree Likert type scales, namely: intention (1 statement) to participate in a virtual wine experience in the next future (VWEINT), behavior (VWEBEH), attitude toward virtual wine tourism experiences (ATT – 6 items, Cronbach's alpha = 0.92), subjective norms (SN – 3 items, Cronbach's alpha = 0.93), and perceived behavioral control (PBC – 3 items, Cronbach's alpha = 0.79). Scales for measuring ATT, SN and PBC are adapted from Lam and Hsu (2006) and Meng and Cui (2020).

VWEINT was measured through the following 7-point agree-disagree single-item construct, adapted from Sparks (2007): "I intend

to participate in a virtual wine tourism experience in the next 12 months." Also, VWEBEH was captured by the following statement (dummy variable): "Have you ever participated in a virtual wine tourism experience (e.g., virtual wine tastings)?." In this section, we also measured variables to be included in the extended TPB model such as risk attitude (RISKATT), wine involvement (WI), and future wine tourism intention (WTINT). In line with Dohmen et al. (2011), RISKATT was self-assessed through the following statement: "On a scale from 0 (not at all willing to take risks) to 10 (very willing to take risks), how would you assess your personal preference to take risks?." For data analysis, this scale was reversed so that higher values indicate greater risk aversion. We opted for this simple measure of risk attitude, as extensively done in the literature (Meraner and Finger, 2019; Höschle et al., 2023), to ensure proper survey length (due to the high number of questions in the survey), while producing results that can be compared to other elicitation methods (e.g., lotteries) (Dohmen et al., 2011). As for WI, we opted for Hirche and Bruwer's (2014) 10-items scale (Cronbach's alpha = 0.94), ranging from 1 = totally disagree to 7 = totally agree, while WTINT was assessed through a 7-point agree-disagree single-item construct adapted from Sparks (2007) and formulated as follows: "I plan to visit a wine region in the next 12 months." The single-item constructs were operationalized as scales, following Hair et al. (2019) and Petrescu (2013). Specifically, factor loadings were set to the square root of the best-guess reliability (0.85), while the error variance term was set to one less than the best-guess reliability. The third section focuses on aspects related to wine consumption and wine tourism habits while the fourth section investigates the socio-demographic characteristics of the sample units.

3.3 Data analysis

For data analysis, the study applied structural equation modelling (SEM) using IBM SPSS AMOS 27 software. First, confirmatory factor analysis (CFA) assessed the validity of the measurement model including all the latent constructs (ATT, SN, PBC, WI, WTINT, RISKATT, VWEINT). Being BEH an observed variable, it was excluded from the CFA analysis. Afterwards, we run the structural model to test both the base version of Ajzen's Theory of Planned Behavior and the extended TPB framework. Therefore, a Chi-square difference ($\Delta\chi^2$) tested the two models: notably, when a significant difference is shown, the extended version is preferred to the original. The goodness of fit of the models is tested considering the following cut-off values: less than 5 for CMIN/DF, less than 0.9 or more for CFI and TLI, less than 0.07 for RMSEA, less than 0.08 for SRMR (Hair et al., 2019).

4 Results

4.1 Sample description

The socio-demographic characteristics of the sample are shown in Table 1. Most respondents are between 35 and 64 years old (69.7%) and come from Northern Italy (47.1%). They are mostly employees (55.3%), with a high school qualification (51.5%), and with a medium economic class level (50.3%). The majority (65.7%) claim that the pandemic did not significantly impact their household income.

Regarding wine consumption and wine tourism-related habits (Table 2), 59.7% of the sample drinks wine at least 2–3 times a week (27% every day), and 39.9% purchase it at least once a week (8.6% more than once a week). The usual place for buying wine is the supermarket (44.7%) followed by specialized shops (27.4%), and about one-fifth of the respondents purchase wine directly from the producer (19.3%). The average price-per-bottle (0.75 L) paid ranges between 6 to 15 € for more than half of the sample (56%). Most respondents prefer to consume wine at home (69.2%), and about 56% of them normally store up to 5 bottles of wine at home. The 48% travel to a wine region 2–3 times a year, with visiting wineries and purchasing wine as the primary motivation. Finally, 26% of the sample has already taken part in a virtual wine tourism experience prior to the study.

TABLE 1 Socio-demographic information of the sample (N = 559).

