

# A Systematic Literature Review on Technological Innovation in the Wine Tourism Industry: Insights and Perspectives

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**Abstract:** This study comprises a systematic literature review of 68 articles published between 2010 and 2024, identifying and coherently grouping the wine tourism sector's adoption of technological innovation practices. The articles were analyzed using a framework developed from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The selection criteria included peer-reviewed, full-length articles in English emphasizing technological innovations in the wine tourism sector. The results highlight several key trends in technological innovation applied to wine tourism. The innovations were categorized into five areas: digital marketing and promotion, sustainability and innovation, immersive technologies (AR/VR), e-commerce and distribution models, and smart technologies for winery management. The review reveals a growing interest in digital marketing and immersive technologies in promoting wine tourism through digital platforms and creating engaging tourist experiences through virtual and augmented reality. The review focuses only on peer-reviewed studies published in English, which may limit its global scope. Books and non-peer-reviewed articles may have introduced further developments in technological innovation that are not captured in this review. This study is a post-COVID-19 review of technological innovation in wine tourism. The findings provide significant implications for researchers and policymakers, suggesting future research areas and offering insights on how public funds can support wine tourism's digital transformation and sustainability

**Keywords:** systematic literature review; wine tourism; innovation; technology



**Citation:** Piras, F. A Systematic Literature Review on Technological Innovation in the Wine Tourism Industry: Insights and Perspectives. *Sustainability* **2024**, *16*, 9997. <https://doi.org/10.3390/su16229997>

Academic Editor: Mark A. Bonn

Received: 22 October 2024

Revised: 12 November 2024

Accepted: 14 November 2024

Published: 16 November 2024



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## 1. Introduction

Various definitions of wine tourism are presented in the literature. Ref. [1] defines wine tourism as a specific type of consumer behavior where wine enthusiasts or those interested in wine regions travel to selected destinations. Similarly, ref. [2] describes wine tourism as an experience directly tied to wine, offering a dynamic and multifaceted journey that integrates wine culture and heritage. This immersion creates emotions, sensations, connections, and sensory experiences during the visit, encouraging the wine tourist to become a supporter of a particular winery, brand, or region.

A widely recognized academic definition comes from [3], which describes wine tourism as visiting vineyards, wineries, wine festivals, and wine shows, where the primary motivation is wine tasting or exploring the characteristics of a wine-producing region.

In recent years, wine and food tourism has gained significant importance on a global scale. Wine tourism in particular plays a crucial role in rural tourism, fostering opportunities for both horizontal and vertical connections in rural environments. It is a significant draw for tourists in several key wine-producing nations, such as the USA, Australia, France, and Italy, where wine tourism is integrated into broader tourism strategies [4].

According to [5,6], studies on wine tourism emerged between 1990 and 2000, focusing on destinations, wine industry stakeholders, and the behavior of wine tourists. The experience of the wine tourist is seen as multidimensional, shaped by various factors, including the natural landscape, wine, food, cultural elements, local heritage, staff quality, service, and technology [7].

Rogers's innovation adoption theory [8,9] provides a useful framework to better understand the integration of technological innovations in the wine tourism sector. This theory explains the process through which new ideas and technologies are adopted within a social system, highlighting four critical elements: innovation, communication channels, time, and social system. Additionally, Rogers identifies five attributes that influence the rate of adoption of an innovation: (1) relative advantage, or how beneficial the innovation is perceived compared to current practices; (2) compatibility, the degree to which the innovation aligns with the adopters' values and experiences; (3) complexity, or the ease of understanding and use; (4) trialability, which allows potential adopters to experiment with the innovation; and (5) observability, or how visible the benefits are to others.

In the context of wine tourism, these factors can help explain differences in the adoption of technologies such as augmented reality (AR) and virtual reality (VR), e-commerce platforms, and smart winery management tools. For instance, technologies with a clear relative advantage, such as enhancing customer experience or optimizing resource management, are more likely to be adopted. However, complexity, limited trialability, and implementation costs can pose significant barriers, particularly for small wineries with fewer resources.

Using innovation adoption theory as a framework, this systematic review explores how different technological innovations have been adopted within the wine tourism sector and how specific factors, such as business context, market maturity, and user characteristics, influence the adoption rate. This theoretical approach allows for a better organization and understanding of technology adoption trends in the sector, providing a basis for recommendations on how companies and policymakers can encourage the adoption of sustainable and innovative technologies in the long term within Rogers's theory model.

Technology is one of the most extensively researched areas in tourism. Its adoption has significantly altered how tourism experiences are produced, promoted, communicated, and sold. Innovative technologies can be effective marketing tools for promoting destinations by fostering an emotional connection to a place even before a visit. Virtual reality influences visitors' behavioral intentions and has potential in destination marketing, as [10] indicated. In particular, technology is driving substantial changes in the food and wine tourism sectors, similar to other travel segments [11]. Technology integration initially helped tourism providers support tourists by simplifying access to information and bookings through websites, reservation systems, and email communications [12,13].

