

Does wine innovation research require ageing? A bibliometric review

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Abstract

Although wine is an old issue, wine business research and particularly innovation in the wine sector seem to be relatively young areas in the literature. With its production limited to certain regions but its consumption being more widespread, wine plays a relevant role in the economic development of some rural European regions. Considering this strong influence in certain European countries, the purpose of this study is to provide a comprehensive assessment of innovation in wine-related articles published in scholarly journals between 1998 and 2019 to describe how this field of research has evolved. This article combines a systematic literature review process with a bibliometric review. The use of both methodologies makes a universal, neutral and reliable contribution, reducing the possible bias of traditional literature reviews. The main advantage of the employment of a bibliometric methodology is the speed with which we can analyse a large number of documents to obtain the key issues identified in the literature. A relevant finding in our research is that sustainable innovation is emerging as a distinct type of innovation, related to those involving procedural and organizational changes. The results also exhibit that a large fraction of wine business literature is regionally based, which makes sense given the characteristics of the industry.

Keywords

Wine; Literature review; Bibliometric; Natural language processing; Sustainability; Product innovation; Process innovation; Organizational innovation; Marketing innovation; Tourism; Regional development.

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1. Introduction

Wine is a complex and attractive research field. Beyond its nature as an alcoholic product (in many jurisdictions categorised as food) with strong international demand, it has played a relevant role in Mediterranean culture since antiquity, accompanying the Roman Empire in its expansion (Unwin, 1991; Griffe; Méheut, 1996).

With its production limited to certain regions and its consumption being more widespread, wine has been traded across large distances for many centuries (Unwin, 1991). In fact, in the early XIX century, David Ricardo used it to explain comparative advantage with the example of England and Portugal trading textile products for wine¹. This trade led to the creation of the first geographical measures to protect the production of certain regions gifted with specific *terroirs* (Meloni; Swinnen, 2018) where *industrial districts* in Becattini's sense were developed around wine (Becattini, 1979; 2000; Lachaud-Martin, 2018). When the *phylloxera* pest and other grape diseases severely hit the wine producing regions in the second half of the XIX century and early XX century, the dramatic shifts in the structure of the global market reshaped the map of wine regions (González-Larreina, 1996; Badia-Miró *et al.*, 2010). This radical change depressed the economy of the affected regions and even impacted the health of their inhabitants (Banerjee *et al.*, 2010).

“ This review describes how wine innovation field of research has evolved ”

In the early 2020s, wine has a nature all of its own and is aligned with the trendy concept of *glocalism*: the global wine market reached more than 38 billion euro in exports in 2018, while keeping strong roots that are very difficult to delocalise (Castrìota, 2015). It continues to play a relevant role in the economic development of some rural European regions² (Larreina; Aguado, 2008), and has boosted the development of some regions in the so-called *New World* (Fensterseifer, 2007; Roberts; Enright, 2004).

In the academic field, this multifaceted product has attracted phytologists, chemists, historians, sociologists, economists, lawyers, market researchers and many others, providing ample ground for interdisciplinarity.

There was already an interest in wine research which led to the creation of multidisciplinary journals on wine in the early 1990s. Since then, the literature on wine research has grown, and the topics covered have evolved to include regional development, tourism, branding, strategy, etc. (Bonn *et al.*, 2018). Purely oenological topics have moved from multidisciplinary journals to more specific subject areas like chemistry or agricultural and biological sciences. Simultaneously, the large businesses linked to wine, and its economic role in some regions and countries, have fuelled the interest of business, marketing and economic researchers (Orth *et al.*, 2007; 2012).

The evolution of consumer behaviour and its recent trends can be tracked in the topics covered in wine-related papers: while wine tourism was virtually non-existent before 1995, it grew to become a well-researched area in the 2000s (Carlson, 2004). Similarly, the dissemination of knowledge within wine clusters has gained relevance (Giulani; Bell, 2005; Giulani, 2007; Morrison; Rabbellotti, 2009).

In recent times, a new field of academic research has emerged that is focusing on wine studies and devoting attention to the sector. A number of scientometric studies have attempted to analyze the research contents of wine-related papers (Bonn *et al.*, 2018; Castillo *et al.*, 2018; Weatherbee *et al.*, 2019), typically applying a country focus or conducting journal-specific research. This has opened new research questions, such as for instance, why Mexican researchers have not followed the pace of their growing wine industry, while in other countries this growth is parallel.