Variable name	Categories	%
Gender	Male	50.1
	Female	49.6
	Other	0.4
Age	18–24 years	10.4
	25–34 years	12.7
	35–44 years	25.8
	45–54 years	20.6
	55–64 years	23.3
	over 64 years	7.3
Education (highest level completed)	Middle school or lower	5.9
	High school	51.5
	University (bachelor or master degree)	33.5
	Post-graduate	9.1
Monthly household income	Less than €2,000	38.8
	€2,000-4,000	50.3
	More than €4,000	10.9
Household income evolution after Covid-19	Worsened	27.5
	Unchanged	65.7
	Improved	6.8
Occupation	Employee	55.3
	Student	6.8
	Business owner	5.0
	Retired	9.7
	Unemployed or housewife	15.0
	Freelance	8.2
	Other	0.0
Geographical area of residence	Centre	18.4
	North-East	20.4
	North-West	26.7
	South and Islands	34.5

4.2 Empirical results

Correlations among variables are reported in Table 3. Sample respondents show a high PBC (mean value = 5.46), a high positive

10.3389/fsufs.2024.1384011

TABLE 2 Information on wine consumption and wine tourism habits of the sample ($N = 559$).

Variable	Categories	%	Variable	Categories	%
Wine consumption frequency	Once per month	8.4	Usual wine consumption place	Home	69.2
	2–3 times per month	12.3		Wine bar	9.3
	Once per week	19.5		Restaurant	14.1
	2–3 times per week	32.7		Special occasion	7.0
	Everyday	27.0		Online	0.4
Wine purchase frequency	1–2 times per year	5.2	Usual wine shopping outlet	Supermarket	44.7
	2–3 times per month	10.4		Discount	2.3
	Once per month	17.4		Wineshop	27.4
	2–3 times per month	27.2		Bar/restaurant	2.0
	Once per week	31.3		Winery	19.3
	2–3 times per week	8.6		Online	4.3
N. of wine bottles usually stored at home	None	2.1	Average expenditure on a wine bottle (0.75 L)	Less than 6 €	34.5
	1–5	56.0		6–15 €	56.0
	6–15	30.6		15–20 €	7.5
	more than 15	11.3		More than 20 €	2.0
How many times a year do you visit a wine region on average?				0	6.1
				1	27.4
				2–3	48.1
				More than 3	18.4
Usually, wine and visits to local wineries are the main reason why you visit a wine-growing region?				No	48.7
				Yes	51.3
Have you ever participated in virtual wine tourism experiences (e.g., virtual wine events, virtual tastings, virtual cellar tours)? (VWEBEH)				No	74.2
				Yes	25.8

TABLE 3 Correlations and descriptive findings between variables.

	1	2	3	4	5	6	7	8
(1) WI	4.52 (1.37)							
(2) ATT	0.564***	5.27 (1.31)						
(3) SN	0.714***	0.687***	4.28 (1.71)					
(4) PBC	0.441***	0.549***	0.399***	5.46 (1.18)				
(5) VWEBEH	0.372***	0.174***	0.352***	0.098**	0.26 (0.44)			
(6) RISKATT	−0.441***	−0.251***	−0.310***	−0.234***	−0.239***	4.64 (2.61)		
(7) VWEINT	0.621***	0.678***	0.674***	0.454***	0.336***	−0.297***	4.44 (1.67)	
(8) WTINT	0.496***	0.397***	0.351***	0.353***	0.144***	−0.336***	0.455***	5.34 (1.32)

Mean (Standard Deviation) for each variable on the diagonal.
***$p < 0.01$.
**$p < 0.05$.

attitude toward VWEs (5.27) and high subjective norms (4.28). Moreover, they are high involved in wine (4.52) and risk averse (4.64). They declare a great intention toward both future wine tourism (5.34) and virtual wine experiences (4.44).

The model performance is satisfactory as goodness of fit ($\chi^2 = 925.44$; DF = 255; $p < 0.001$; CMIN/DF = 3.63; CFI = 0.94; TLI = 0.93; RMSEA = 0.069; SRMR = 0.062). For convergent validity, we evaluated the standardized factor loading and construct reliability (Table 4). All standardized factor loadings are above the recommended threshold of 0.5, most of them having an optimal value above 0.7. Similarly, construct reliability for all constructs is above 0.7, and the average variance extracted (AVE) is always above the 0.5 threshold, in line with Hair et al. (2019) guidelines. We confirmed discriminant validity as the squared root of AVE is greater than the correlation between constructs.