Over time, technological advancements have shifted the focus to empowering tourists during all phases of their journey—before, during, and after travel [14,15]. The rise of social media, interactive websites, virtual marketplaces, and real-time communication tools has enabled a process of co-creation between tourists and service providers, resulting in a more customized and meaningful experience [16]. Emerging technologies such as virtual reality (VR), augmented reality (AR), interactive touch screens, multitouch tables, and projections have transformed how tourists engage with experiences, offering more immersive and dynamic content [17,18].

Over the past two decades, numerous studies have explored the topic of technological innovation in wine tourism, highlighting the growing scholarly interest in this field. Despite this attention, research remains somewhat fragmented, which has led to only a partial understanding of technology's role in wine tourism's current and future development. This observation underscores the need to consolidate and better organize existing studies by integrating various perspectives, particularly those of users of innovative technologies and tourism businesses providing these services. For example, studies such as [19] illustrate that companies increasingly consider including VR tourism experiences in their business models, especially following the COVID-19 pandemic. Consequently, VR is now being studied not only from the tourist perspective but also from the business standpoint, offering a broader perspective on the potential applications of VR for tourism purposes.

The present study systematically reviewed research on technology and innovation within the wine tourism literature. Although several literature reviews and some systematic

reviews have been conducted in the broader fields of tourism and wine tourism, there still seems to be a notable gap in the specific focus on how innovations and applied technologies have been addressed in wine tourism research.

To our knowledge, the study by [20] is the only existing work that systematically analyzes review papers in the wine tourism domain. While their contribution provides valuable insights into the trends and impacts of the digitization process in the wine tourism sector, it only includes studies published before 2021 (covering 72 journals) and predates the COVID-19 pandemic. Consequently, their review needs to capture the rapid changes in digital communication and the significant impact the pandemic may have had on innovation within the sector. Despite a growing interest in technological advancements in the wine tourism sector, specific studies that systematically address post-COVID shifts in wine tourism technology adoption still need to be expanded. While previous reviews have focused on the broader tourism industry or pre-2021 developments, this is the first time anyone has examined how COVID-19 has accelerated digital transformations, particularly within wine tourism. This study aims to bridge this gap by offering an updated and comprehensive review of post-COVID technological innovations in wine tourism.

Recognizing the need to identify and organize updated knowledge available in the public domain—yet not fully assessed—has been deemed essential for informing policy development and expanding the scope of current research [21]. Moreover, the value of systematic reviews lies in acknowledging that “most research can only be fully understood within its broader context, which includes the findings of other studies” [22].

Building on these principles, the current study seeks to provide an updated and more comprehensive systematic review of the innovations applied to wine tourism. It closely follows specific guidelines, particularly those outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework [23], to assess the impact of technology and innovation in wine tourism through systematic review methodologies (see Supplementary Materials).

To address the existing gaps and offer an updated, comprehensive review of the recent innovations in wine tourism innovations—particularly those spurred by rapid technological progress in the post-pandemic era—this study analyzes articles published between 2010 and 2024. Specifically, the primary objectives of this research are to categorize the innovations and technological applications relevant to the wine tourism sector and to evaluate these studies using the frameworks above critically. By doing so, the study aims to track the evolution of these innovations, highlight emerging trends, and provide insights into future research directions and policy implications for the field.

## 2. Materials and Methods

A systematic review of papers on technological innovation in wine tourism published between 2010 and 2024 was conducted to examine how scholars in this field have approached and reported innovations applied to the wine tourism sector. Technological innovations before 2010 are now considered acquired by the industry and already commonly adopted and recognized by the system according to the scheme proposed by Roger (2003) [8].

It is important to note that there are various types of reviews. For instance, ref. [24] identifies 14 different types, distinguished by the methods used for searching, appraising, synthesizing, and analyzing the body of knowledge. However, refs. [25,26] have criticized traditional literature review methods for their limitations, including insufficient scientific rigor, the absence of explicit or systematic approaches, the potential for biased perspectives, and a tendency to include only evidence supporting a particular stance. These critiques highlight concerns about traditional reviews’ reliability, validity, and research bias in generating evidence-based knowledge [27].

In response to these limitations, systematic review methods have been developed to enhance the quality and transparency of literature reviews by minimizing bias and omissions. Systematic reviews follow a replicable, scientific, and transparent process that

reduces bias through comprehensive literature searches and provides a clear audit trail of the decisions, procedures, and conclusions [21].

The term “systematic” refers to the research protocol that “helps protect objectivity by providing explicit descriptions of the steps taken” [21]. This protocol includes outlining specific research questions, defining the study’s focus, and setting explicit inclusion and exclusion criteria [28]. These structured steps allow systematic reviews to support evidence-based practices, making them a fundamental scientific activity in both scientific and social science disciplines [29].

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [23]. PRISMA, consisting of a 27-item checklist and a four-phase flow diagram (see Table 1), was initially developed in the medical field by 29 scholars to enhance the transparency and accuracy of literature reviews. PRISMA was chosen over other protocols for its comprehensiveness, widespread use across disciplines beyond the medical field, and ability to increase review consistency.

To build the primary dataset, a protocol was established in advance to document the analysis methods and inclusion criteria, following [30]’s simplified protocol.