The first analysis was published in 2018 by Bonn, Cho and Um, in an attempt to clarify the trends and directions in wine research, examining a 26-year period. Their database includes 739-refereed articles published in 22 wine and tourism business journals, drawing on a co-word analysis in five different stages. It is interesting to note that innovation appears in the fourth period (2005-2009) as an isolated topic in the literature and research and development emerges in the fifth one (2010-2015), with higher centrality in the wine research.

The analysis performed by the Mexican scholars Castillo *et al.* (2018) directly focused on the Mexican publications around viticulture and oenological research. They recognized wine research was an emerging field in Mexico compared with other Latin American countries, with 164 papers out of 3,232 Latin American publications. However, their database includes not only business-oriented articles, but biological and chemistry ones as well. Therefore, their results do not highlight the situation of wine innovation in their database.

“ Wine business research and particularly innovation in the wine sector seem to be relatively young areas in the literature ”

Finally, Weatherbee *et al.* (2019) provide an overview of the business research published in the *International journal of wine business research* during 2007-2017. Innovation appears as the fifteenth theme, as it was addressed inconsistently according to the year. While 2 articles are found in 2008 on wine innovation, no more articles appear until 2013, when 3 new papers were published. Consequently, wine innovation became an isolated issue, linked to Canada and Italy and to the study of the wine-making process.

The purpose of this study is to provide a comprehensive assessment of innovation in wine-related articles published in scholarly journals between 1998 and 2019 and excluding those connected to natural sciences (phytology, chemistry, oenology...). This paper describes how this field of research has developed, maps the main research clusters, and discusses its recent evolution and expected progress.

2. Database and methodology

This article provides a bibliometric review of the innovation in the wine sector (Boell; Cecez-Kecmanovic, 2015; Doloreux; Porto-Gómez, 2017; Randhawa *et al.*, 2016; Doloreux *et al.*, 2019; López-Robles *et al.*, 2019). The main purpose of a review is to clarify a specific question for which evidence in the literature is searched, following a rigorous, replicable and transparent scheme in order to identify key scientific contributions to a research field or a question and provide a conclusive assessment regarding a research question (Amrollahi; Ghapanchi; Talaei-Khoei, 2013; Boell; Cecez-Kecmanovic, 2015).

The use of this methodology (Adunlin *et al.*, 2015; Chen *et al.*, 2018) contributes in a universal, neutral and reliable manner, reducing the possible bias of traditional literature reviews (Collins; Fauser, 2005). Specifically, natural language processing (NLP) analysis (Onan *et al.*, 2016) is the bibliometric tool used in this paper to contrast the content of the articles forming our database

Figure 1 provides a graphic explanation of the bibliometric procedure that was followed. The analysis was based on six stages:

- (1) the paper-dataset to be analysed was selected and downloaded;
- (2) all the text from the accessed articles was extracted and the parts of the manuscript that were not accessible text (e.g. graphs) were removed;
- (3) using the rapid automatic keyword extraction (RAKE) algorithm (Rose *et al.*, 2010) the extraction of the keywords from each article was performed. These keywords were not the ones identified by the author(s) of each manuscript (usually on the title page), but rather the words that were identified as being central to the understanding of the manuscript according to the RAKE algorithm;
- (4) the previous keywords were classified according to categories identified by Doloreux *et al.* (2019). This stage was necessary to adapt, to the greatest possible extent, the results of the present paper to those characterizing innovation literature;
- (5) the relationships between these keywords were established; and
- (6) a visualisation of the results was created in order to aid in the understanding of the relationships between studies raising subjects related to wine innovation.

Some of the steps (i.e. steps two and four) were performed manually as it was necessary to know the literature on wine innovation, so that the keywords that were derived from the bibliometric analysis could be coherently grouped into the categories identified by other innovation bibliometric analyses (Doloreux *et al.*, 2019). This is certainly one of the aspects that requires further exploration in the future so as to reduce the potential bias of this manual and subjective allocation on the final results. The remaining steps (i.e. steps three, four and five) were automatized and combined several computer algorithms.³ In the following paragraph, the methodology that was followed in each of the six stages is described in further detail.

2.1. Papers downloaded to the database

The criteria to judge the eligibility of the papers to be included in the study were the following:

- 1) The papers had to deal with innovation in the wine industry as the core analytical theme under which the empirical investigation was carried out.
- 2) The papers had to be published in a peer-reviewed journal indexed in the *Web of Science*. Other publication forms (e.g. conference proceedings, books, book chapters, working papers, etc.) and platforms (e.g. *Scopus*, *ProQuest*, *Google Scholar*) were not considered.

