MASTER THESIS

3D WINERY TOURS AS A TOOL OF WINE TOURISM PROMOTION. THEIR IMPACT ON CONSUMER BEHAVIOUR

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TABLE OF CONTENTS

Abstract

The purpose of this thesis is to explore how the 3D winery tour experience influences tourist decisions. The research was conducted on the product of 3D tours developed by Second Winery. It focuses on studying how the 3D winery tour experience influences the consumers' intentions to visit the winery personally and buy the wines after a 3D tour.

Utilizing the Technology Acceptance Model and the Theory of Planned Behavior, the research investigates 3D tours' influence on consumer behaviour for generalized groups: wine lovers and wine professionals in comparison with the sample that had a "conventional" experience of learning about the winery and the wines. The factors of perceived enjoyment, ease of use, immersiveness, and willingness to recommend 3D tours were analyzed to reveal their impact on the desired behaviour. The study involves a qualitative approach with a limited sample size, providing valuable insights into the product of 3D tours, but also highlighting the need for broader quantitative analysis. SPSS software was used to analyze variables, while semantic analysis was done utilizing ATLAS.ti Web solution to systematize comments received via an open-ended question and interviews.

Findings indicate that both study groups show increased intentions to visit and purchase after the 3D tour experience, although the intention was not significantly higher compared to the one influenced by traditional marketing methods. The research also confirmed that perceived enjoyment and immersiveness of virtual tours significantly boost visit intentions.

The research underscores the potential of 3D virtual tours as a marketing tool in the wine tourism industry. Further refinement and targeted strategies to maximize the impact done by this technology are needed. Future research should expand the sample size and explore additional factors influencing consumer behaviour to enhance the generalizability and robustness of the findings.

Keywords: virtual tourism, 3D tours, 3D winery tours, consumer behaviour, VR tour in wine tourism.

List of abbreviations

CJM – Customer Journey Map

NFT - Non-Fungible Tokens

RH – Research Hypothesis

TAM - Technology Acceptance Model

TPB - Theory of Planned Behavior

VR – Virtual Reality

USP – Unique Selling Proposition

List of Tables

List of Figures

1. Introduction

1.1 The Company

“Second Winery” is a project curated personally by Eduardo Ferrín, CEO of AALTO BODEGAS Y VIÑEDOS, S.A.

The project idea was developed in response to the global challenges the wine industry is facing nowadays: young generations give their preferences to spirits or non-alcoholic drinks resulting in shrinkage in wine consumption, and a sophisticated approach to wine science and education. The latter is the reason consumers representing Millennials and Generation Z find wine intimidating and exclusionary and prefer to disconnect from wine culture. The project owner targeted to bridge the gap between the wine industry and the consumers and invigorate the market.

Today “Second Winery” has 3 main directions under its brand: tasting kit sets, a learning platform with gamification techniques, and 3D winery tours. The objective is to become a leading platform to discover and learn about wine through winemaking roles, provide unique gamified tasting experiences that can be enjoyed from any place and in any company, and entertain with 3D immersive visits that align with modern youth lifestyles.

3D winery tours were the direction the whole project started with. At the beginning of 2023, it targeted creating the first wine metaverse with a marketplace for collectible Non-Fungible Tokens (NFTs), where the users could buy the most exclusive wines and even vineyards. The wines could be stored in private virtual cellars. The users could visit events at digital wineries which would promote the wines and their history.

A year later the business idea transformed to its current stage leaving behind NFTs. 3D tours are launched with 4 wineries that have their lifelike “digital twins” recreated in 3D. The tours are built with metaverse technology - “Scalable Pixel Streaming” and represent the highest image quality. Tours are stored in the cloud servers; thus, a user does not need a powerful personal computer to have an immersive experience of walking freely through the recreated cellars with incredible 3D details.

3D winery tours direction is a potential revenue center for the company. However, there are some challenges in project development. Those challenges are to be solved by working with 2 stakeholders: the wineries and the subscribers. The objective is to create added value for the product that would help to promote the product and sell the service of 3D tour creation to more wineries.

1.2 Duties and Activities Performed

“Second Winery” is a start-up project thus the duties and activities are never narrowed down to one business section. Summing up the tasks performed the work could be described as business development with an emphasis on product sales.

The internship started with a full product analysis and review. A detailed analysis of the customer experience was undertaken. All aspects of the Customer Journey Map (CJM) through the “Second Winery” platform were analyzed. A report on each section was created and delivered to the project owner. The report highlighted both the positive aspects, as well as contextual mistakes and technical bugs. The improvement ideas were also submitted and discussed with the owner for further implementation.

Further step undertaken was focused on creating e-mail templates for future product development and sales. 3 groups of templates for tasting kits and 3D winery tours were created including follow-up templates. Extra attention was paid to the tone of voice for the company communication. The tone had to represent an innovative and dynamic company that is ready to change the wine industry.

Before the meticulous work on the templates, the task of summarizing the product’s unique selling propositions (USP) was fulfilled. USPs were created for each group of the targeted audiences based on the Jobs to be Done approach. The existing USPs were updated to highlight other benefits and match the client’s needs better.

At the same time, work with an external Digital Marketing agency was coordinated. The agency worked on the development and implementation of a social media strategy for Instagram. Thus, the USP used for social media promotion and the tone of voice had to match the general business strategy.

The next important task was to work on the sales network development. The existing database representatives were contacted to introduce the “Second Winery” product and find collaboration opportunities. As well as new potential partners were also looked for and contacted. The sales strategy had to be created going from wine importers and wine shops for tasting kits to smaller businesses and even some creative approaches which included wine lover clubs and hotels in the European wine regions. The research of the prospective accounts in target markets was an important part of the work both for tasting kits and 3D tour products.

1.3 Thesis Objectives and Organization of the Work

The product of 3D winery tours developed by Second Winery is an innovation in the sphere of wine tourism. The scholars have earlier stated that innovation research in tourism is limited and empirical tests of innovational practices are moderate (Hjalager, 2010).

As with each of the innovational practices the first implementations and use of the technology is done by the category of “early adopters” (Rogers, 2003). Today’s “adopters” are 4 wineries that are already reproduced in virtual reality by Second Winery. However, to be fully accepted by the industry the product should have an obvious impact on the economic indicators of an enterprise (Sarkady et al., 2021). This study aims to reveal if the 3D winery tour product may stimulate the tourists to come to the winery personally after the 3D tour experience or buy the wines. Moreover, the research aims to reveal potential areas of improvement which might be suggested by the research participants.

The anticipated results of the research should help Second Winery to better define its USP and improve the product.

The following sections of the thesis will provide a comprehensive review of the relevant literature on virtual tour technologies, their specific applications and impacts within the wine industry, and their implementation. They will be followed by sections explaining the research design, hypotheses, participant recruitment and sampling methods, and data analysis techniques employed in the study. The “Results and Discussion” chapter presents the findings of the research, discussing the results in the context of the theoretical frameworks and their practical implementation. The limitations of the study are also outlined, addressing potential constraints, and suggesting areas for future research. The final chapter summarizes the key findings of the research, discusses their implications for the company, and provides recommendations for further product development.

2. Main Concepts and Literature Review

2.1 Virtual Tours Technologies and Their Implementation in the Tourism Industry

The concept of 3D and virtual tours was first introduced in the mid-1990s (Perry Hobson & Williams, 1995). Over time it has evolved alongside the development of computer graphics software, imaging technology, and internet capabilities (El-Hakim et al., 2004).

Recent trends show that virtual and 3D tours are becoming more common in tourism businesses: from museums (*Armchair Culture: Virtually Touring Budapest's Museums and Galleries.: EBSCOhost*, n.d.; 'Virtual Tour Brings Museum to Town', 2013; Bairstow, 2000), hotels (Lim et al., 2024), and restaurants (Ali, 2022) to whole regions (De Canio et al., 2021; González-Delgado et al., 2015; Sukardani et al., 2023) and even types of tourism (Hultman et al., 2015; Wu & Wai, 2022).

Even though VR technologies have been used in the tourism industry for more than 30 years now there is no agreed-upon definition of virtual tours in literature.

One of the first definitions of virtual tours was formulated in 2000. Virtual tours are those tours that attempt to replace the tourist experience of the physical world with computer-generated material. They use sensory stimulation technologies to influence sight, sound, and even touch and make the users believe they are experiencing the real thing (Sussmann & Vanhegan, n.d.).

A recent definition by Guttentag from 2022 highlights the same features of a virtual tour: the use of a computer-generated environment, the ability to navigate this environment and interact with it, for example, select and move objects, combined with real-time simulation of one or more senses (D. Guttentag, 2022).

GoogleTrends analytics shows stable interest in 3D tours has been maintained since 2008 (Figure 1), although the first curiosity about the technology arose in 2005 (marked with a red vertical line).

Figure 1. GoogleTrends graph showing web search frequency on the request "3D virtual tour" worldwide in all categories from 2004 to the present (*Google Trends*, n.d.).

However, with the attempt to narrow down the industry to the "Travel" category one may find a different trend (Figure 2).