**Table 1.** Recommended items of PRISMA for future systematic reviews in tourism and hospitality.

Section/Topic	Item Number in PRISMA	Checklist Item
TITLE Title	1	Identify the report as a systematic review.
ABSTRACT Structured summary	2	Provide a structured summary, including, as applicable, background, objectives, data sources, study eligibility criteria, synthesis methods, results, limitations, conclusions, and implications of key findings.
INTRODUCTION Rationale	3	Describe the rationale for the review in the context of what is already known.
Objectives	4	Provide an explicit statement of questions being addressed.
METHODS Protocol and registration	5	Indicate if a review protocol exists and if and where it can be accessed (e.g., web address). If available, provide registration information, including the registration number.
Eligibility criteria	6	Specify study and report characteristics (e.g., years considered, language, publication status) used as eligibility criteria, giving rationale.
Information sources	7	Describe all information sources (e.g., databases with coverage dates, contact with study authors to identify additional studies) in the search and the date last searched.
Search	8	Present a complete electronic search strategy for at least one database, including any limits used, so that it could be repeated.
Study selection	9	State the study selection process (i.e., screening and eligibility included in the systematic review).
Data collection process	10	Describe the data extraction method from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming investigator data.
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.
RESULTS Study selection	17	Give the number of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, context, methods) and provide the citations.
Synthesis of results	21	Present the main results of the review.

Table 1. Cont.

Section/Topic	Item Number in PRISMA	Checklist Item
DISCUSSION		
Summary of evidence	24	Summarize the main findings, including the strength of evidence for each main outcome, and consider their relevance to key groups (e.g., researchers, practitioners, users, and policymakers).
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias) and the review level (e.g., incomplete retrieval of identified research, reporting bias).
Conclusions	26	Provide a general interpretation of the results in the context of other evidence and implications for future research.
FUNDING		
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data) and role of funders for the systematic review.

Source: adopted from [31].

We utilized the Scopus database to search for documents published in journals that contained the terms “wine tourism” OR “eno tourism” AND (technolog\* OR innovat\* OR digital) in their titles, abstracts, and/or keywords, with date and language restrictions applied. The search terms were combined using the Boolean operator “AND”, which allowed us to explore the article title, abstract, and keywords of every document published in this field. The search was conducted in September 2024. The decision to use only the Scopus database was based on its inclusion of the most highly indexed articles and the most significant number of publications.

The metadata of the identified records—such as title, abstract, keywords, authors’ names and affiliations, journal name, and year of publication—were exported to an MS Excel spreadsheet. Two independent reviewers then screened the titles and abstracts of the documents separately. Papers that did not require further systematic review, such as empirical, descriptive, or conceptual papers, were excluded.

Following this, the two reviewers independently conducted an eligibility assessment by thoroughly examining the full texts of the remaining papers based on predefined eligibility criteria. Setting and clarifying inclusion and exclusion criteria in advance is a critical step in ensuring that a systematic review remains unbiased.

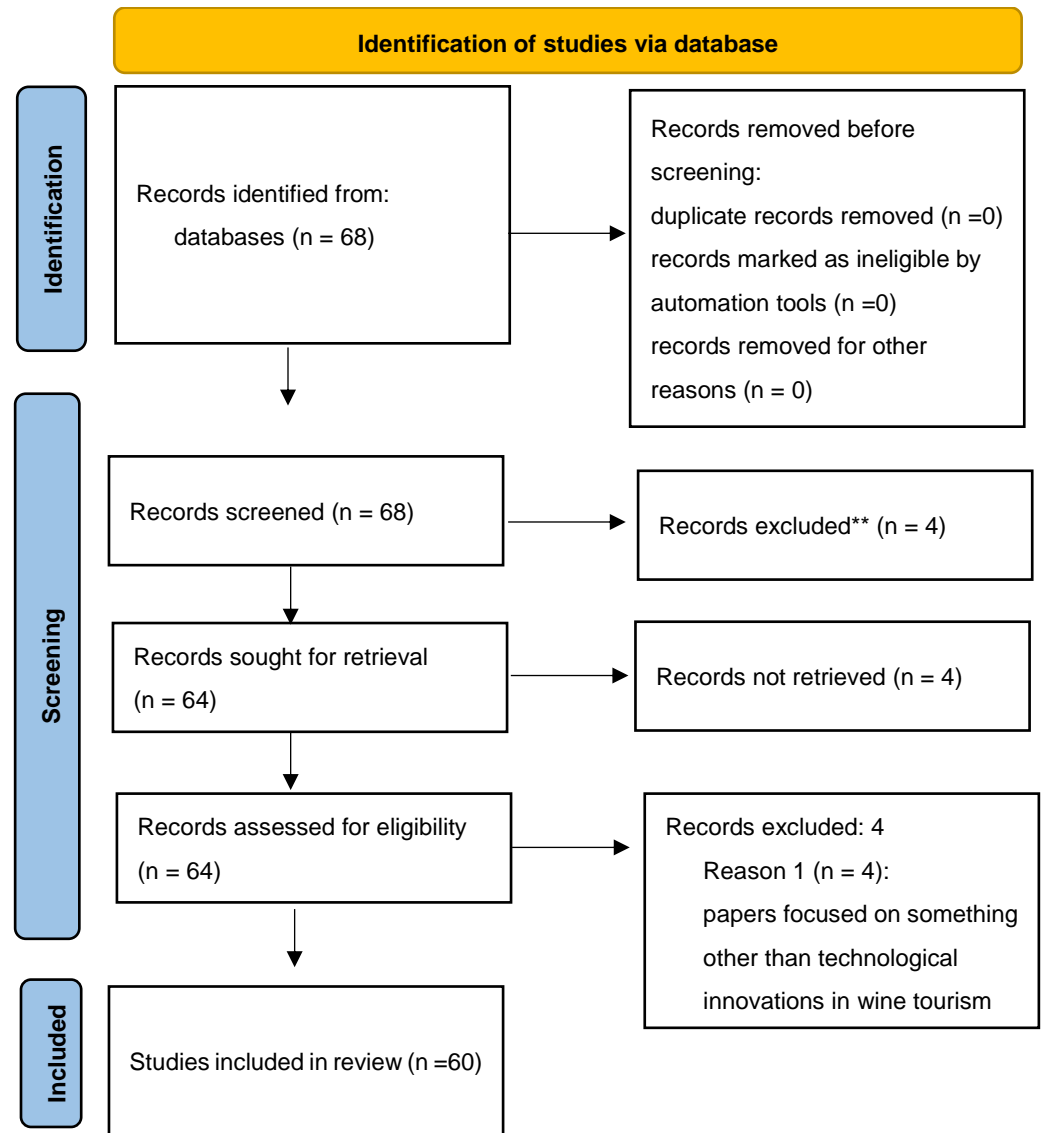
The articles needed to meet three specific criteria for inclusion. First, the article had to be published in a peer-reviewed journal. Second, the article required a full-length publication in English, meaning that research notes, editorial comments, reader responses, and book reviews were excluded. The third and final criterion was that the article had to focus on technological innovations applied to wine tourism. Merely mentioning an innovation was insufficient: the technological innovation had to be central to the research, and its application or potential application in the wine tourism sector had to be discussed.