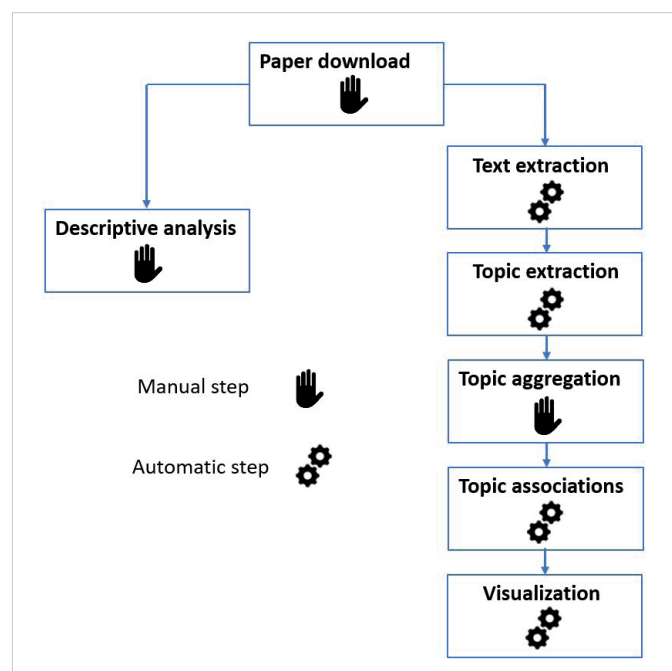


Figure 1. Description of the methodology. Based on Doloreux *et al.* (2019).

- 3) Both empirical and/or conceptual papers could be included.
- 4) Articles had to be published in English.
- 5) The journals of publication should be labelled in the following categories: Business, Management, Economics, Geography, Agricultural Economics Policy, Regional and Urban Planning, Environmental Science, Urban Studies, Area Studies, and Sociology. Therefore, articles published in journals related to Horticulture, Agriculture, Law or Engineering were excluded.

The search query on the *Web of Science* was performed on November 5th 2019, with the 31st of October 2019 chosen as the last date considered in the search. The previous search returned 243 articles for query 1 (see Equation 1), which captures articles including wine and innovation, or wine and knowledge both in the title or abstract of the document (Table 1, column a). However, not all of these articles were used for the bibliometric process, as 16 of them were unrelated to the wine sector, though using “wine” in the sense of “old wine in new bottles” or similar phrases. Hence, these articles were removed from the database (Table 1, column b). Furthermore, we did not have direct access to 14 more articles, which left a final database of 213 articles (Table 1, column c).

The equation that we used for the query was:

$$TS = ('wine \text{ AND } innovation')OR('wine \text{ AND } Knowledge')$$

Where *TS* is a topic-based query like ‘topic’ = ‘title’ + ‘keyword’ + ‘abstract’

Table 1. Articles under analysis

Total number of articles	# Articles retrieved from the WoS (a)	# Potential articles included in the analysis (b)	# Final articles database (c)
	243	227	213

2.2. Text extraction

For this second stage, an automatic tool for the extraction of the text was developed,⁴ which included each of the previous 213 articles. In this step, the text was not pre-processed (i.e. filtering symbols, page numbers, title headings, etc.) and the bulk of words identified in each paper was considered. This automatic tool allowed for a large number of pdf files to be processed very quickly, and it also filtered all the files that had some kind of error.

2.3. Topic extraction

The aim of this third stage was to extract the keywords from each paper. Once these keywords were identified it was possible to check whether any relationship existed among them. To achieve this goal, each paper was considered as a collection of ‘topics’ in a specific research area. The most repeated topics in a paper would be indicative of the main interest themes in each paper. Therefore, an automatic algorithm was required that recollects key topics into what was coined as ‘keywords’. In recent years, the literature has singled out *RAKE* as an interesting tool to extract keywords from unique documents (Thushara *et al.*, 2018) since it extracts the keywords of a document by parsing the text, not considering the typical stop words.

To identify these potential keywords in each paper, *RAKE* uses some parameters to refine the search detection. The first of these parameters is based on the criteria that any significant word that can potentially characterize the main contents of any of the papers considered needs to have a minimum of three letters. The second parameter is selected because papers often resort to passive and subjunctive grammatical structures, so the sentences are usually long. Finally, the last parameter points to the number of minimum repetitions that a certain word must have in the entire paper (in the present paper’s case it was six repetitions), so that the keyword becomes representative of the topic under analysis inside the document. As a result of this phase, 1,637 unique keywords were obtained from the 213 papers analysed (see Table 1, column c).