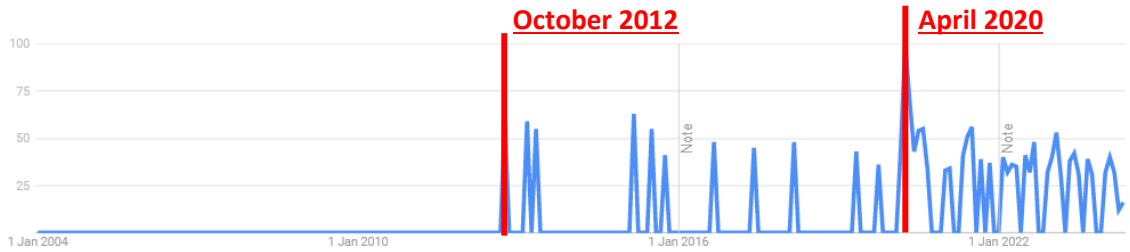

Figure 2. GoogleTrends graph showing web search frequency on the request "3D virtual tour" worldwide in the "Travel" category from 2004 to the present (*Google Trends*, n.d.).

In the travel industry, the first interest in 3D tours was noticed in October 2012 and the trend fluctuated with research frequency going up and down to zero frequency search before April 2020 – the COVID-19 Pandemic time and lockdown periods. The pandemic stimulated the rise of interest in the new technology.

During the pandemic, virtual tourism was considered to be a way to substitute physical tourism for the period when there were so many travel restrictions (Verkerk, 2022; Zeqiri, 2024). It was considered to be an authentic and enjoyable way of exploring destinations and points of interest at the time of global lockdowns. After the significant increase in the number of businesses that adopted VR technologies during the COVID-19 pandemic (Zeqiri, 2024) some of them closed those projects when the restrictions were eased (*Amazon to Shut Down 'Explore' Virtual Tour Product in Latest Cut: EBSCOhost*, n.d.). Those facts contribute to the intensity of the discussion on the issue of virtual tourism being less attractive than physical one or being able to substitute real-world tourism experience, which is still ongoing (Guttentag, 2022; Sarkady et al., 2021; Verkerk, 2022; Zeqiri, 2024).

Research by Sussmann and Vanhegan published in 2000 stated that virtual tourism will never replace conventional tourism, leaving virtual experiences to be more important for the disabled and elderly holidaymakers (Sussmann & Vanhegan, n.d.). Another potential group of tourists who would give their preference to virtual experiences was expected to be people with limited holiday time and budget. The same idea was confirmed in the research conducted by Prideaux, his respondents in 2001 were confident that VR will never replace real adventures (Prideaux, 2002).

Another wave of research on VR tours and their acceptance by customers was stimulated by the COVID-19 pandemic (Chirisa, 2020; Sarkady et al., 2021; *Virtual Tours*

a Means to an End: An Analysis of Virtual Tours' Role in Tourism Recovery Post COVID-19 - Osman El-Said, Heba Aziz, 2022, n.d.; Zeqiri, 2024). Virtual tours started to be explored as well in the context of resilience for the tourism industry (Verkerk, 2022). Ans recent articles are not that categorical about the future of virtual travel experiences and their acceptance.

Sarkady et al. in 2021 concluded that tourists are willing to experience VR travel technologies not only during various crises, such as the pandemic of COVID-19, but also after it (Sarkady et al., 2021). However, this research had a major limitation as it was conducted during the period of lockdowns and travel restrictions from March 14 to May 12, 2020, and the expected willingness of respondents to use VR tourism technologies after the period of lockdowns might have been a hypothesis that did not come true.

According to the study conducted by Verkerk in 2022 virtual tours will not be able to replace conventional trips but should be considered a futuristic tourism niche (Verkerk, 2022). Moreover, the implementation of VR technologies is important for the tourism industry's resilience, especially in cases of popular tourist attractions, which are at the risk of over-crowding, and possible travel restrictions affecting regions or even the whole world.

The researchers do not have a unified opinion if VR tourism experiences could be considered a substitute for conventional tourism or if they will complement physical tourism (Zeqiri, 2024). There is also a lack of research on the acceptance and influence of VR tourism technologies on consumers in a post-pandemic period. This master's thesis aims to fill in this gap, focusing on wine tourism and the use of 3D technologies in it.

6 main areas in the tourism industry where the implementation of VR instruments may make the most considerable impact are discussed by the scholars: marketing; planning and management; sustainability and preservation issues; accessibility aspects; educational part; and entertainment (Guttentag, 2010).

Below the topics of sustainability, accessibility and marketing will be overviewed as the author found them the most relevant for the product that inspired this research – 3D winery tours created by Second Winery.

2.2 Virtual Tour Technologies and Sustainability

The scholars research if VR products can potentially be an ideally sustainable tool (Verkerk, 2022).

They consider that VR experiences might be an alternative to a real trip to a destination, helping to reduce emissions caused by travel. Various research shows that tourism's carbon footprint and emission of greenhouse gases caused by transportation, accommodation, food services, and various activities that accompany a tour is a major challenge for all destinations (Gössling & Scott, 2012). Moreover, the amount of emissions has increased drastically in the last decades, both the total and per capita (Huang & Tang, 2021).

Speaking about the wine industry, this is wine tourism that is responsible for more than a third part of the carbon footprint in it (Sun & Drakeman, 2022). Transportation accounts for the biggest part of tourism's carbon footprint in the tourism industry (Li & Zhang, 2020) and wine tourism. Transportation solutions are still accused of not contributing enough to the set targets for the reduction of carbon emissions (Holden et al., 2020), despite all the efforts already made. The topic is gaining popularity with the unchanged for 10 tears trend of tourists' preferences toward more frequent and shorter trips (Higham et al., 2013; Martínez-Falcó et al., 2023).

The number of research focused on sustainability issues and carbon footprint in tourism has grown in recent years (De-la-Cruz-Diaz et al., 2022; Kosčak & O'Rourke, 2019; Sun & Drakeman, 2022). However, the tool of virtual tours in terms of sustainability is mostly discussed in two contexts: as a substitute for physical tourism (Guttentag, 2022; Sarkady et al., 2021; Sussmann & Vanhegan, n.d.; Verkerk, 2022; Zeqiri, 2024) or as a preservation tool for sensitive touristic sites, that are restricted to tourists and that are at risk of being over-crowded (Verkerk, 2022). There is also a lack of research on 3D tour implementation in the context of rural tourism.

Virtual tours can make a big contribution to sustainability, especially in the wine and wine tourism industry, reducing unnecessary travel, for example, helping to reduce the number of trips that are done for sales and promotional purposes to connect with consumers from different regions and countries. One of the research hypotheses of this thesis is questioning if a 3D tour experience may stimulate the consumer to buy the wine from the winery he or she explored in 3D. In case there is a positive influence on the intention to buy wine from the winery visited during a virtual tour VR product might be

considered to be an innovational practice that contributes to the development of sustainability practices in the industry. Sun et al. in 2020 highlighted that the tourism industry lacks new sustainable tools and efforts to implement them into the industry (Sun et al., 2020).

The topic of sustainability is more complicated than the issue of a sustainable way of getting to the destination. The industry and the tourists should be guided and encouraged to change and adopt new approaches, not only to understand sustainability issues but also to use more sustainable solutions for their travel experiences (Gössling et al., 2016). 3D tours might be considered one of these solutions which is ready for implementation in the real life of more enterprises.

The effort is most likely to be supported by society as it is ready to act on sustainability issues. According to the recent Eurobaromener survey 77% of EU citizens already consider climate change to be a very serious problem (*Climate Change - July 2023 - - Eurobarometer Survey*, n.d.). The same percentage of Europeans feel a personal responsibility to take action to help limit climate change, while 54% are convinced they have enough skills to support the green transition (*Fairness Perceptions of the Green Transition - October 2022 - - Eurobarometer Survey*, n.d.). Those figures sound promising for the new product of 3D winery tours.

The implementation of new technologies and approaches in the industry will change the whole concept of wine tourism sustainability (S. A. Cohen et al., 2016). Virtual tours might contribute to the development of the “Low-mobility societies” concept introduced by Holden et al (Holden et al., 2020), or at least to a “Lower-mobility” one. Thus, 3D winery tours may affect sustainability visions and pathways for further sustainable practices development in the wine and wine tourism industry and help identify new paths to a more sustainable future (Helgeson et al., 2022).

2.3 Virtual Tourism Experiences and Accessibility

One more dimension for 3D tour applications is the accessibility aspect of tourism. Very often when scholars speak about the relationship between virtual tourism and accessibility, they relate to the sites that are remote, expensive, difficult to visit, fragile or do not exist anymore (Guttentag, 2010).

However, in the thesis, the author would like to highlight another aspect of accessibility – VR technologies make tourism and wine tourism available for people with reduced mobility.

According to the latest data published by the World Health Organization, today 16% of the global population worldwide experiences a significant disability (*Global Report on Health Equity for Persons with Disabilities*, n.d.). An estimated 1.3 billion people have special requirements for tourism activities. Wine tourism, being a part of the tourism industry, should also consider those tourists as their customers.

To bring to life accessibility practices wineries need to put in extra effort and sometimes even go through partial renovation and special device installation to eliminate physical barriers. It requires investment, which not every property is ready for. The research proved that the availability of accessible tourism options in the wineries influences positively the brand image, and the company's reputation, but also contributes to economic benefits (Jević et al., 2019). Virtual tours might be a good solution for some areas in the wineries or even whole tours that become available from any point in the world.