The base and the extended TPB were estimated (Table 5). The base TPB model shows a good fit: $\chi^2 = 332.603$, df = 71, CMIN/DF = 4.685, CFI = 0.958, TLI = 0.946, SRMR = 0.060, RMSEA = 0.081. The results show that ATT ($\beta = 0.316$), SN ($\beta = 0.440$) and PBC ($\beta = 0.125$) have a significant and positive effect on the intention to partake in a virtual

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TABLE 4 Measurement model results from the confirmatory factor analysis.

Scale	Source	Item description	Item coding	Std loading	AVE	CR	Mean (SD)
Attitude toward virtual wine tourism experiences (ATT)	Lam and Hsu (2006)	For me, participating in virtual wine tourism experiences is an enjoyable activity	ATT1	0.899	0.74	0.94	5.27 (1.31)
		For me, participating in virtual wine tourism experiences is a positive activity	ATT2	0.895			
		For me, participating in virtual wine tourism experiences is a fun activity	ATT3	0.837			
		For me, participating in virtual wine tourism experiences is a worthwhile activity	ATT4	0.697			
		For me, participating in virtual wine tourism experiences is an enjoyable activity	ATT5	0.908			
		For me, participating in virtual wine tourism experiences is an attractive activity	ATT6	0.893			
Subjective norms (SN)	Meng and Cui (2020)	Many of the people who are important to me (friends, family) think I should have a virtual wine tourism experience	SN1	0.921	0.81	0.93	4.28 (1.71)
		Many of the people who are important to me (friends, family) would like me to experience wine tourism virtual	SN2	0.924			
		People whose opinion matters a lot to me (friends, family) view virtual wine tourism experiences positively	SN3	0.859			
Perceived behavioral control (PBC)	Meng and Cui (2020)	Whether or not to participate in a virtual wine tourism experience is entirely up to me	PBC1	0.625	0.57	0.79	5.46 (1.18)
		If I want, I can have a virtual wine tourism experience	PBC2	0.817			
		I have enough resources, time, and opportunities to experience wine tourism virtual	PBC3	0.8			

(Continued)

TABLE 4 (Continued)

Scale	Source	Item description	Item coding	Std loading	AVE	CR	Mean (SD)
Wine involvement (WI)	Hirche and Bruwer (2014)	I have a good general knowledge of wine	WI1	0.806	0.61	0.94	4.52 (1.37)
		Every now and then, I visit a wine seminar	WI2	0.832			
		Other people often ask me for advice regarding wine	WI3	0.853			
		Sometimes, when drinking wine, I like the intellectual challenge of complex tastes	WI4	0.711			
		Wine offers me relaxation and fun when life's pressures build-up	WI5	0.674			
		I am or would consider getting a member of a wine club	WI6	0.742			
		I take particular pleasure in wine	WI7	0.639			
		I regularly attend wine events/festivals	WI8	0.857			
		I very much enjoy spending time in a wine shop	WI9	0.858			
		Every now and then, I participate in a wine tasting	WI10	0.799			
Virtual wine tourism intentions (VWEINT)	Sparks (2007)	I intend to participate in a virtual wine tourism experience in the next 12 months					4.44 (1.67)
Future wine tourism intention (WTINT)	Sparks (2007)	I plan to visit a wine region in the next 12 months					5.34 (1.32)
Risk attitude (RISKATT)	Dohmen et al. (2011)	How would you assess your personal preference to take risks?					4.64 (2.61)

Std. Load, Standardized factor loading; AVE, Average variance extracted; CR, Construct Reliability; SD, standard deviation. VWEBEH is not reported as it is an observed variable (for this reason it was excluded from the CFA).

wine tourism experience. Moreover, intentions have a significant and positive effect on behavior (VWEINT ➔ VWEBEH $\beta = 0.411$) as opposite to PBC, which negatively predicts it ($\beta = -0.114$). It follows that H5 is confirmed, while H4 is only partially supported as a significant effect is reported but in a opposite direction than the expected one. R^2 estimates of the two dependent variables suggest the model explains 60.2 and 13.2% of their variance, respectively (see Figure 2).