2.4. Topic aggregation

In this step, a new classification was created which groups the different valid keywords of the texts identified in the previous stage into meta keywords. These clusters were created following the approach of Doloreux *et al.* (2019).

After converting keywords into meta keywords, the number of meta keywords for the complete database and their relative weight as compared with the total number of meta keywords was created. The most frequently cited topics are related to Tourism and Marketing Innovation, leaving aside technological innovation. The low relevance of knowledge generation stakeholders, such as universities or research centers, is also significant although networks seem to have a strong influence on the sector.

2.5. Topic associations

Once the previous information was pre-processed, the *Apriori algorithm* (Hahsler; Chelluboina, 2011) was used, which is applied in two steps –the *FP-Growth* and the *Association rules*– in order to extract the most frequent keywords. First, the *FP-Growth* was used to obtain the ruleset that was included in the pre-processed information. This method was efficient and scalable for mining both long and short frequent patterns. The algorithm can be described as a recursive

elimination scheme: a pre-processing step deletes all items from the relationships that are not frequent individually (i.e., do not appear in a user-specified minimum number of transactions) and defined by the user as a parameter of the algorithm called minimum support value (Borgelt, 2005). 0.15 was chosen as the minimum threshold, which means that the relationships not repeated more than 15% were considered not representative and discarded (Elgaml et al., 2015). The FP-Growth tree (Hong et al., 2013) was constructed as an output of this, and a tuple of {keywords, frequency} was obtained, which was used as the input for the next step.

Secondly, Association rules (Agrawal et al., 1993) mining was run to find relationship patterns among the keywords. This algorithm provides the confidence values of the relationships between two keywords which range between 0 and 1, with 1 being the highest possible confidence value of the relationship.

$$\text{Confidence}(\text{KeywordA}, \text{KeywordB}) = \frac{\text{Frequency}(\text{KeywordA} \cup \text{KeywordB})}{\text{Frequency}(\text{KeywordA})}$$

The previous algorithms have been implemented in R using a software package called *arulesViz*.

2.6. Visualisation

In order to show wine innovation literature, graphical illustrations of the meta keywords were created once the results had been obtained from the previously identified meta-keywords. The chosen method was co-word mapping, which can clearly and concisely present the relationships between the different meta-keywords.

For this purpose, a system of rules of precedence and associativity has been created, with which the words can be clearly observed regarding how they relate to each other. This clearly shows the importance of each of the words in the context in which they are spoken, in addition to the precedence of the previous words.

3. Study findings

As mentioned in the methodology section, in this work we combine a descriptive literature review and a bibliometric analysis, based on natural language processing so as to thresh and better understand the state of current wine innovation literature.

3.1. Descriptive analysis

First of all, we present a description of the articles included in our database, by the journals in which those works have been published and the publication year.