Another angle of accessibility to pay attention to is the language barrier issue (Guttentag, 2010). Usually, It affects smaller producers, who often lack resources and qualified employees (Francioni et al., 2017). VR tours that are available in multiple languages might be a solution for this accessibility issue as well.

2.4 Virtual Reality Technologies and Marketing

Research also shows that virtual tours are considered to be a part of marketing activities (Y.-C. Huang et al., 2013). The fact that by implementing 3D tours into business practices a venture may shape the behavioural intentions of the customers and their desire to visit the location might be a solid argument in favour of the technology.

VR technologies may assist in creating activities which will provide a "try before buy" experience to potential tourists (Guttentag, 2010; Tussyadiah et al., 2018). It has already been proved that VR experiences can create a sense of presence, which leads to higher perceived enjoyment levels from VR products. Consequently, the perceived satisfaction contributes to the visit intention of the previously visited VR destination (Tussyadiah et al., 2018; Ouerghemmi et al., 2023).

Another possible implication of VR in tourism is communication. It might be used to ease the communications between tourists and create communities or as a tool for informing potential customers about points of interest and providing recommendations (Guttentag, 2010).

One of the objections to the product of VR experiences in the tourism industry is that they might cause a decrease in the number of visitors coming personally. 3D winery tours might also be influenced by this objection. However, the research proves the opposite – virtual products may increase the desire to visit the destination (Zeqiri, 2024). In his article, Zeqiri gives the example of the music industry: online music services do not cause a decrease in sales for music shops. However, the industry was transformed and products like audio cassettes disappeared from the market. Thus, we cannot deny that a new product in the wine tourism industry will not cause a shift in it.

2.5 VR Experiences Implementation in the Wine Industry

In recent years with technological advancement, the fusion between the physical and virtual worlds is getting even stronger for the tourism industry (Bowen & Whalen, 2017; Bulchand-Gidumal, 2022; Seid, 2022; Tuo et al., 2021). The technology penetration is getting more convincing yearly (Gao et al., 2010; Pencarelli, 2020). However, the analysis of the industries that are currently interested in 3D tour technologies shows that wine tourism is not one of the niches deeply involved in the change (Figure 3).

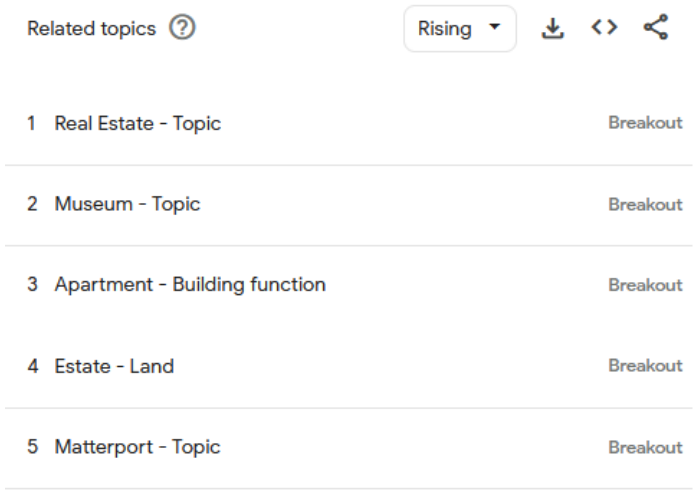

Figure 3. GoogleTrends ranking of the topics that users searched in addition to "3D virtual tour request". (*Google Trends*, n.d.).

The interest in 3D tour technology is growing in the real estate industry (*Malouf Develops 3D Virtual Tour of Vegas Showroom.: EBSCOhost*, n.d.). In the tourism section – museums are most interested in its implementation, they are already actively working with it and there is a significant number of research on virtual tour implementation for the museums as well as how 3D tours form visitor's experience (Kabassi et al., 2019; J. Li et al., 2022).

Wine tourism has not yet implemented the technology on a wide scale. GoogleTrends shows the following search frequency requests for 3D virtual tours in the Vineyards & Wine tourism niche (Figure 4).

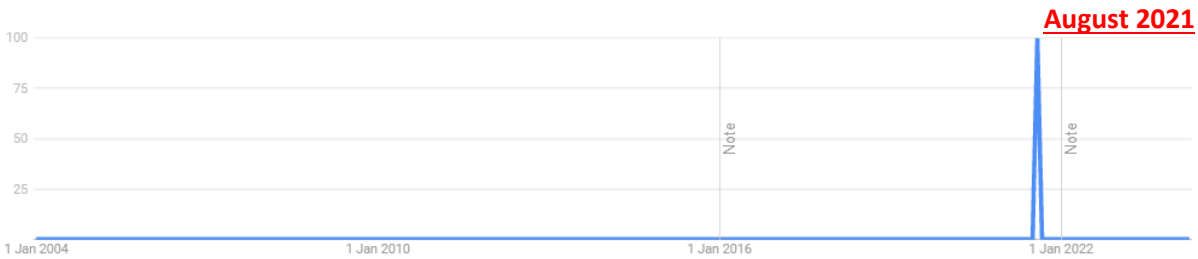

Figure 4. GoogleTrends graph showing web search frequency on the request "3D virtual tour" worldwide in the "Vineyards & Wine" category from 2004 to the present. (Google Trends, n.d.).

The peak of the interest was registered in August 2021 and then disappeared. It shows that both, the potential tourists, and business owners do not expect those innovative technologies to be already implemented in the industry.

However, the researchers state that once the technology is well-implemented in the industry it should gain popularity: the more enjoyable a virtual experience is, the more potential tourists will be involved in virtual tourism (Zeqiri, 2024).

In the SCOPUS database the search with the parameters "Wine tourism" and "Virtual tour" in the article title, abstract, and keywords, resulted in the reveal of only 3 articles. All of them were published recently.

The scholars already discuss frameworks that may be applied to the wine tourism industry on a global scale taking into account trends and innovations, including virtual experiences (Santos et al., 2021). Another research is focused on the influence of virtual wine tours on sensory experience and further purchasing behaviour with attention paid mostly to the ability of VR products to influence wine sensorial analysis and perception (Wen & Leung, 2021). The research was focused on the influence on the tasting experience and the intention to buy wine and lacks research on the influence of visiting intention. The results favoured the use of VR experiences, which had a greater influence on the willingness to purchase the wine. This research is useful for further product development of VR experiences in the wine and wine tourism industries, possible implications will be introduced in the conclusion of the thesis.

An abstract from conference materials by Qesja et al. published in 2022 focused on the impact of VR experiences on the development of the Riverland wine region in South Australia. The scholars investigated if VR experience has any influence on the desire to visit and purchase using a specially created for the research VR product (Qesja et al., 2022). The research concluded that VR experiences are a successful new tool in influencing tourist decisions. This research is the most relevant one regarding the topic of this master's thesis, however, there is a considerable difference in the product used for the case study, as well as the scale of wine tourism – the study was focused on a regional level and a VR product created especially for the research. The current thesis, on the contrary, is based on a case study of the product that already exists on the market and focuses on the enterprise level.

Obviously, the topic and the technology are new and there are few implementation cases, however, there is both a lack of research on 3D tour implementation in the wine tourism industry and a lack of interest in the technology from the entrepreneurs and tourists involved in it as the practical implications have not been measured yet.

2.6 VR Experiences' Impacts on the Tourism Industry

With the first companies implementing the technology and the first winery 3D tours becoming available the analysis of the impact of virtual tours on the wine tourism industry is still insufficient, as well as its influence on consumer behaviour.

The majority of the scholars focus in their research on the ability of VR experiences to stimulate travel intentions (Tussyadiah et al., 2018). It has been already proved that VR experiences result in a preference given to the destination experienced in VR and a positive attitude change in visitation intention. There is also a positive influence on the awareness about the products (Suh & Lee, 2005), and brand, as well as a positive memory of experiences (Mania & Chalmers, 2001).

The scholars consider that VR experiences may influence tourists' behaviour in the following stages of travel: dreaming, planning, booking, transit, experiencing, and sharing (Bulchand-Gidumal & William, 2022). According to the study conducted by Bulchand-Gidumal et al. a "try before buy" experience is important for "dreaming", "planning" and "booking" phases. At the stage of "transit" VR experiences might serve as entertainment, at the "experiencing" stage VR technologies might help to complete the experience, for example with augmented reality technologies ('VR Reveals

Stonehenge, from a Distance. UK', 1996), and at the final stage of "sharing" – we may talk about sharing experience and reviews in social media.

This model can be applied to 3D winery tours influencing the same stages of a wine tourist's travel cycle. However, the product will not find its way to the industry if business implications are not clear and there is no economic value in the technology implementation (Sarkady et al., 2021). The economic advantages might be generated by sustainability, accessibility, and advancement in promotional or sales aspects overviewed in this chapter. This supports the study objective to evaluate the potential economic benefits for wineries which implemented 3D tours, aligning with the strategic goals of "Second Winery" to boost sales.

2.7 Objectives Derived from Literature Insights

The reviewed literature highlights that virtual experiences can affect consumer attitudes and behaviour, especially in terms of the visit intentions. One of the main research questions for this study aims to reveal if this effect is relevant to the wine tourism industry and 3D tours developed by Second Winery.

By focusing on the specific products and market context of Second Winery, this thesis aims to provide actionable insights that can inform strategic decisions and marketing efforts for the product of 3D tours.