The extended TPB model shows better goodness of fit than the base model: $\chi^2 = 995.110$; df = 277; CMIN/DF = 3.592; CFI = 0.937; TLI = 0.926; SRMR = 0.064; RMSEA = 0.068. The Chi-square difference between the two models is significant ($\Delta\chi^2 = 662.51$; df = 206; $p < 0.0001$). Moreover, the Parsimony Normed Fit Index (PNFI) is greater for the extended model (0.780), indicating it performs better than the base TPB (0.739) (Hair et al., 2019). Hence, we can conclude that the extended TPB model represents an improvement to the base TPB framework. Overall, the R^2 of both intention and behavior is greater than in base TPB (Figure 2).

Looking at path estimates, results highlight that ATT ($\beta = 0.304$), SN ($\beta = 0.308$), and PBC ($\beta = 0.064$) significantly and positively affect intentions. Similarly, wine involvement ($\beta = 0.150$) and the future wine tourism intention ($\beta = 0.143$) are significant antecedents of the intention, as opposed to risk attitude. Furthermore, we find that the behavior is positively determined by the intention ($\beta = 0.371$) and negatively affected by risk attitude ($\beta = -0.164$) and PBC ($\beta = -0.133$). In this case, 63.6% of the variance of VWEINT and 15.6% of VWEBEH are explained. We can conclude that H9, H10, and H8 are supported, while H7 is not.

Finally, we tested whether attitude affects behavior indirectly through intention (H6). The specific indirect effect is positive and

TABLE 5 Results for the structural model: comparison between the base TPB model and the extended one.

	Base TPB model		Extended TPB model	
χ^2	332.603		995.110	
CMIN/DF	4.685		3.592	
CFI	0.958		0.937	
TLI	0.946		0.926	
SRMR	0.060		0.064	
RMSEA	0.081		0.068	
	β	Sig.	β	Sig.
Dependent variable = VWEINT				
ATT	0.316	***	0.304	***
SN	0.440	***	0.308	***
PBC	0.125	***	0.064	**
WI			0.150	***
WTINT			0.143	***
RISKATT			0.001	
Dependent variable = VWEBEH				
VWEINT	0.411	***	0.371	***
PBC	−0.114	**	−0.133	**
RISKATT			−0.164	***

significant (β = 0.11; $p = 0.002$) with a non-significant direct effect (β = − 0.11; $p = 0.107$), showing that intention fully mediates the attitude-behavior relationship. Figure 2 reports the results of the base and extended TPB model for each tested hypothesis.

5 Discussion

5.1 Results discussion

This work implements the full TPB model to analyze virtual wine consumers' behavior related to dedicated virtual experiences. The research aim is to unravel drivers of intention and behavior toward this novel consumption pattern. In doing this, the study tests 9 causal hypotheses and 1 mediation effect by applying covariance-based SEM.

Results validate the efficacy of the TPB framework to explain the decision-making regarding VWEs' choice, as all TPB variables significantly predict the intention and behavior under investigation. Going into detail, evidence shows that people's intention to partake in VWEs is positively driven by subjective norms and their positive evaluation of such experiences (i.e., ATT). This result supports the H1 and H2 hypotheses and in line with the existing literature (Pratt and Sparks, 2014; Quintal et al., 2015; Han et al., 2016; Meng and Cui, 2020). Particularly, peer pressure (SN) emerges as the most powerful predictor of the intention in the base TPB model. We can reasonably explain this result as the novel feature of VWEs and, consequently, with the scarce personal experience of respondents on it. The literature explains this reasoning by stressing the primary role of others' opinion, i.e., word-of-mouth, in shaping new product purchase decisions, especially when such products are experience goods (Cui et al., 2012; Li et al., 2021). Hence, people may strongly rely on their peers' opinion when building their behavioral decisions on VWEs. Even in the extended model, the effect size of subjective norms slightly decreases but remains comparable to that of attitude.