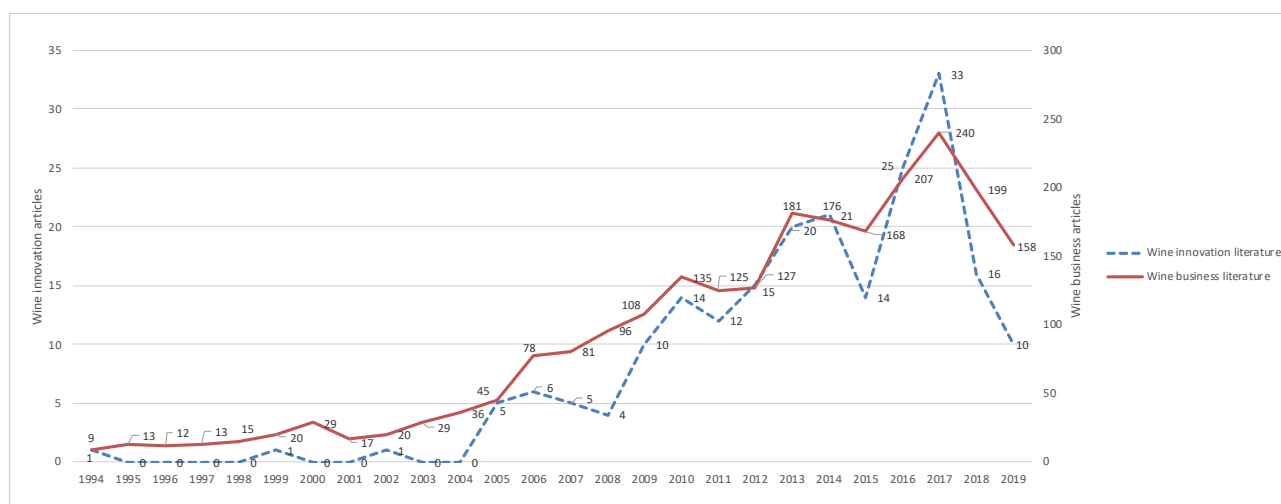
3.1.1. Sources and nature of articles

Wine business literature is relatively recent. While academic research on wine-related topics in the *Web of Science (WoS)* dates back to the first decade of the 20th century [the first article appeared in the *Journal of the American Chemical Society* in 1901: "A new indicator for use in determining total acidity of wines" (Runyan, 1901)]. A significant number of papers had already been published in the 1960s, articles related to the economic and managerial side of the industry were uncommon before the eighties. From 1901 to 2019, 41,840 articles on wine were published in the *WoS*. From 1901 to 1970 we find a mere 0.83% of articles on this issue, with 91.60% of the articles being published between 1996 to 2019.

At the time of preparing this paper, only two journals appeared in *WoS* when searching for wine-related sources: The *Australian journal of grape and wine research*, which has been covered under the *JCR* label from 2003 to the present (and included in the category Horticulture), and the recently included *Journal of wine economics* (2018). Even though there are other wine business journals, for a number of reasons they are not indexed in *WoS*.

Table 2. Articles on wine indexed in the *WoS*

Year	Wine innovation literature	Wine business literature	Total wine literature
1994	1	9	329
1995	0	13	424
1996	0	12	497
1997	0	13	569
1998	0	15	622
1999	1	20	722
2000	0	29	795
2001	0	17	824
2002	1	20	962
2003	0	29	1,005
2004	0	36	1,141
2005	5	45	1,201
2006	6	78	1,391
2007	5	81	1,604
2008	4	96	1,681
2009	10	108	1,655
2010	14	135	2,001
2011	12	125	2,056
2012	15	127	2,194
2013	20	181	2,256
2014	21	176	2,233
2015	14	168	2,385
2016	25	207	2,618
2017	33	240	2,609
2018	16	199	2,578
2019	10	158	2,726
Total	213	2,337	



Graph 1. Publication year of the 213 articles in our database

As seen in Graph 1 and Table 2, wine innovation articles surge in the mid-2000s. From a single article being published in 1994, 1999, and 2002, this subset of the literature jumped to five articles in 2005, 10 articles in 2010 and up to 33 articles in 2017⁵. Thus, it seems that this is an emerging area which is gaining interest from the research perspective. However, if we compare the wine innovation results with the wine business research under the same categories in the WoS, we find that its interest is limited: around 10% of wine business research refers to innovation in this industry.

The final dataset with 213 theoretical and empirical articles is published in 146 different journals. Only 30 of them include more than a single article, which can be checked in Table 3. This implies that 57% of the articles are being published in 116 different journals in totally dissimilar categories such as Psychology, History or Operations Research. This indicates a multidisciplinary situation in the research on wine business issues and its diversity. Simultaneously, it may also be interpreted as a lack of clear research areas.

Table 3. Journals publishing 2 or more articles on wine innovation research⁶

Journals	% articles (n = 213)	JCR Impact quartile			
		WoS categories	Quartile	WoS categories	Quartile
<i>Journal of wine economics</i>	4.72	Agricultural Economics & Policy	Q2	Food Science & Technology	Q3
<i>International journal of contemporary hospitality management</i>	2.83	Hospitality, Leisure, Sport & Tourism	Q1	Management	Q1
<i>Journal of cleaner production</i>	2.83	Green, Sustainable Science & Technology	Q1	Engineering, Environmental	Q1
<i>Agricultural economics</i>	1.89	Economics	Q1	Agricultural Economics & Policy	-
<i>International food & agribusiness management review</i>	1.89	Agricultural Economics & Policy	Q4	-	-
<i>International journal of hospitality management</i>	1.89	Hospitality, Leisure, Sport & Tourism	Q1	-	-
<i>Prometheus</i>	1.89	Not currently indexed in WoS			
<i>Research policy</i>	1.89	Management	Q1	-	-
<i>European planning studies</i>	1.42	Geography	Q2	Urban Studies	Q2
<i>Geoforum</i>	1.42	Geography	Q1	-	-
<i>Journal of economic geography</i>	1.42	Economics	Q1	Geography	Q1
<i>Journal of product & brand management</i>	1.42	Business	Q3	Management	Q3
<i>Small enterprise research</i>	1.42	<i>Emerging Sources Citation Index Business</i>			
<i>Sustainability</i>	1.42	Green, Sustainable Science Technology	Q3	Environmental Science	Q2
<i>Tourism analysis</i>	1.42	<i>Emerging Sources Citation Index Hospitality, Leisure, Sport & Tourism</i>			
<i>Agribusiness</i>	0.94	Agricultural Economics & Policy	Q2	Food Science & Technology	Q3
<i>Asia Pacific journal of marketing & logistics</i>	0.94	Business	Q4	-	-