While the literature provides a general framework, there are research gaps regarding virtual tour implementation in the wine tourism industry and their effects on consumer behaviour. This thesis addresses these gaps by conducting empirical research on the actual performance and consumer responses to Second Winery's 3D tours.

3. Research Design

In 2010 Guttentag stated that research on VR tourism implementation, its influence on consumer behaviour, and acceptance of the technology, need to be constantly updated and re-evaluated due to rapid changes in the technology of VR tourism experiences (Guttentag, 2010).

Although the possible positive effects of VR technologies implementation in the tourism industry have been explored earlier there is an obvious gap in the research of virtual tours in the wine tourism industry.

Therefore, this thesis aims to address the identified research gap. The effort should lead to a better understanding of the roles of the 3D winery tour experience in shaping consumers' attitudes towards actual wine purchase from the winery visited in a 3D tour and intention to visit the winery personally. The consequences of the consumer's perception of being captivated by the wine producer after experiencing a 3D tour are important for business owners and managers as they are dealing with strategic decisions about investing in tools and technologies to help boost their sales and wine consumption.

The practical implementation of the research is supported by the statement that the products that are not able to create value are not accepted and adopted by the market (Garibaldi & Sfodera, 2020). This thesis aims to analyze if there are potential economic benefits for the wineries implementing 3D tour technology. Those benefits might result in an increased number of visitors on-site or extra sales to the customers who attended a 3D tour but did not make a physical visit. Thus, the main goal of the thesis is to assess the effect of attending a 3D winery tour created by Second Winery on tourists' "post-3D" decision-making, precisely in buying the winery's products or visiting the winery physically.

The study was conducted on the product that is available on the market. 3D tours are created for 4 wineries: 2 of them are in Ribera del Duero in Spain (Bodegas Aalto and Pago de Carraovejas) and 2 are in the Bordeaux area in France (Château Branaire-Ducru and Chateau Montrose).

In the following chapters, the research methodology will be explained and justified, and research hypotheses will be formulated. In the "Results and Discussion" section the demographical data of the research participants will be provided as well as the results of the study will be analyzed and explained. Moreover, possible practical implications of 3D winery tours will be discussed, as well as future research directions.

3.1 Research Methodology and Hypotheses

This research was designed to compare the behavioural patterns of the consumers who experienced a 3D winery tour created by Second Winery and those participants who had a "conventional" experience of learning about the winery and its wines. Thus, 2 samples of research participants were defined for the study.

The first group of respondents experienced the product of 3D winery tours from the Second Winery. Each of the respondents had access to all 4 tours and could choose any of them to attend, as well as could attend all of them, or several of them. The group of

respondents who tested 3D tours was also subdivided into 2 subgroups: wine lovers and wine professionals. Wine professionals were defined as the people who work in the wine industry while wine lovers had other occupations.

The second group of respondents saw pages “About the winery” and “Visit us” from Aalto winery’s website before replying to the question about their intention to visit the winery. The question about the intention to buy the wines was preceded by the image of wines and the page about Aalto PS 2021 wine taken from the website. The images used are presented in Annex 1.

The research was designed using a qualitative exploratory approach. It was conducted through the application of a real 3D winery tour product available on the market and the real offer from the winery. The exploratory nature of the research is justified by the novelty of 3D winery tours in the industry: there is limited research on VR implications in the wine tourism industry. It allows to identify patterns and hypotheses for future research and technology implications to develop a deeper understanding and generate new insights (Stebbins, 2001).

The research measured and compared the behavioural intention to buy wine or to visit a winery after participation in a 3D tour and visit and purchase intention after reading the information about the winery and its wines, presented in a “conventional” way.

5 main research hypotheses (RH) were developed for the study.

RH1. Wine lovers will demonstrate a higher intention to visit the winery personally after they visit it on a 3D tour in comparison with the participants who learn about the winery “conventionally”.

RH2. Wine lovers will demonstrate an intention to buy the wine from the winery after they visit it on a 3D tour.

It was supposed that if a respondent is professionally involved in the wine industry, he or she will demonstrate a different behaviour in the intention to visit the winery. It was expected that there would be no visit intention after a 3D tour experience. However, the intention to buy wine will be demonstrated and it would be higher in comparison to wine lovers. Thus, it was decided that wine professionals would be invited to participate in the research, however, the responses given by wine professionals and wine lovers would be analyzed separately. 3 more hypotheses were formulated regarding wine professionals.

RH3. Wine professionals will not demonstrate an intention to visit the winery personally after they visit it on a 3D tour.

RH4. Wine professionals will demonstrate an intention to buy the wine from the winery they visited in a 3D tour.

RH5. The wine professionals' demonstrated intention to buy the wine from the winery they visited in a 3D tour will be higher than the intention to taste wine demonstrated by wine lovers.

3.2 Participant Recruitment and Sampling

Wine enthusiasts and professionals who were willing to try 3D winery tour products were invited to participate in the research. The respondents were recruited by advertisement of “3D virtual winery tours” on Instagram, which targeted the audience aged 30-55 residing in 26 European countries where Second Winery tasting kits are currently delivered. The audience had the following interests: wine (alcoholic drinks), food & wine, and winery. The targeted expansion was switched on aiming to broaden the audience. Another source of recruitment used was groups on Facebook on the theme of wine and wine tourism. The aim was to recruit respondents with a broad spectrum of sociocultural backgrounds, however, interested in wine and wine tourism, and varied levels of wine expertise. Those who were willing to test the product and answer the questionnaire were invited to express their willingness to do so. Then each of the potential respondents was contacted personally and explained the purpose of the research and the way it was designed. Only those respondents who agreed to take part in the research were included in the data collection process and provided the access details with the following guidelines. To encourage participation and to inspire participants to complete the survey, a promo code for a free-of-charge wine-tasting kit from Second Winery was offered, the promo code was communicated after the survey submission.

The participants for the sample of the research regarding “conventional” wine tourism and wine offers were recruited via the same Facebook groups.

Since the research involved qualitative elements through an open-ended question and interviews, the focus was on the depth of the research rather than breadth. The sample size for the research was determined based on established guidelines in the qualitative research literature (Crouch & McKenzie, 2006; Greg et al., 2006; Sarah Elsie & Rosalind, 2012). The aim was to achieve a saturation point for the research and ensure rich, in-depth data collection was established (Mason, 2010). The scholars proved that

saturation often occurs within the first 12 interviews. Thus, a target of a total of 36 responses was set. Since the research hypotheses were formulated for three distinct groups of respondents (a sample group for conventional experience, wine lovers and wine professionals), the targeted sample size was divided equally between the respondent groups - 12 responses per group. However, the aim to reach the saturation point of the research for each of the groups was the most meaningful for each of the sample subgroups.

Those who agreed to participate in the 3D research were provided with free-of-charge access to the product of 3D winery tours, although usually, the access is only available for the Second Winery customers for a monthly fee. The respondents were informed of the credentials and guided to the website section which should be explored. Then they had individual tour experiences from any device they preferred at their own pace with the deadline set for the feedback on their experience to be submitted.

In the second part of the 3D research, the participants were asked to evaluate their 3D winery tour experience. The structured questionnaire was used to track the respondents' attitude towards the product, and their behavioural intentions and fix the results. The survey was hosted on the Google Forms platform. Those who were willing to share their experiences and opinions about the product in person were invited to do so during interviews. The use of personal interviews and questionnaires was appropriate to gather in-depth insights and quantitative ratings, providing a comprehensive understanding of consumer perceptions and intentions and saving the information for further analysis.

The respondents' group focused on conventional experiences received a short questionnaire hosted on the Google Forms platform. They were asked to evaluate their intention to visit the winery and buy the wines after reading the information.

3.3 Survey Design

The survey was divided into sections, which were preceded by notes introducing the researcher and explaining the research objectives.

The first section for both surveys captured the demographic information about the respondents: age group, gender identification, and country of residence. The respondents were also asked to evaluate their knowledge level about the wines; if they were working in the wine industry, and if they had earlier experienced a winery visit and 3D winery tour. The question about the respondent's relation to the wine industry was important for further respondents' classification into wine lovers or wine professional

subgroups of the “3D experience” sample. Closed-ended questions were used in this section to gather numerical data.

The second section of the survey gathered information about experiences and differed for 2 samples: the conventional and 3D ones.

The group exploring virtual tours evaluated the 3D tour experience via an extended questionnaire. It explored respondents’ experience with the 3D winery tours in detail: their perception of the product, overall enjoyment, ease of navigation, and the tour’s ability to simulate an actual winery visit and wine purchase. Likert scales from 1 (lowest) to 10 (highest) were used to measure respondents’ attitudes, perceptions, and purchase intentions.

The group with the conventional approach evaluated only their attitudes toward the intention to visit and buy the wines applying a Likert scale ranging from 1 (lowest) to 10 (highest).

The questions for the second section were prepared based on two well-established models widely used in research on consumer behaviour: the Technology Acceptance Model (TAM) and the Theory of Planned Behaviour (TPB).

The TAM approach was used to understand respondents’ acceptance of new technologies – 3D winery tours. This model evaluates the perceived ease of use and usefulness of technology. In the research, TAM was applied to assess how easy it was to navigate and interact with the 3D winery tours (Davis, 1989; Venkatesh & Davis, 2000).