Reviewer disagreements were discussed and resolved through consensus during the review process. In cases where consensus could not be reached, a third reviewer’s perspective was sought to finalize the decision.

The MS Excel spreadsheet was updated to include additional fields for data management purposes. Specifically, bibliographic details of the included studies were organized, and key elements from the PRISMA checklist, with some modifications, were incorporated. An additional item was added to track the reporting of the PRISMA flowchart. However, certain items—such as those related to assessing the risk of bias, confidence intervals, measures of consistency, sensitivity or subgroup analyses, outcome-level assessments, and combining results from meta-analyses (items 12–16, 19, 20, 22, and 23)—were excluded, since they did not apply to systematic reviews in this context or the scope of the present study.

### 3. Results

Figure 1 provides a summary evaluating the extent to which the included reviews adhered to the PRISMA checklist. A detailed overview of the findings follows this.



**Figure 1.** Flow diagram of the study selection process. Source: Page MJ, et al. *BMJ*. 2021;372:n71. doi: 10.1136/bmj.n71. [32].

The current study reviewed 68 papers. The study selection process is summarized in Figure 1.

The literature search conducted across databases and search engines initially yielded 68 records. However, five were eliminated as they did not include the selected keywords in their titles, abstracts, or keywords. The full texts of the remaining 64 articles were then thoroughly reviewed, excluding four additional papers that needed to meet the eligibility criteria based on content. Specifically, these papers focused on something other than technological innovations in wine tourism.

The results, summarized in Table 2, indicate that the final dataset consisted of 60 journal articles sourced from 44 different journals. Most of the articles were distributed across various journals, with only a few journals publishing multiple relevant articles. Notably, *Sustainability* (Switzerland) featured six publications, followed by the *International Journal of Wine Business Research* with five publications and the *Journal of Tourism and Development*

with three. Several other journals, including the *British Food Journal*, *Current Issues in Tourism*, *Frontiers in Sustainable Food Systems*, *Journal of Vacation Marketing*, and *Journal of Wine Research*, each contributed two publications.