Contrary to what we expected, the perceived behavioral control exerts a negative impact on the behavior. This result is in contrasts with many past TPB studies on agri-food products' consumption (see, for example, Sultan et al., 2020) and in line with some other (D'Souza et al., 2022). Instead, the perceived easiness of joining an VWE positively influences the intention, although to a minor extent. The contrasting effect of PBC on behavior is not related to the conflicting relationship from the new variables included in the extended model as it is found to be negative already in base TPB estimations. Particularly, the behavior explained by the model reflects whether respondents are VWEs' consumers. Instead, PBC deals with the respondent's belief of being in the condition to act according to the intention (Ajzen, 1991). Thus, the negative effect of PBC on behavior indicates that the more respondents feel in control of joining an VWE if they want to, the less likely they are to do it. When variables of the extended model are added to the base TPB (WI, WTINT, RISKATT), the PBC effect on VWEINT is almost halved, while its impact on VWEBEH slightly increases.

Nevertheless, the PBC-VWEBEH relationship does not necessarily hold for future behavior, leaving an open question for the next studies.

The effect of ATT on VWEINT remains consistent in sign as well with a small change in magnitude, and the same is observed for the relationship between intention and behavior. As hypothesized, the intention is a positive predictor of behavior (ElHaffar et al., 2020; Sultan et al., 2020): its effect size is greater than that of PBC in the base TPB model, in line with previous findings on food (e.g., Dunn et al., 2011; Giampietri et al., 2018) and wine consumption behavior (Tomić Maksan et al., 2019). This outcome suggests that the subject's personal preference for VWEs overcomes the negative effects of tangible and intangible perceived barriers in pursuing the target behavior.

Focusing on the additional variables included in the extended model, both future wine tourism intentions and wine involvement positively affect the intention. This result partially aligns with the findings of the exploratory studies from Gastaldello et al. (2022) and Sparks (2007), where WI is a positive predictor of interest in VWEs and future wine tourism intentions, respectively. Nevertheless, the former study found the relationship between wine tourism intentions and interest for VWEs to be not significant. This incongruency may be a consequence of different data collection timing or different nature of the outcome variable (i.e., interest instead of intention).

The fact that the effects of WI and WTINT are smaller compared to most TPB predictors except PBC, suggests they are less critical yet positive drivers of the intention to partake in an VWE.

Lastly, risk attitude does not seem to affect the intention, while it negatively impacts the behavior. This evidence highlights the existence of a perceived risk associated with VWEs, perhaps because of their intangible or less realistic nature compared to onsite visits. This effect reasonably stems from the still innovative nature of VWEs that would merit greater awareness among people through information campaigns. In this regard, Monaco and Sacchi (2023) see virtual tourism experiences based on the Metaverse as a strategy that, being more immersive, could reduce the associated perceived risk and prepare visitors for real visits before travelling. At present, risk attitude