The TPB was designed to understand factors influencing behavioural intention (Ajzen, 1991). The model was used to explore the perceived enjoyment and immersiveness of the 3D tour, as well as to evaluate purchase and visit intentions.

The third questionnaire section for the survey regarding 3D tours offered the participants to share any additional comments and feedback regarding their experience and the product of 3D tours. The respondents could also suggest improvements.

The data collection ensured the anonymity of participants, it did not require any personal information.

The survey and access to Second Winery 3D tours were distributed from May 7 to May 27, 2024. The conventional survey was distributed from May 23 to May 30, 2024.

3.4 Data Analysis

The received data was analyzed by IBM SPSS Statistics version 29 for Windows.

Percentages are used to show qualitative results. To ensure the reliability of the instrument used for the research, Cronbach's Alpha was calculated. To assess the valuables - an arithmetic mean with standard deviation was used. The differences in the possible consumer behaviour between groups were analyzed by Multivariate ANOVA (MANOVA). Correlation analysis was used to define the interdependences of the factors. For prediction, linear regression analysis was applied. Statistical relevance is defined at the level of probability from $p \leq 0.05$.

To analyze and visually display the information collected during interviews and through an open-ended question of the survey ATLAS.ti Web software was used.

4. Results and Discussion

Cronbach's Alpha was calculated for the items related to the 3D winery tour experience. The value obtained was 0.812, which indicated “very good” internal consistency (J. Cohen, 1988). High reliability shows that the survey results are accurate representations of the respondents' opinions and behaviour.

4.1 Characteristics of the Research Participants

The research was closed reaching 42 responses: 12 respondents evaluated the conventional experience and its influence on consumer behaviour, 30 respondents evaluated 3D experience: 21 wine lovers, and 9 wine professionals.

The majority of research participants are between the ages of 25 and 34 (45.2%), followed by the group of 35 to 44 (35.7%) as presented in Table 1.

Table 1. Characteristics of all research participants: age groups

Age Group	N	%
18-24	5	11.9%
25-34	19	45.2%
35-44	15	35.7%
45-54	2	4.8%
65+	1	2.4%

In the case of the age group analysis of the respondents who volunteered for the 3D tour experience the age group of 25 to 34 years prevailed (53.3%) (Table 2).

Table 2. Characteristics of 3D tour research participants: age groups

Age Group	N	%
18-24	5	16.7%
25-34	16	53.3%
35-44	7	23.3%
45-54	1	3.3%
65+	1	3.3%

The bigger representation of the younger generation respondents who volunteered to evaluate 3D tour experiences might be a future research topic. As the participants were not interviewed on the reasons why they volunteered to experience 3D tour technology the reason for this disproportion is unclear: the respondents might be interested in the technology itself or the convenience of access to the winery experience from the comfort of their home as well as other reasons. This might be explored further.

83.3% of all respondents were women, 16.7% were men.

In terms of Geographical representation, 31% of respondents were residents of the Netherlands, followed by 19% from Germany and 14.3% from Spain (Table 3).

Table 3. Characteristics of participants: countries of residence.

Country of Residence	N	%
Austria	1	2.4%
France	2	4.8%
Germany	8	19.0%
Indonesia	1	2.4%
Italy	2	4.8%
Netherlands	13	31.0%
Portugal	4	9.5%
Russia	4	9.5%
Spain	6	14.3%
United States	1	2.4%

The research participants were also asked to choose a statement that characterized themselves the best in terms of wine knowledge so that it would be possible to segment the respondents into 4 groups of wine consumers according to the concept introduced by Tach and Olsen in 2006 (Thach & Olsen, 2006). Most respondents (42.9%) defined themselves as wine enthusiasts knowledgeable about wine, their taste and quality characteristics, as well as vintages (Table 4).

Table 4. Characteristics of all research participants: consumer segments

Respondents grouped by wine consumer segments

	N	%
Casual Drinkers	4	9.5%
Adventurous Consumers (Explorers)	9	21.4%
Enthusiasts	18	42.9%
Connoisseurs	11	26.2%

The respondents were also asked if they had earlier visited a winery personally and 66.7% said they had visited wineries personally before (Table 5).

Table 5. Characteristics of all research participants: previous physical winery tour experience.

Previous Winery Tour Experience

	N	%
Yes	28	66.7%
No	14	33.3%

The research participants were asked if they had experienced a 3D winery tour before. Only one of the respondents mentioned that this was the case, representing 2.4% of the sample, while the remaining respondents (97.6%) had not had such an experience (Table 6). This fact proves the statement that 3D tours are not widely implemented in the wine tourism industry.

Table 6. Characteristics of all research participants: previous 3D winery tour experience.

Previous 3D Winery Tour Experience	N	%
Yes	1	2.4%
No	41	97.6%

4.2 Research Findings

The mean scores for the results of the questions about the respondent's willingness to visit the winery and buy the wine were calculated to answer the research hypotheses (Table 7). The means were calculated for each of the respondents' samples and sub-samples.

Table 7. Mean Scores for Visit Intention and Purchase Intention.

	Visit Intention	Purchase Intention
Conventional experience	6.1667	7
3D: wine lovers	5.7619	6.4268
3D: wine professionals	6.4444	6.7778

Contrary to the hypothesis that supposed that the sample of wine lovers would demonstrate a higher intention to visit the winery personally after their 3D tour experience in comparison with the participants who learned about the winery "conventionally", wine lovers showcased lower visit intention compared to those who received the information conventionally.

Wine professionals, on the contrary, demonstrated the highest visit intention, which disproves RH3. It stated that wine professionals will not demonstrate an intention to visit the winery personally after they visit it in a 3D tour. The mean score for this research group was the highest.

The results of the analysis of the visit intention revealed that 3D tour product influences willingness to visit the winery personally, however, the visit intention for the subgroup of wine lovers is lower than the result demonstrated by the sample group that tested the conventional approach, whereas wine professionals turned out to be the most responsive

group to the stimuli generated by 3D tours. An attempt to reveal the reasons for the results demonstrated by wine lovers will be undertaken in the following chapter.

RH 2 and RH4 stated that the intention to buy wine after a 3D visit will be demonstrated by both groups that experienced 3D tours. The mean values for purchase intention of 6.4268 for wine lovers and 6.4444 for wine professionals demonstrated a moderately high intention to buy wine. Although, hypotheses were supported for both samples the highest purchase intention was demonstrated by the participants who experienced the conventional way of learning about wines. The "conventional" sample mean for the purchase intention equals 7. The reason for this might lie in the way the information about the wine was presented on the winery's website with details and pairing recommendations, a comment about it was received from one of the research participants (Annex 2), while no time was devoted to the presentation of the wine during 3D tours. This hypothesis might also lead to further research and product development. One of the possible tests that might be undertaken is the creation of tasting kits for each of the wineries represented in 3D tours so that virtual tourists could not only experience the tour but also wine tasting.

RH5 stated that wine professionals will demonstrate a higher intention to buy the wine from the winery they visited in a 3D tour than wine lovers. The assumption was proved by a higher mean value of the purchase intention demonstrated by wine professionals: 6.7778 against 6.4268 for wine lovers. Wine professionals tend to have a slightly higher purchase intention than wine lovers, almost reaching the same mean demonstrated by the respondents who tested the "conventional" method. However, the anticipated influence on customer behaviour of the wine lovers sample compared to the conventional approach was not observed.

A MANOVA test was run to determine if there were any statistically significant differences in the purchase and visit intentions demonstrated by the respondents' samples. The result suggested that there is no significant difference in the consumer behaviour of these groups ($p = 0.703$). This result supports the same findings from other studies that stated that there are no statistically significant differences, only minor ones, in the behaviour demonstrated by different respondent groups which are defined by their occupation, gender, age of product expertise (Celhay & Remaud, 2018; Sussmann & Vanhegan, n.d.). The reason for this might also lie in the research limitation determined by a small sample, this might be investigated in further studies.

The research results show that while both wine lovers and professionals show positive intentions toward visiting and purchasing from the winery after experiencing the 3D tour, the overall effectiveness of the 3D tour in enhancing these intentions in comparison with the conventional way is not significant.

Those results suggest further research in the direction of improvement in the 3D tour experience to better engage consumers. As well as a further test of the hypothesis regarding technology implementation in the wine and wine tourism businesses and the targeted audiences. For example, the main targeted audience for the 3D winery tour product might be the group of wine professionals who demonstrated higher visit and purchase intentions than the sample group of wine lovers. The research findings may influence the marketing strategy of the Second Winery which targets novice wine lovers now.

4.3 Research Findings on the 3D Tour Product by Second Winery

An attempt to better investigate the factors for the revealed customer behaviour shown by the research participants was undertaken. Mean values for the parameters that might have influenced the respondents' intention to buy wine were calculated (Table 8).

Table 8. Mean Scores for the number of tours visited, perceived enjoyment, ease of use, immersiveness, and willingness to recommend the 3D tour.

	No of Tours	Enjoyment	Ease of Use*	Immersiveness	Willingness to Recommend
3D: wine lovers	1.8095	6.4286	3.62	5.2857	6.1905
3D: wine professionals	2.3333	6.6667	3	4.8889	5.5556

* Ease of use was evaluated from 1 (very difficult) to 5 (very easy) scale.

The results of the analysis revealed that wine professionals attended more tours and enjoyed them more. At the same time, they found the 3D tours to be more difficult to use than wine lovers, less immersive, and they were less willing to recommend them.