**Table 2.** Research articles by journal.

Journal	Articles
<i>Administrative Sciences</i>	1
<i>Advances in Hospitality and Tourism Research</i>	1
<i>Agriculture and Forestry</i>	1
<i>Agronomy</i>	1
<i>Annals of Tourism Research Empirical Insights</i>	1
<i>British Food Journal</i>	2
<i>CASE Journal</i>	1
<i>Competitiveness Review</i>	1
<i>Consumer Behavior in Tourism and Hospitality</i>	1
<i>Corporate Governance and Organizational Behavior Review</i>	1
<i>Cuadernos de Desarrollo Rural</i>	1
<i>Current Issues in Tourism</i>	2
<i>Doxa Comunicación</i>	1
<i>Ecocycles</i>	1
<i>Economia Agro-Alimentare</i>	1
<i>Economic Annals-XXI</i>	1
<i>Event Management</i>	1
<i>Frontiers in Sustainable Food Systems</i>	2
<i>GeoJournal</i>	1
<i>International Entrepreneurship and Management Journal</i>	1
<i>International Journal of Culture, Tourism, and Hospitality Research</i>	1
<i>International Journal of Innovation and Technology Management</i>	1
<i>International Journal of Innovation Management</i>	1
<i>International Journal of Tourism Research</i>	1
<i>International Journal of Wine Business Research</i>	5
<i>Journal of Destination Marketing and Management</i>	1
<i>Journal of Family Business Management</i>	1
<i>Journal of Foodservice Business Research</i>	1
<i>Journal of Hospitality and Tourism Technology</i>	1
<i>Journal of Organizational Change Management</i>	1
<i>Journal of Small Business and Entrepreneurship</i>	1
<i>Journal of Tourism and Development</i>	3
<i>Journal of Vacation Marketing</i>	2
<i>Journal of Wine Research</i>	2
<i>Prabandhan: Indian Journal of Management</i>	1
<i>Procedia Environmental Science, Engineering and Management Sustainability (Switzerland)</i>	1
<i>Sustainability (Switzerland)</i>	6
<i>Tourism and Hospitality Research</i>	1
<i>Tourism Management Perspectives</i>	1
<i>Tourism Review</i>	1
<i>Tourism Review International</i>	1
<i>Wine Economics and Policy</i>	2
<i>Worldwide Hospitality and Tourism Themes</i>	1
Total	60

The results also revealed a growing number of studies over time. Nearly 50% of the articles were published from 2023 onwards, following the pandemic, underscoring the importance of updating the systematic review on this subject. Additionally, less than 20% of the studies were conducted before 2019, further highlighting the recent advancements in innovation within the wine tourism industry. This increase in post-pandemic research reflects the sector's evolving focus on technological innovations as businesses adapt to new challenges and opportunities. Please see Table 3.

**Table 3.** Research articles by journal and by year of publication.

Journal	Number of Publications Per Year											
	2007	2011	2012	2015	2017	2018	2019	2020	2021	2022	2023	2024
<i>Administrative Sciences</i>									1			
<i>Advances in Hospitality and Tourism Research</i>										1		
<i>Agriculture and Forestry</i>												1
<i>Agronomy</i>											1	
<i>Annals of Tourism Research Empirical Insights</i>									1			
<i>British Food Journal</i>											1	1
<i>CASE Journal</i>											1	
<i>Competitiveness Review</i>												1
<i>Consumer Behavior in Tourism and Hospitality</i>										1		
<i>Corporate Governance and Organizational Behavior Review</i>											1	
<i>Cuadernos de Desarrollo Rural</i>								1				
<i>Current Issues in Tourism</i>									1	1		
<i>Doxa Comunicación</i>									1			
<i>Ecocycles</i>											1	
<i>Economia Agro-Alimentare</i>				1								
<i>Economic Annals-XXI</i>								1				
<i>Event Management</i>												1
<i>Frontiers in Sustainable Food Systems</i>											1	1
<i>GeoJournal</i>												1
<i>International Entrepreneurship and Management Journal</i>												1
<i>International Journal of Culture, Tourism, and Hospitality Research</i>								1				
<i>International Journal of Innovation and Technology Management</i>										1		
<i>International Journal of Innovation Management</i>								1				
<i>International Journal of Tourism Research</i>											1	
<i>International Journal of Wine Business Research</i>			1		1			1	1			1
<i>Journal of Destination Marketing and Management</i>					1							
<i>Journal of Family Business Management</i>												1
<i>Journal of Foodservice Business Research</i>											1	
<i>Journal of Hospitality and Tourism Technology</i>								1				
<i>Journal of Organizational Change Management</i>										1		
<i>Journal of Small Business and Entrepreneurship</i>			1									
<i>Journal of Tourism and Development</i>								1			2	
<i>Journal of Vacation Marketing</i>											1	1
<i>Journal of Wine Research</i>						1					1	
<i>Prabandhan: Indian Journal of Management</i>											1	
<i>Procedia Environmental Science, Engineering and Management</i>									1			



Table 3. Cont.

Journal	Number of Publications Per Year											
	2007	2011	2012	2015	2017	2018	2019	2020	2021	2022	2023	2024
<i>Sustainability (Switzerland)</i>						1		1		1	1	2
<i>Tourism and Hospitality Research</i>						1						
<i>Tourism Management Perspectives</i>												1
<i>Tourism Review</i>												1
<i>Tourism Review International</i>						1						
<i>Wine Economics and Policy</i>										1		1
<i>Worldwide Hospitality and Tourism Themes</i>											1	
Total	0	1	1	1	2	4	2	7	5	7	15	15

The analysis of the 60 selected articles revealed several key trends in technological innovation within the wine tourism sector. The innovations identified were primarily concentrated in three main areas: digital platforms for promoting and marketing wine (23 articles), the integration of smart technologies and sustainable practices (20 articles), and the enhancement of the tourist experience through digital tools (14 articles). While many articles provided insights into these three categories, some also emphasized other important themes, such as e-commerce and direct-to-consumer distribution models (8 articles) and smart technologies applied to winery management (15 articles). Since articles often covered multiple topics, the total number of themes addressed exceeded the number of articles reviewed.