Table 3 continues in next page 7

Journals	% articles (n = 213)	JCR Impact quartile			
		WoS categories	Quartile	WoS categories	Quartile
<i>Cornell hospitality quarterly</i>	0.94	Management	Q1	Hospitality, Leisure, Sport & Tourism	Q2
<i>Euromed journal of business</i>	0.94	<i>Emerging Sources Citation Index</i> Business			
<i>European journal of tourism, hospitality & recreation</i>	0.94	<i>Emerging Sources Citation Index</i> Hospitality, Leisure, Sport & Tourism			
<i>International journal of entrepreneurial behavior & research</i>	0.94	Business	Q2	Management	Q2
<i>International journal of innovation management</i>	0.94	<i>Emerging Sources Citation Index</i> Management			
<i>International journal of organizational analysis</i>	0.94	<i>Emerging Sources Citation Index</i> Management			
<i>Journal of business research</i>	0.94	Business	Q1	-	-
<i>Regional studies</i>	0.94	Economics	Q1	Environmental Studies	Q2
<i>Supply chain management: an international Journal</i>	0.94	Business	Q1	Management	Q1
<i>Thunderbird international business review</i>	0.94	<i>Emerging Sources Citation Index</i> Business			
<i>Tourism & hospitality research</i>	0.94	<i>Emerging Sources Citation Index</i> Hospitality, Leisure, Sport & Tourism			
<i>Turizam: međunarodni znanstveno-stručni časopis</i>	0.94	Not currently indexed in WoS			
<i>World development</i>	0.94	Development Studies	Q1	Economics	Q1

As Table 4 shows, the main areas of the journals in which the articles are published are indexed in JCR categories related to Management, Business and Economics (Management 15.79%, Business 14.47%, Economics 11.84%, and Agricultural Economics and Policy 10.53%).

In a second large field, we find categories related to geography, regional and urban studies (Geography 7.89%, Development Studies 2.63%, Urban Studies 2.63%, Regional and Urban Planning 1.32%).

As a third cluster, we find those journals related to environmental change and sustainability such as Environmental Science 5.26%, Environmental Studies 3.95%, Green, Sustainable Science and Technology 3.95% and Environmental Engineering 2.63%.

Therefore, we can identify three main areas in which wine innovation articles are mainly accepted: Business Management and Economics, Geography and Regional Development, and finally Environmental Change and Sustainability.

3.1.2. Authorship characteristics

Since 1994, 472 authors have contributed to wine innovation literature. These authors' degree of contribution to the discipline varies, with only 19 of them contributing to 58 papers in total (27.23%). On the other extreme, 416 academics have only one work in our sample.

Co-authorship is frequent in wine innovation research: almost 60% of the papers analyzed have been written by either 2 or 3 researchers (see Table 5). Around one-fifth of the sample corresponds to a single author (39 papers). A very small percentage of the papers shows 5 authors or more (there is just one article with 7 authors, the largest collaboration in the sample).

Table 4. JCR categories of our sample database

JCR categories	% of articles (n = 76)
Management	15.79
Business	14.47
Economics	11.84
Agricultural Economics and Policy	10.53
Geography	7.89
Hospitality, Leisure, Sport and Tourism	5.26
Environmental Science	5.26
Environmental Studies	3.95
Food Science and Technology	3.95
Green, Sustainable Science and Technology	2.63
Development Studies	2.63
Operations Research and Management Science	2.63
Engineering, Environmental	2.63
Urban Studies	2.63
History of Social Science	2.63
Engineering, industrial	1.32
History	1.32
Regional and Urban Planning	1.32
Sociology	1.32

Furthermore, authors seem to engage in collaboration mostly in the country where their institutions are located: only 57 out of the 174 papers co-authored have involved researchers belonging to institutions in different countries.