An Exploratory Factor Analysis was conducted to reveal which of the factors from Table 8 influenced the consumers' intention to buy and visit in person (Annex 3). The results highlighted that each of the explored characteristics of a 3D tour is important, as well as the number of tours visited has its influence.

At the next step regression analysis was undertaken to reveal which of the tour characteristics influenced the visit and purchase intention more (Annex 4).

Perceived enjoyment (B = 0.506, p = .006) and immersiveness (B = 0.544, p = .003) of the 3D tours make the biggest contribution to the visit Intention, whereas the perceived ease of use (B = -0.563, p = .044) revealed a significant but negative correlation to visit Intention. This means that higher perceived ease of use might decrease the intention to visit, which could be contradictory and need further research. Willingness to recommend (B = -0.220, p = .117) turned out to be not a significant predictor of visit Intention.

Thus, two of the most important characteristics of a 3D tour that influence the intention to visit the winery personally are perceived enjoyment and immersiveness of the 3D wine tour.

However, the linear regression analyses for the variable of purchase intention showcased that only 20% of the variance is dependent on the factors of perceived enjoyment, ease of use, immersiveness, and willingness to recommend ($F(4, 25) = 1.563$, $p = .215$). This means, that other factors not included in this research might have a bigger importance in influencing purchase intention. The reason might also be the sample size, which turned out to be insufficient to detect significant correlations.

The attempt to define interdependent factors was assessed via correlation analysis.

Visit intention and purchase intention showcased a positive correlation ($r = 0.685$, $p < 0.001$), indicating that those who intend to visit wineries are also more likely to intend to purchase wine. Visit and Purchase intentions showed as well significant positive correlations with the factors of enjoyment ($r = 0.661$, $p < 0.001$; $r = 0.357$, $p = 0.053$ correspondingly) and immersiveness ($r = 0.685$, $p < 0.001$; $r = 0.426$, $p = 0.019$ correspondingly). Whereas willingness to recommend is significantly influenced by "the factor of immersiveness ($r = 0.685$, $p < 0.001$).

Thus, the main characteristics of a 3D winery tour that might influence consumer behaviour are the factors of perceived enjoyment and immersiveness. While the perceived enjoyment was highly evaluated by both sub-groups of the research participants with mean values of 6.4286 for wine lovers and 6.6667 for wine professionals, immersiveness, on the contrary, had relatively low mean values (5.2857 and 4.8889 correspondingly). Thus, Second Winery should concentrate on increasing the perception of immersiveness in its product to boost visit intention levels.

4.4 Semantic Analysis of the Comments

In addition to the statistical analysis of the data received from the survey, and comments received from an open-ended section of the survey, 9 interviews were conducted with the research participants who volunteered to discuss their experience and share their ideas about the product in person. The aim was to gain a deeper understanding of the 3D virtual tour experience and obtain information for further product development and improvement.

The analysis of the respondents' comments received via an open-ended question in the third part of the survey and comments left during the interviews was done using ATLAS.ti Web software.

First, all the comments were analyzed sentence by sentence using a sentiment analysis approach to define the context in which they were used (Poria et al., 2018). The comments (Annex 5) were distributed to 3 groups: positive, neutral, and negative (Figure 5).

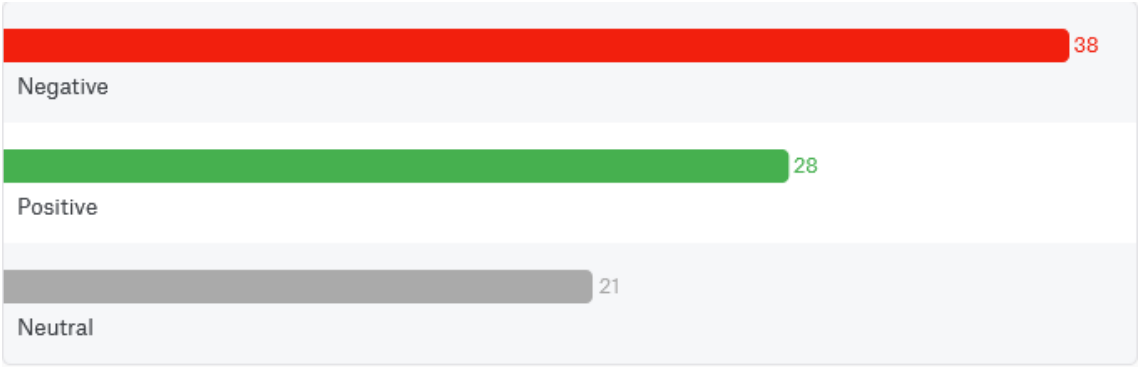

Figure 5. Sentiment analysis of the comments received during the interviews about the Second Winery 3D tour experience.

Although 28 and 21 sentences correspondingly had a positive and neutral context, the majority of the comments had a negative one (38). Negative comments were not focused on the negative overall impression of the use of the product, but on the factors that influenced respondent enjoyment levels and led to its decrease as it was stated by the respondents themselves.

To explore further which aspects of 3D tours should be improved the analysis which applied coding technique was conducted (Friese, 2012; Woods et al., 2016).

Figure 6 demonstrates that 7 areas for improvement were identified: navigation, the feeling of realism (immersiveness), human touch, issues with different detailization of tours, technical issues connected with the ability to explore tours (open them), and gamification of the product.

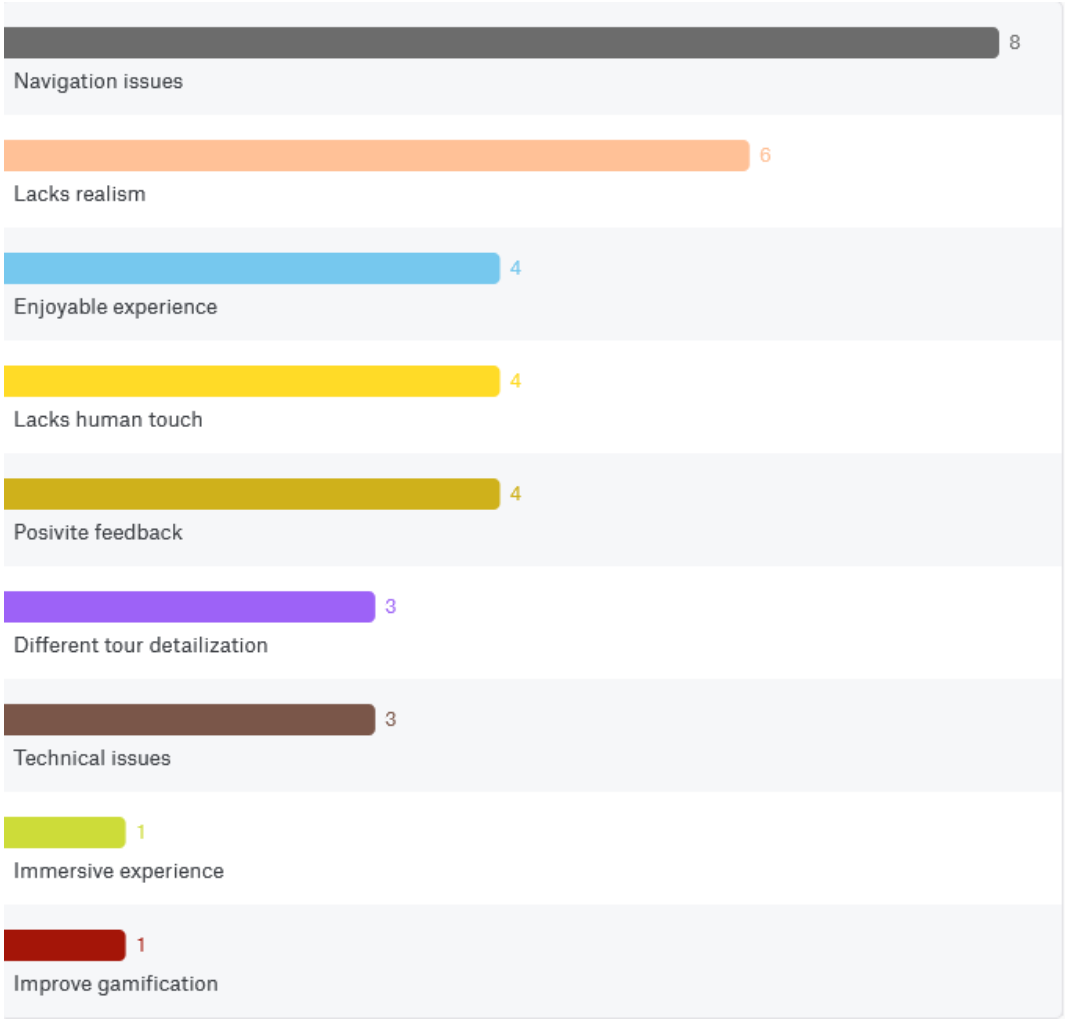

Figure 6. Coding analysis of the comments received during the interviews about the Second Winery 3D tour experience.

The majority of the comments mentioned that the participants faced issues with navigation: it was either too difficult to deal with it, sometimes even impossible, or it was unclear which way to go. One of the potential research participants even reported that navigation was the reason why the person had to skip participation in the research.

Although statistical analysis was not able to reveal the connection between the ease of use of the product of 3D tours with perceived enjoyment, navigation is the aspect that should be paid attention to and improved.