As shown in Table 4, a substantial portion of the articles did not focus on a specific country, indicating that many were either systematic reviews or not centered on specific markets. However, Italy, followed by Portugal and Spain, stood out as a focal point for studies on the sustainable development of wine tourism and digital marketing.

Table 4. Countries cited in the research per topic.

	Promotion and Digital Marketing in Wine Tourism	Sustainability and Innovation	E-Commerce and Innovative Distribution Models	Enhancement of the Tourist Experience	Optimization of Winery Management Through Smart Technologies
Argentina			1		1
Australia	1	1		1	5
Brazil		1			1
Croatia	1				1
France	2			1	3
Germany			1	1	3
Greece	2	2			4
Italy	2	5	2	1	13
Mexico			1		2
Montenegro	1				1
Multiple countries/no countries	8	4	2	5	22
New Zealand		1			1

Table 4. Cont.

	Promotion and Digital Marketing in Wine Tourism	Sustainability and Innovation	E-Commerce and Innovative Distribution Models	Enhancement of the Tourist Experience	Optimization of Winery Management Through Smart Technologies	
Portugal	3	3	1	3	3	13
Romania	1	1				2
Spain	2	2		2		6
Ukraine					1	1
USA					1	1
Total	24	21	9	15	16	85

Most articles concentrated on the leading European wine-producing nations with established wine tourism industries, except France. Australia has been the subject of many studies outside of Europe, with a relatively even distribution across the topics examined.

### 3.1. Promotion and Digital Marketing in Wine Tourism

The role of digital platforms in promoting wine tourism has emerged as a key area of focus, with 23 articles dedicated to examining how online marketing and digital tools are used to boost wine tourism. These studies explored wineries' digital marketing strategies, including using websites, social media, and digital content to engage consumers and attract tourists. For instance, research by [33,34] highlighted how wineries leverage digital marketing innovations to promote wine and establish a direct, personalized connection with consumers.

In some regions, such as Crete and Santorini, wineries have increasingly relied on social media and other digital tools to boost their visibility [35]. Similarly, studies of wineries in Italy and Romania, such as those by [36,37], demonstrate how wine tourism businesses can improve their marketing strategies through enhanced digital content and web presence, leading to better consumer engagement and increased tourist attraction.

### 3.2. Sustainability and Innovation

A recurring theme in the literature is the strong connection between technological innovation and sustainability in wine tourism, as [38] highlighted. Numerous studies—20 in total—demonstrated how emerging technologies enhance production efficiency and reduce the environmental impact of wine-related activities [39]. For instance, several studies investigated the implementation of sustainable practices in wine tourism regions such as Tuscany in Italy [40], the Peloponnese in Greece [41], and wine regions in Brazil [42].

Adopting eco-friendly technologies and process digitization allows wineries to monitor and minimize the use of natural resources like water and energy, thereby promoting more sustainable agricultural practices. Many wineries also integrate renewable energy systems and waste management tools, blending technological innovation with environmental conservation efforts. In wine tourism, a study of Spanish wineries found that wine tourism activities positively impact green innovation, improving product and process sustainability [43]. This demonstrates how the integration of technological advancements supports not only operational efficiency but also the long-term environmental goals of the wine industry.

### 3.3. Enhancement of the Tourist Experience Through Immersive Technologies

Fourteen studies documented using augmented reality (AR) and virtual reality (VR) to enhance wine tourism experiences. These studies highlighted the growing application of immersive technologies to enrich the wine tourism experience. Tools such as AR and VR

enable virtual tours of wineries, interactive experiences linked to the history and culture of wine, and even simulated wine tastings.

For example, approximately 30% of the articles detailed how AR engages visitors by providing in-depth information about winemaking processes via mobile devices or VR headsets. These innovations allow tourists to embark on personalized and unique journeys, even from remote locations [44,45].

A study from the Douro Valley in Portugal introduced a multisensory virtual wine tourism experience designed to offer tourists a more emotional and immersive engagement with the region [46]. Similarly, another study examined how VR enhances memorable tourist experiences, demonstrating that immersive virtual interactions can boost tourists' intention to visit actual wine destinations in the future [47].

### *3.4. Optimization of Winery Management Through Smart Technologies*

Fifteen studies examined the application of smart technologies in winery management, particularly how wineries integrate tradition with innovation to enhance wine tourism and hospitality experiences. For instance, ref. [48] investigated how wineries blend traditional practices with cutting-edge technologies to improve production and management processes.

Ref. [49] provided insights into the innovative business models of German wineries, focusing on how small and medium-sized enterprises are expanding into tourism by leveraging smart technologies to streamline their operations. Ref. [50] explored how digitization and the adoption of smart technologies influence wineries' sustainability and overall performance, especially in the context of wine tourism.

Additionally, ref. [51] analyzed the impact of technology-based virtual experiences adopted during the pandemic, demonstrating how these innovations have expanded the scope of wine tourism by introducing new technological solutions for managing the tourist experience.

Many articles also focused on smart technologies applied directly to winery management, explicitly using sensors and drones to optimize wine production. These technologies contribute to precision agriculture, enabling wineries to enhance production efficiency while maintaining sustainable practices.