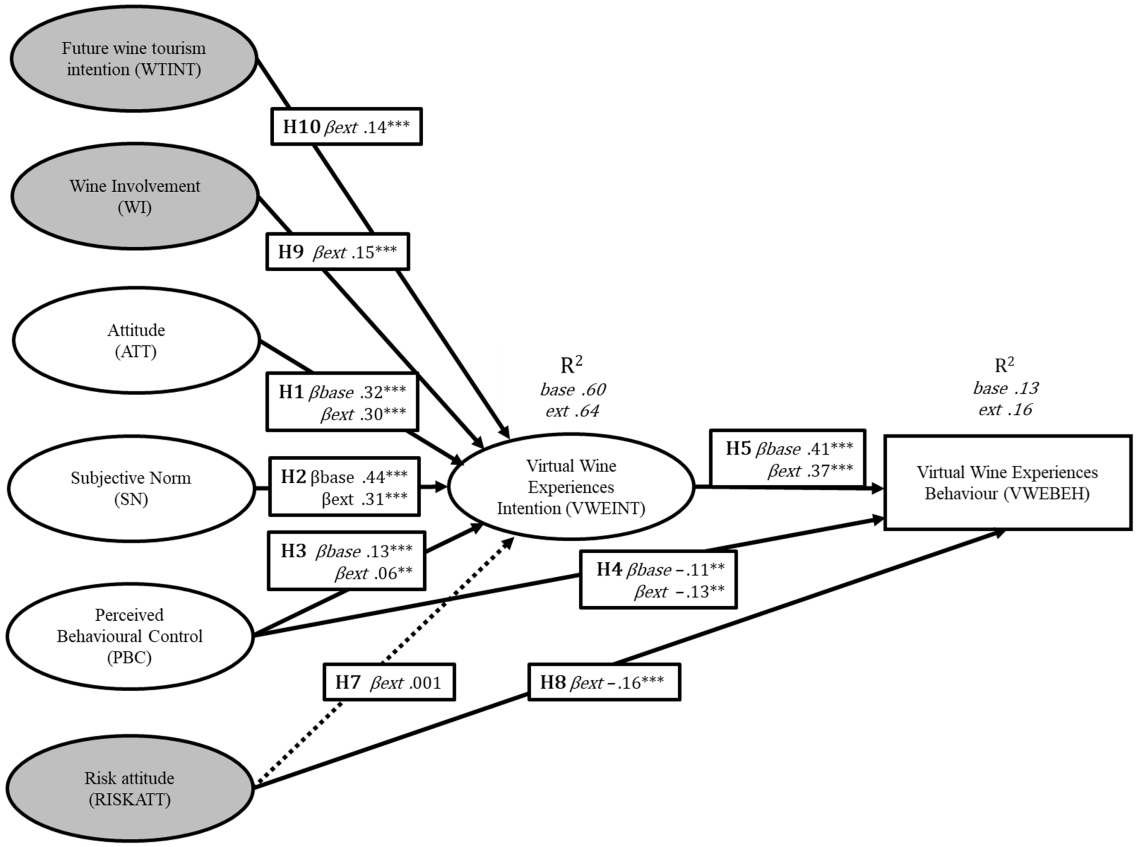

FIGURE 2
Results of the base and extended TPB model estimation. Note: extended TPB constructs are represented as light-grey ovals; white ovals represent constructs from Ajzen's original TPB. VWEBEH is represented with a rectangle as it is an observed variable. Results of estimations of the base and extended TPB model for each hypothesis tested are reported in small rectangles as follows: βbase = standardized path coefficient from the base TPB model; βext = standardized path coefficient from the extended TPB model. *** $p < 0.001$; ** $p < 0.05$. Non-significant paths are represented as dotted lines. H6 = mediation effect: RISKATT ➔ VWEINT ➔ VWEBEH.

provides a direction for segmenting wine tourists potentially interested in VWEs, i.e., the less risk-averse individuals.

Alike in Sultan et al. (2020), both the intention and PBC do explain a small share of the observed behavior analyzed ($R^2 = 13\%$), suggesting that an intention-behavior gap is present and needs further investigations. By including risk attitude to explain behavior in the extended TPB model, the variance explained increases ($R^2 = 16\%$). Still, the model's explanatory power for VWEBEH is limited compared to VWEINT. It follows that additional potential mediators and moderators should be investigated to detect additional key factors transforming intention into behavior.

Lastly, the presence of full mediation from intention between attitude and behavior, which is in line with recent results obtained by Sultan et al. (2020), confirms that the effect of attitude transmits to behavior through intentions (Sultan et al., 2020; Caliskan et al., 2021). Nevertheless, the small scale of such an effect calls for further investigations into potential interfering factors.

The study is not free from limitations. One limitation of this study is that it only analyzes the effects of certain determinants on the intention and behavior toward VWEs. To gain a better understanding of the phenomenon, it would be beneficial to include additional antecedents from the literature. Furthermore, the study measures behavior using a dichotomous variable without examining the constraints or motivations that hindered participation in VWEs.

5.2 Concluding remarks and future research agenda

Virtual wine experiences (VWEs) represent a novel wine consumption occasion that, following the digitalization megatrend, has the potential to stay. The present study is the first, to the best of the authors' knowledge, to shed light on the determinants of wine consumers' intention and behavior toward VWEs and provide valuable insights to academics, sector stakeholders, and policymakers in this regard. Specifically, this research builds on the widely validated framework of the Theory of Planned Behavior while testing an extended model that accounts for relevant constructs related to wine and novel products' consumption. Academically, the study provides an updated application of the TPB to emerging wine consumers' behavior, contributing to the related body of literature while providing empirical evidence of the attitude-behavior relationship, as well as evidence supporting the intention-behavior gap. Since VWEs are offered through virtual platforms, the latter gap is reasonably linked to aspects such as subjects' digitalization and attitude toward technology. Future research could test the mediating role of such constructs in the intention-behavior relationship.

Since personal wine involvement and intention to visit a wine region soon positively predict the VWE intention, virtual wine consumption is more likely to concern highly involved wine consumers

(i.e., wine lovers and wine enthusiasts) as well as people having stronger wine tourism intentions. The latter are segments of interest to both rural destinations and single wineries, which might adopt VWEs as a long-term marketing strategy thus favoring the growth of virtual wine consumption.