The second most popular comment was related to the realism of the winery images. It was revealed that the majority of the research participants did not expect to see the fully computer-generated environment of the wineries, which is the main feature of 3D tours (Loaiza Carvajal et al., 2020).

Several issues were revealed regarding this group of comments. First, the consumers do not differ in technologies applied in virtual tours: 3D does not differ from panoramic tours for them, and once they receive the product they do not fully understand what to expect from it. This fact influences their satisfaction level from the experience. Second, there is still confusion in terms of the definitions for those groups of technologies and the differences between them in the academic literature, very often the terms VR, AR, and 3D are used interchangeably or even via a slash sign, for example, in the article by Zidianakis et al. (Zidianakis et al., 2021).

The participants also mentioned the lack of human touch in 3D tours, commenting that one of the most important aspects of a conventional winery visit – the opportunity to talk to the winemaker in person and be in the company of other wine lovers.

Paying attention to those aspects Second Winery might attempt to improve the product in terms of better and more user-friendly navigation, as well as to educate the consumers about specific features of 3D tours. It has already been proven in earlier studies that obtaining tourist expectations of product attributes significantly influences customer satisfaction (Kyriakaki & Kleinaki, 2022; Liu et al., 2024; Nilashi et al., 2015).

4.5 Research Limitations

The research has several limitations that should be acknowledged.

First, the research was restricted to the investigation of a single product – 3D winery tours developed by Second Winery. The findings are relevant to this product and might not be transferred to other 3D winery tour experiences and products developed by different companies.

The second research limitation to be considered is the size of the research sample which could impact the statistical power of the results.

Finally, the research was designed to gather considerable insights on the product and was focused on qualitative insights. This approach provided insights into the product but might have limited the scope of quantitative analysis.

5. Conclusions

This research has provided valuable insights into the impact of 3D winery tours on consumer behaviour in comparison with a conventional marketing method. The research was particularly focused on visit and purchase intentions stimulated by the 3D tour experience developed by Second Winery.

While both subgroups of the research sample which experienced 3D tours (wine lovers and professionals) showcased positive visit and purchase intentions after the 3D tour experience, the overall effectiveness of the virtual tour in enhancing consumer behaviour compared to conventional methods was not statistically significant. This indicates that while 3D tours have potential, they may need further product improvement to fully leverage their advantages over traditional methods. It has also been revealed that customer education on 3D tour products is essential to properly shape their expectations regarding the experience.

The subgroup of wine professionals demonstrated a higher behavioural response to the stimuli created by the 3D tour experience, which led to a hypothesis that it might be more effective to define wine professionals as the main targeted audience for the product of 3D winery tours by Second Winery replacing the target segment of novice wine lovers.

The study proved that perceived enjoyment and immersiveness of a tour are significant factors influencing the intention to visit after experiencing a 3D tour, whereas the intention to visit stimulates higher purchase intention. Based on the previous research by Wen and Leung (Wen & Leung, 2021) the author suggested that it might be the case that if a 3D tour was accompanied by a wine-tasting kit from Second Winery it might influence the factor of immersiveness, this hypothesis should be tested. Further studies might explore which factors influence the variables of enjoyment and immersiveness.

The research also identified several areas for improvement in the 3D tour product. Issues such as navigation difficulties, the realism of the winery images, and the lack of human interaction were highlighted by the research participants. Improvements in those aspects can enhance user experience and satisfaction, potentially leading to higher conversion rates.

The key findings from the study lead to the suggestion that at the current stage of product development, 3D tours will be the most effective as a part of a broader, integrated marketing strategy. This approach will help to maximize the economic impact of the 3D winery tour technology implementation in the daily winery operations.

Future research should address the limitations identified in this study, including expanding the sample size and exploring additional factors that might influence consumer behaviour such as sustainability and accessibility which were not emphasized in the current research design. Moreover, continued investigation into the technological and experiential improvements of 3D tours could enhance their effectiveness as a marketing tool in the wine tourism industry.

On the industry-scale level, the research findings highlight the necessity to integrate 3D tours into a broader marketing strategy to amplify their impact. The multi-channel marketing approach can effectively increase the effect of 3D tour implementation not only for wineries but also for wine tourism destinations. Destinations can use 3D tours as part of their broader tourism strategy to attract visitors highlighting unique experiences that set them apart from other regions. This can boost overall tourism numbers and economic impact.

Wineries and wine regions can also expand their market reach to attract tourists who are unable to visit due to geographical or logistical constraints. This can open new revenue streams and increase overall market penetration. Collaboration with various industry stakeholders can promote 3D tour experiences and help enhance its reach and effectiveness.

Another valuable research takeaway reminds us of the importance of targeting. Tailored content and promotional efforts can increase the effectiveness of 3D tour implementation. At the current product development stage, it is important to focus on better targeting the wine professional segment. New market segments might be reached with the product as well, for example, tech-savvy younger generations could be attracted by it, but obviously, the product should be adjusted to their needs and interests.

3D winery tours represent a promising tool for promoting wine tourism and influencing consumer behaviour. While there are challenges to be addressed, the potential benefits in terms of increased visitor numbers and wine sales make it a valuable addition to the marketing strategies of wineries. Continued refinement and targeted research will be essential to fully realize the potential of 3D tours in this sector.

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Annexes

A1. Information Presented to the “Conventional” Sample

A1.1 About the Winery and Winery Visits

Images that preceded the question about the visit intention.

The Winery

The **AALTO project** was founded in February 1999, in the prestigious winemaking region of Ribera del Duero (Spain). The foundational aim of Mariano Garcia and Javier Zaccagnini in **AALTO** was to make a wine that shows a different personality, of high quality and being a faithful reflection of distinct locations, blending them at the end of the aging process to obtain balance and complexity.

A few years later, in 2006, Masaveu and Nozaleda families joined **AALTO**, both owners of wineries in other wine regions of Spain, providing experience and stability to the project, which meant the consolidation of the winery to this day.

From its beginnings in 1999 until the harvest of 2004, the production of our wines took place in rented facilities in Roa (Burgos, Spain). While the project was being established, the founders began looking for a new place to locate their own new winery. A beautiful plot of 15 hectares belonging to the municipality of Quitanilla de Arriba (Valladolid) was chosen.

The first phase of the new winery was completed in 2005, being that year the first harvest that was produced in these facilities. The modern design chosen for this new winery was carried out only with the very highest quality criteria. The architecture of the winery is perfectly integrated into the environment, in a typical Ribera del Duero plateau, with a lineal and harmonic design without ostentation, and minimalistic details, elegant and comfortable. The second phase of the winery corresponding to the more social part of the winery was completed in 2016.

Winemaker

Mariano García Fernández

Born in Valbuena de Duero

Mariano García studied at the “Escuela de la Vid y el Vino” in Madrid and made his first harvest in 1968 at Vega Sicilia, where he developed his professional career as Technical Director of the company for 30 years, until 1998. In 1999, he founded with Javier Zaccagnini, Bodegas AALTO, as Technical Director from the first day. As a winemaker, Mariano García firmly controls the yields, respecting the grapes as much as possible and his philosophy of minimum intervention, searching for the maximum expression of the terroir in each plot. The wines unite the power and structure with elegance and complexity.

Visit the Winery

Guided Visit to Aalto Winery

The visitor will be guided following the same way the grapes do as they are processed during harvest, fermentation and barrel ageing, along the five levels of our gravity-led winery. After this, a tasting of our wines will be offered to the visitor.

The tour ends with a tasting of our AALTO and AALTO PS wines.

Schedule: Monday through Friday at 9:00; 11:00; 1:00 p.m.
Closed weekends and holidays.

Duration of the visit and Tasting: 60-90 minutes approximately.

Reservation: Essential appointment, minimum 3 working days in advance. Visits without reservation are not allowed. A minimum group is not required.

Capacity visits: 15 people.

How to get

A1.2 About the Wines

Images that preceded the question about the purchase intention.

The Wines

For full details about each of our wines, click on the images.

AALTO 2021

AALTO Blanco de Parcela 2022

AALTO PS 2021

AALTO XX Anniversary

Download Data Sheet

AALTO PS 2021

Climatic conditions

The farming year started with a rainy October, autumn had smooth temperatures and rainfalls were around **150 l/m^2**. The year 2021 began with a strong storm, Filomena, that caused big snowfalls and a sudden decrease of temperatures reaching -12ºC. Soft temperatures and little precipitation remained the rest of winter. Springtime initiated with a decrease of temperatures and some frosts in mid-April that scarcely affected the buds. The vines sprouted the first days of May.

July started with smooth temperatures and a heat wave arrived in the middle of this month whose high temperatures extended until August. No rains happened.

September's storms left some showers that led to an optimal ripening of the grapes.

Grape origin

100% Tinto Fino (Tempranillo) primarily from very old vines – 60 to 90 years old – from selected plots in La Horra and La Aguilera.
The harvest was done by hand, in small boxes of 15 kilos that are thoroughly inspected, bunch by bunch, on the selection table.

Tasting notes

Intense purple colour. Black fruits together with spicy nuances displayed in the glass confer on this wine complexity and elegance on the nose. It is fresh on the mouth; its soft and silky tannins give it great intensity and volume.

Average oak ageing

21 months in new French oak barrels.