### *3.5. E-Commerce and Innovative Distribution Models*

Innovation in wine distribution and sales models gained significant attention during the pandemic, as numerous studies analyzed the adoption of online platforms to maintain sales. E-commerce platforms and digital solutions became essential for keeping sales active, particularly during the COVID-19 pandemic, providing wineries new ways to engage with customers [52]. The widespread adoption of e-commerce models, including personalized services such as subscription boxes and direct-to-consumer sales through digital channels, has transformed the winery–customer relationship, offering a more direct and continuous interaction [46].

Wineries increasingly turned to online platforms to sell their products and expand into new markets. For example, a study in Italy highlighted the critical role of digital wine experiences and e-commerce in sustaining wine tourism during the travel restrictions imposed by the pandemic [51]. Similarly, introducing subscription models and direct-to-consumer sales has reshaped how wineries connect with their clientele, creating more personalized and ongoing relationships [49]. These innovations in distribution and sales are helping wineries adapt to new consumer behaviors and market conditions.

## **4. Discussion of the Empirical Material**

Scholars from various academic fields have explored wine tourism. This diversity underscores the multi- and interdisciplinary nature of tourism in general and wine tourism in particular. The involvement of these diverse perspectives offers a broader understanding of the field, which can be valuable for policymakers and stakeholders in crafting tourism policies and implementing effective management and marketing strategies.

However, due to the fragmented and interdisciplinary nature of scientific research on wine tourism, how effectively these insights can support the industry remains to be seen. Synthesizing a cohesive and comprehensive understanding of wine tourism innovation presents a significant challenge. Despite this, the current systematic review aims to identify consistent current and future trends in the field. These trends may have important implications not only for the wine tourism industry but also for shaping future research directions.

The findings of this systematic review provide detailed insights into how technological innovation is reshaping the wine tourism sector, with a significant focus on the growing use of digital technologies, particularly in marketing and promotion. The fact that digital marketing is the most represented category among the 61 reviewed articles suggests that wineries are increasingly leveraging digital strategies to expand their reach, boost visibility, and attract new segments of tourists. This aligns with previous research highlighting the rising influence of social media and online platforms in promoting wine tourism [33,35]. La Cité du Vin, in the Bordeaux region of France, represents one of the most innovative examples of this concept. Interactive touch screens and a multitouch table are displayed in themed spaces, allowing visitors to access various videos, images, and sounds that make them more informed about the wines of the world and their history [7]. The official website of wine tourism in France, Visit French Wine (<http://visitfrenchwine.com> accessed on 15 November 2024), represents another example of encouraging tourists to discover wines, wineries, and wine regions within the country [11].

Moreover, the destination management organization of Napa County in the United States, Visit Napa Valley ([www.visitnapavalley.com](http://www.visitnapavalley.com)), uses Facebook, Instagram, Pinterest, Twitter, YouTube, and TripAdvisor to publish trip ideas and quizzes for discovering places, restaurants, producers, etc., while encouraging tourists to generate text and visual content and share their opinions with experience providers and other tourists [11].

Another notable result concerns the growing role of immersive technologies, such as augmented reality (AR) and virtual reality (VR), in enhancing the tourist experience. Although their impact is more limited than digital marketing, these immersive technologies are gaining traction as powerful tools to create unique, engaging visitor experiences. The findings suggest that, while still in the early stages of adoption, AR and VR hold significant potential to make wine destinations more attractive to tourists. Early studies, such as the one by [46] on the application of VR in the Porto wine region, demonstrate the effectiveness of these technologies in enriching the wine tourism experience. Moreover, these results can assist tourism managers who wish to adopt virtual reality (VR) as a business strategy to respond to future crises and address the challenges of seasonality and sustainability. VR enables managers to offer content that engages tourists during the low season and can potentially reduce the sector's ecological impact while preserving cultural and natural heritage [19].

Two successful examples of the application of AR and VR technologies are described by [11]. Bodegas Ramòn Bilbao in Spain and Brancott Estate in New Zealand provide examples of the possible application of VR. This VR-based experience at Bodegas allows us to discover the entire winemaking process and be introduced to the range of products that can be appreciated in the tasting room. Using this technology, the winery offers a new and more engaging experience that overcomes physical barriers. In other words, VR recreates the "journey of the wine" and provides access to the win escape during all seasons.

In 2016, the Brancott Estate winery commissioned the creation of the "Red Shed Experience", a virtual reality-based experience that will also be used during company presentation events.

Sustainable innovation is another crucial theme in this systematic review, with numerous wineries adopting ecological practices integrated with smart technologies. This trend reflects the growing recognition of sustainability's role in resource management and attracting environmentally conscious tourists. However, challenges such as the high costs of implementation and the lack of infrastructure in rural areas continue to impede

widespread adoption, particularly for smaller wineries. In this context, ref. [38] highlights how sustainability is becoming a critical factor in wine tourism, even though logistical hurdles remain significant.