Nevertheless, the results also indicate that having personal positive feelings about VWEs is even more important than being interested or passionate about wine *per se*. Behavioral research could further investigate attitude determinants, i.e., behavioral beliefs, while better profiling VWEs consumers from a socio-demographic and psychographic perspective.

Furthermore, subjective norms show an equivalent effect to the attitude in forming VWE-related intentions, suggesting that peer pressure (here, family, and close friends) plays a critical role in shaping them. In this respect, further research may investigate the role of wine experts, connoisseurs, and influencers' opinions in impacting consumers' behavior toward VWEs.

The negative effect risk attitude exerts on VWEs' behavior is reasonably connected to the uncertainty underlying the decision to purchase an experience that has been newly introduced on the market and the subsequent lack of consumer knowledge and experience. If this is the case, increasing market knowledge about VWEs may reduce the potential perceived risks associated with their purchase thus mitigating the detrimental effect of risk attitude on the observed behavior that emerged from this research. While this study does not consider the sources of risk related to VWEs consumption, this is a topic that future research could explore, also applying different techniques to elicit it (e.g., contextualized experiments). Particularly, academics should also test whether an increased product acquaintance would reduce the impact of subjective norms and risk attitude on VWEs behavior.

In this respect, online and offline word-of-mouth might both bridge the abovementioned knowledge gap and the perceived risk connected to VWEs promoting their diffusion and thus an increase in virtual wine consumption.

Some critical reflections arise on VWE with respect to their sustainability potential. As Ozdemir et al. (2023) underline, experiences like VWEs offer consumers an environmentally friendly way to discover new regions, wineries and wines and eventually buy them without traveling, thus lowering the carbon footprint. This aspect does not mean that VWEs should become substitutes of wine holidays or cellar door experiences, but rather a greener complimentary option, among others for shorter trips solely targeted at gathering preliminary information or purchasing wine at the cellar. Therefore, VWE can be both a resilience strategy during crisis and a long-term marketing strategy. Additionally, VWEs can be used to accustom wine drinkers to greener packaging (e.g., bag-in-box). In fact, wineries usually ship the tasting set to participants upon the experience purchase. Thus, they could promote sustainable packaging alternatives by using the in these sets and inform consumers on the related benefits during the experience. Indeed, the literature found evidence that a critical aspect of non-glass wine packaging acceptance is the belief that alternatives would compromise wine quality, and it may be overcome by properly informing consumers, particularly those who are less traditionalist (Ferrara et al., 2020).

Moreover, VWE may embody an economic sustainability dimension for wine stakeholders. For example, they could allow attracting new customers and future visitors, including those living far away from the destination, and offering wine tourism activities in the low season at a relatively low cost in terms of personnel and advertising.

Given the pressing need to strengthen sustainability outlined by the European Sustainable Development Goals (SDGs), sector academics should explore VWEs potential in this respect. Qualitative results of a recent study from Lu et al. (2022) highlight that VTEs could contribute to lower unnecessary greenhouse gasses emissions of the sector associated to transportation, as well as to make destinations virtually accessible to consumers hindered by physical or economic barriers.

Finally, researchers could validate the 4Es framework in virtual wine experiences to explore if and how it differentiates from the one traditionally associated to in-person wine tourism experiences. In this respect, Wei et al. (2023) recently introduced a new dimension, connection, to the four proposed by the original model (entertainment, education, escapism, and aesthetics) to accommodate the unique features of the virtual environment. To conclude, the extent that wine consumption has reached worldwide, and the increasing relevance of digitalization call for further monitoring of the VWEs phenomenon, and eventually infrastructural and learning support to wine operators willing to develop VWEs paired with ever-relevant consumer education.

Data availability statement

The datasets presented in this article are not readily available because the authors cannot make the data freely accessible. Requests to access the datasets should be directed to EG, elisa.giampietri@unipd.it.

Ethics statement

The studies involving humans were approved by Research commission of the Department of Land, Environment, Agriculture and Forestry, University of Padova. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

GG: Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Writing – original draft, Writing – review & editing. LR: Funding acquisition, Project administration, Writing – review & editing, Supervision. EG: Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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