A relatively large number of collaborative papers (34.1%) involved researchers affiliated to the same institutions; this is particularly the case for Italian and Spanish institutions. There is also an interesting pattern in papers co-authored between researchers affiliated to institutions in different countries (32.95% of those being written collaboratively): just six countries appear in 90% of the papers in this subsample (Italy, USA, France, UK, Australia and Spain). Among them, we can see that Australian researchers tend to publish with co-authors from many other countries, which is also the case of French and Italian ones.

Other countries tend to cooperate mainly with researchers affiliated in a few countries. The two countries with the highest collaboration between researchers at their institutions are Australia and the UK, with 5 papers co-authored by researchers from both countries. In any case, researchers studying wine innovation tend to cooperate with other authors in their countries (whether they are affiliated to the same institution or not), in order to produce new research.

Some authors appear relatively frequently in our sample. Table 6 identifies the most prolific researchers in this field who have participated in 58 papers⁷, more than one-quarter of the total. As we can see, 7 of these researchers work for Italian institutions, while three are affiliated to US institutions, with the same number working for Australian ones. Other countries (the Netherlands, Canada, Hungary and Spain) also have productive researchers. What might seem surprising is that no researchers affiliated to French or British institutions appear in this short-list.

Given that wine is a very local and regionally rooted product, it is interesting to delve into where authors conducting research in wine innovation work. We find that they are located in 35 countries, half of which are in Europe.

Specifically, those countries where these authors most frequently conduct their research correspond to countries with a long wine-producing and/or consuming tradition (Anderson; Nelgen, 2011; OIV Statistical report, 2019), showing interest in both sides of the value chain. Table 7 shows the 11 countries whose institutions have 5 or more publications on wine innovation research. The rest of the countries in the sample have only published 3 or fewer papers on this topic.

3.2. Wine innovation: A bibliometric approach

The following sub-sections evidence the results achieved with the application of the bibliometric methodology explained in Section 3. The following were studied: the innovation features, the type of methodologies used to analyse wine innovation, and the worldwide distribution of the research and its geographical approach.

Table 5. Number of authors per article

N. of authors	% of papers (n=213)
1	18.40
2	30.19
3	28.77
4	15.09
5	4.72
6	2.36
7	0.47

Table 6. Most prolific authors

Author	N. of papers published	Working country
Andrea Morrison	7	Netherlands
Johan Bruwer	7	Australia
Roberta Rabellotti	7	Italy
David Aylward	5	Australia
Elisa Giuliani	5	Italy
David Doloreux	4	Canada
Giuseppe Festa	4	Italy
Abel Duarte-Alonso	3	Australia
Alfonso J. Gil	3	Spain
Aron Torok	3	Hungary
Giuseppe Di-Vita	3	Italy
Imran Rahman	3	USA
Jozsef Toth	3	Hungary
Mario D'Amico	3	Italy
Mario Pezzillo-Iacono	3	Italy
Mark A. Bonn	3	USA
Nelson Barber	3	USA
Vincenza Esposito	3	Italy
Vanessa Ratten	3	Australia

Table 7. Main countries publishing on wine innovation compared with wine-production. Source: OIV.

Country	% of publications (n = 213)	% wine production (n = 292 mhl)	% wine consumption (n = 246 mhl)
USA	17.92	8.18	13.41
Italy	16.04	18.77	9.11
Australia	13.68	4.42	2.44
Spain	8.49	15.21	4.27
France	7.08	16.64	10.89
UK	5.66	-	5.04
Canada	3.77	-	1.99
New Zealand	3.77	1.03	-
Netherlands	3.30	-	1.42
Portugal	2.36	2.09	2.24
South Africa	2.36	3.25	1.75

3.2.1. Research features

Through the process explained in the Topic extraction section (2.3) we have obtained 1,637 keywords from the papers in our sample. They have been clustered in 161 subjects that are covered in the wine research literature. As expected, the variety of topics seen in Graph 2 shows a multidisciplinary approach that awakens the interest of researchers with a very different focus.

The most cited topics (according to the size of the bubbles) are the *wineries* and the *businesses* involved in the wine *innovation process*, the participation of *research centers*, and the *markets* to which each winery is oriented. With a smaller number of associations we find *culture*, *sustainability*, *quality*, *tourism* or the participation of *universities* in the wine innovation process.