Data of interest

BOTTLING:
September 2023

ALCOHOL BY VOLUME:
15% VOL

ALLERGENS: sulphites

RATING BY D. O.
REGULATORYCONTROL
BOARD:

Excellent

Technical sheets last vintages

2009 | 2010 | 2011 | 2012 |
2013 | 2014 | 2015 | 2016 |
2017 | 2018 | 2019 | 2020

Vintage	R.Parker	Guía Peñín	Guía Gourmets	Wine Spectz
2008	–	92	9.75/10	–
2009	93	94	9.75/10	–
2010	94	98	–	92
2011	94	94	99/100	–
2012	94	95	98/100	95
2013	95	–	99/100	–
2014	94	–	–	91
2015	94	94	99/100	95
2016	94 – 95	95	98	95
2017	94	–	–	–
2018	95	–	–	–
2019	–	–	–	–

A2. Comment from a “Conventional” Survey Participant

So for the description part for me there is too much text and I simply stop reading after two lines - ideally the info shoudl be more in bullet points and categories- ie the philosophy, location, facilities, etc - some bold characters

for the wine wine buying what makes a difference for me is when there is info on the food pairing and use suggestions, ie: for aperitivo in a summer day, important meal etc.. then I immediately visualize it and know the occasion, ie I am more motivated to buy

A3. Exploratory Factor Analysis for the Visit Intention Factor

Principal Component Analysis (PCA) with Varimax rotation was employed to explore the underlying structure of the data and analyze which factors influence consumer’s behaviour after attending a 3D tour. Variables with loadings greater than 0.4 were considered significant (J. Cohen, 1988).

Communalities

	Initial	Extraction
Number O fTours	1.000	.744
Enjoyment	1.000	.786
Ease Of Use	1.000	.517
Immersiveness	1.000	.715
Willingness to Recommend	1.000	.748

Extraction Method: Principal Component Analysis.

A4. Multiple Linear Regression Analysis

A4.1 Multiple Linear Regression Analysis for Visit Intention

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	3.122	1.045		2.988	.006
	Enjoyment	.506	.169	.553	2.990	.006
	Ease Of Use	-.563	.266	-.265	-2.120	.044
	Immersiveness	.544	.164	.547	3.312	.003
	Willingness to recommend	-.220	.135	-.275	-1.624	.117

a. Dependent Variable: Visit Intention

Model Summary

R: 0.801

R Square: 0.642

Adjusted R Square: 0.585

Std. Error of the Estimate: 1.283

The values explain 64.2% of the variance in visit Intention. The variables of perceived enjoyment, ease of use, immersiveness, and willingness to recommend significantly influence the variation in visit Intention.

ANOVA:

F: 11.207

Sig.: < .001

The ANOVA value ($p < .001$) shows that the model significantly predicts the dependent variable of Visit Intention.

Interpretation of Coefficients:

Constant: When all predictors are zero, the predicted Visit Intention score is 3.122.

Enjoyment: For every one-unit increase in Enjoyment, Visit Intention increases by 0.506 units, holding other variables constant (p = .006, statistically significant).

Ease of Use: For every one-unit increase in Ease of Use, Visit Intention decreases by 0.563 units, holding other variables constant (p = .044, statistically significant but negatively associated).

Immersiveness: For every one-unit increase in Immersiveness, Visit Intention increases by 0.544 units, holding other variables constant (p = .003, statistically significant).

Recommendation: For every one-unit increase in Recommendation, Visit Intention decreases by 0.220 units, but this result is not statistically significant (p = .117).

A4.2 Multiple Linear Regression Analysis for Purchase Intention

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	4.475	1.565		2.860	.008
	Enjoyment	.115	.253	.125	.454	.654
	EaseOfUse	-.190	.398	-.089	-.478	.637
	Immersiveness	.339	.246	.340	1.378	.180
	Recommendation	.035	.203	.044	.175	.862

a. Dependent Variable: PurchaseIntention

A5. Comments from the 3D Sample Research Participants

1 Comment: "It does give me a good idea how the winery will or may look like (along with the information given by Ai assistant) but I would like it even more if it looks more realistic (not too cartoonist - both for the AI assistant and for the winery). It is fun! However it didn't give me a feeling of belonging and being present. It is handy but not necessarily something that I would purchase. The AI assistant is amazing she/he is responsive and has a lot of information. However I am missing the 'human touch' so badly both from the assistant but also from the other visitors. I miss the 'natural' conversations actually being in the vineyard touching the leaves feeling the breeze of air etc."

2 Comment: "I don’t see the added value of the freely walking unless it comes with more advanced gamification elements like easter eggs, storyline, videos, and interaction (conversations, explanation, tasting, etc.). I felt like I was searching for something I didn’t find. Personally, I would prefer more real non-animated (Google streetview like) and less freedom in movement over the gamification experience at this point for the tour to be more straightforward. Nevertheless, I do believe in the potential for 3D tours. As a starting point, I would advise the point & click adventure/mystery games approach."

3 Comment: "This might be the future and my answers may not be the best suited because I am not the target audience of this. During the pandemic I enjoyed a lot of virtual tours and attended theatres and shows too but now when we have the access I prefer visiting the wineries in person. Meeting the winemakers and other people involved in winemaking and listening to their stories is different. Just a thought: Maybe the platform can have recorded versions from winemakers as part of the subscription. Also, the chateau Montrose tour was not loading at all! I tried multiple times." Codes: [Technical Issues, Human Touch]

4 Comment: "I’d prefer 3D panoramas. Experience with the phone. I didn't understand how to navigate. Chateau Montrose has only one hall. And there are no two buttons for control. Bodegas Aalto and Pago de Carraovejas have two buttons, you can choose the location. But they are all plainly drawn. This is not interesting to me at all. I expected live views. I don't understand why they had to draw it why can't it be a live panorama? Château Branaire-Ducru does not want to switch locations. I really don't understand why they need to draw literally everything in 3D."

5 Comment: "I am a millennial working in the industry. I am very enthusiastic about the incorporation of new experiences to diversify the offer and good purposes go hand in hand with the incorporation of these technologies. But I think the experience had some frictions. I don't know if it has to do with the browser I used but it was difficult for me to move inside the screen and the exhibition space was limited. I would like the visuals to be more hyper-realistic. Finally, of the 4 tours available, I could only do 1 (Spanish winery); the others appeared with a black screen. An interesting point! Although the experience was not smooth, I'm interested in tasting the wines..."

6 Comment: "Participating in a 3D winery tour is already an exciting pastime in itself. Thank you for this opportunity! However, I would like to note that not all tours are equally well-designed in terms of detail (transportation, the possibility of independently opening

doors and entrances/exits, the number of points for movement) which creates a mixed impression of the overall 3D excursion experience."

7 Comment: "The virtual assistant was not quite helpful. They told me to go this way and that way but did not show me that way so it was kind of useless. Visual element like arrows would help I guess. In general I didn't know what to do and where to go. At some point I got bored wandering around and quit. The list of places to visit with directions would be nice."

8 Comment: "At first I actually got frustrated. I would like to be taken in the usual tour and told all the interesting things there are instead of having to ask things and there is no signage to where I should be going. I got lost and a bit nauseous to be honest. The concept itself is interesting but it felt in those videogames but without an actual goal or instructions."

9 Comment: "I am not very keen on this kind of technology (I know I'm old fashioned) so I would always prefer the real trip to the winery even if 3D tour is just best of the best."

10 Comment: "I really liked it but it doesn't compare to an explanation from a winemaker 'in real life'."

11 Comment: "I thought the overall experience was great, really immersive, and I was not expecting that. It was nice to 'move around' virtually and explore at your own rhythm, revisiting the spaces in any specific order you like or sitting and staying more time in certain places. Something you wouldn't normally be able to do during an actual wine tour. The virtual tour made me want to go visit the winery!"

12 Comment: "It would be good to have the tour with a clear route where to go which is accompanied by the story. As assistant talks only if you ask something and it is not very consistent and smooth in terms of the storytelling. I tried to get the story if I were in real life there but I needed to ask all the questions on my own which is irritating. The first short story and the tour directions is good to have. Moreover, there are some doors which can be opened and others are not be entered which is confusing. Either everything should be possible to visit or there must be signs where we can go and see inside. In general, it is an interesting experience to learn about wine and get the first impression."

13 Comment: "Keep up the great work!"

14 Comment: "It’s a great development. Especially to come in contact with wineries from all over the world without having the need to travel to them. It doesn’t replace a physical visit however."

15 Comment: "I think this type of experience has a huge potential and I would use it a lot as it is an interesting way of getting to know distant places. However, what I expect on a virtual tour is to be able to see the company's real facilities. Despite some low scores I gave, I believe that with some improvements, this type of experience will become very popular among customers! Well done!"

16 Comment: "I was navigating the tour with my iPhone and it was a bit tricky using the buttons. I would prefer to have the view shift as I move my phone. I tried to use both mobile and laptop. It was difficult to navigate with a laptop but I got the navigation button and figured it out but it was impossible to do with phone use laptop for better experience. Most of the times I was seeing ceilings so not really a good experience. I think if they hire a good animation designer or game designer, they might know how to make it smooth. Like in the game, it's so smooth it doesn't feel forced."

17 Comment: "Unfortunately, I couldn’t make it work on phone (screen was not rotating and I couldn’t ever pass introduction phase)."