In addition, e-commerce and innovative distribution models have proven essential, particularly during the COVID-19 pandemic, when wineries had to adapt to reach customers in new ways. Adopting online platforms for direct sales and subscription models allowed wineries to maintain operations and reduce their reliance on on-site sales. Studies like [51] confirm the importance of virtual experiences and online sales in sustaining wine tourism during the pandemic, illustrating how these innovations reshaped consumer engagement with wineries.

Because of rapid technological advancements, new research opportunities and innovative applications are emerging in wine tourism. For instance, integrating artificial intelligence (AI) in the wine sector could facilitate personalized visitor experiences through recommendation algorithms based on individual preferences. Additionally, AI could support the management of winery operations by optimizing production processes and promoting sustainability [53]. Another rapidly expanding trend is the metaverse, which could revolutionize wine tourism by offering virtual tours and tastings in immersive digital environments, making the experience accessible to a global audience [54]. Future studies could investigate how these emerging technologies might influence consumer preferences and how wineries could integrate AI and the metaverse into their marketing and management strategies. Such research would contribute to a deeper understanding of the potential of these innovations to transform visitor engagement and loyalty in an increasingly digitized context.

It is essential to acknowledge some limitations of this study. First, the review primarily focuses on academic sources published between 2010 and 2024, which may omit more recent innovations or practices that still need to be widely documented. Additionally, the review's emphasis on English-language publications may have restricted the global perspective, potentially excluding valuable contributions from other wine-producing regions where research is conducted in different languages.

## 5. Conclusions

Systematic reviews, as discussed, offer a crucial platform for scholars and practitioners to utilize existing knowledge for policy development and further research. The protocols that structure systematic reviews ensure rigor, helping to generate objective, reliable discussions and findings that can inspire actionable outcomes. This study precisely adhered to the PRISMA protocol developed by [23]. While we acknowledge that PRISMA was initially designed for systematic reviews in medicine and some aspects of the protocol may not directly apply to social science disciplines, we recommend adopting and adjusting the items listed in Table 1 following [30] for future tourism researchers conducting systematic reviews. This approach can enhance transparency, reliability, and validity in tourism reviews.

This study successfully addresses the gap in the literature regarding the role of technological innovation in post-COVID-19 wine tourism, highlighting the growing significance of technological innovations in the sector through a systematic review of wine tourism studies. The study provides a structured overview by systematically categorizing innovations in digital marketing, smart technologies, e-commerce, immersive experiences, and sustainability. Furthermore, the research objectives initially outlined—namely, to categorize innovations, analyze their adoption in wine tourism, and highlight future directions—were achieved. This comprehensive review organizes existing knowledge and offers valuable insights for practitioners and policymakers, outlining potential strategies to support digital transformation within the sector.

A key finding is that most tourism and hospitality scholars focus on digital marketing, which has emerged as the most prevalent technology for promoting wine destinations. Social media, interactive websites, and online platforms have allowed wineries to en-

gage with a diverse global audience, significantly increasing their visibility and consumer interaction [55].

While immersive technologies like virtual reality (VR) and augmented reality (AR) are beginning to enhance the tourist experience, their adoption remains limited. In light of the post-COVID-19 landscape, our findings suggest that adopting digital and immersive technologies—such as virtual reality (VR) and augmented reality (AR)—has addressed immediate operational needs and opened new avenues for engaging customers remotely and enhancing in-person experiences. Understanding the factors influencing VR adoption allows managers to make informed decisions, allocate resources effectively, and provide technical support to strengthen the perception of VR as a viable business strategy.

Sustainable practices supported by smart technologies are also gaining traction, enabling wineries to reduce their environmental footprint and appeal to a growing segment of environmentally conscious tourists [56].

These findings have significant practical implications. Wineries that invest in digital and sustainable technologies have the potential to distinguish themselves by offering unique experiences that align with the expectations of modern tourists, especially in improving direct-to-consumer sales channels.

From a policy perspective, this study identifies several areas where public intervention could significantly impact technology adoption in wine tourism. Financial incentives, such as grants or tax credits, can ease the investment burden, particularly for small and medium-sized wineries. Additionally, policies focused on digital literacy and infrastructure development, especially in rural regions, are essential to support wineries in effectively implementing and maximizing the benefits of these innovations. By facilitating technology access and skill development, policymakers can foster a more resilient, innovative, and globally competitive wine tourism sector [57].

It will be valuable to explore how integrating sustainability and digitization continues to shape wine tourism. Future research could focus on making advanced technologies more accessible to small and medium-sized wineries [58] and how emerging technologies such as AI and the metaverse might influence consumer preferences, facilitating a shift toward more innovative and sustainable business models.

**Supplementary Materials:** The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/su16229997/s1>, PRISMA Checklist.

**Funding:** This work was developed within the framework of the project e.INS-Eco-432 system of Innovation for Next Generation Sardinia (cod. ECS 0000038) funded by the Italian Ministry for Research and Education (MUR) under the National Recovery and Resilience Plan (NRRP) 434—Mission 4 Component 2, “From research to business” Investment 1.5, “Creation and 435 strengthening of ecosystems of innovation” and construction of “Territorial R&D Leaders.”

**Conflicts of Interest:** The author declares no conflicts of interest.

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