Some of these clusters, nevertheless, are related to other research topics that form pairs. At the bottom of Graph 2 we identify those cluster associations in dark red. On the one hand, the size of the bubbles shows the number of times the relationship is repeated. Therefore, larger bubbles mean a higher number of links between those keywords. On the other hand, the colour indicates the significance of the relationships. In this sense, the darkest and most significant relationships can be found between *Business*, *Industrial District*, *Organization* and *Innovation Process*. These relationships are bilateral although they also form unilateral relationships with wine. Furthermore, we find that these relationships are strong which means that when one of these is mentioned, the other topic will probably be as well.

Many of the items detected in our analysis are related to wine innovation literature (Graph 2) which can be grouped in the following two clusters (meta-keywords): *Innovation Process* and *Knowledge Creation and Transfer*. We should remark that Graph 2 presents not only Innovation Process but also Process Innovation as keywords extracted from wine literature. While the first one groups together topics related to management innovation, the second one is related to the category of innovation linked to technological processes.

The former involves the features related to the way wineries innovate, which would include product, process, organization or marketing innovation. The latter would be linked to how wine-related knowledge is created and disseminated through universities, research centers, KIBS...

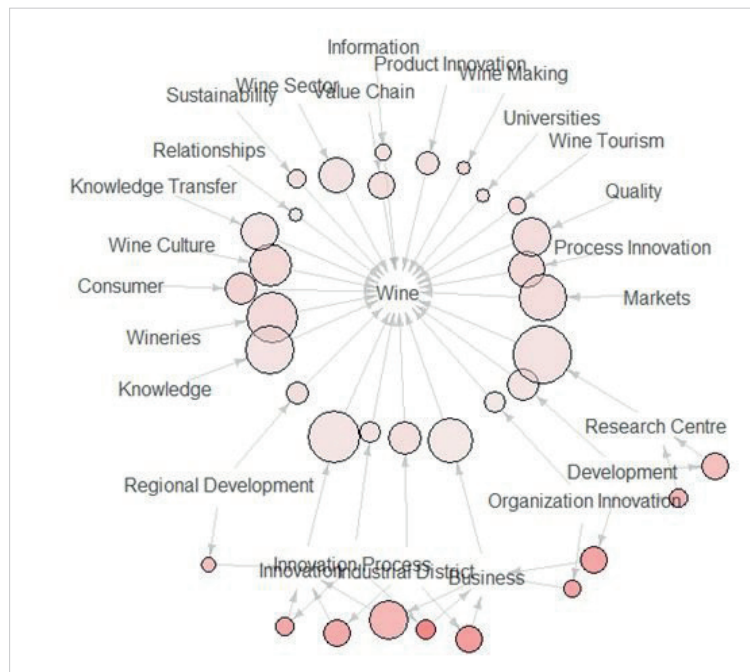
3.2.2. Wine innovation

Then, how does the wine industry innovate? It is interesting to find that an emerging cluster related to sustainable innovation also appears as crucial for this sector (Graph 3). It goes beyond the traditional types of innovation (both technological and non-technological, as will be seen below). The cluster seems to be linked to the need to maintain a sustainable process, connected to both adaptation to environmental change and its mitigation. In this specific sector, it might also have implications in terms of positioning and serving consumers, as sustainable wines can have premium prices.

Graph 4 helps to identify the clear links between different types of innovation in wine research literature. By number of repetitions, process and marketing are the most commonly researched innovation categories, although the most significantly interconnected with other clusters is sustainable innovation (which has a relevant connection with both environmental change and sustainability).

Technology innovations are of course related to both product and process developments; it is worth mentioning that the latter is also connected to sustainable innovation. Similarly, we have found a link between marketing innovation and tourism, which could be expected.

“ Process innovation is linked to the new technology that can possibly be used in the winery, to changes in the manufacturing process ”



Graph 2. Research issues in wine innovation literature

“ Sustainable innovation is emerging as a distinct type of innovation, related to those involving process and organizational changes ”

The literature dealing with process innovation underlines the importance of the manufacturing process and the technology employed; both are linked in a bilateral way, according to our findings. Process innovation is also directly linked to organizational innovation, and, as mentioned before, to sustainable innovation. Its relationship with marketing innovation seems to be strengthened through their common connection to the research on strategy. Surprisingly, there is no direct relationship between process innovation and product innovation, which could be explained by the specific characteristics of this field and the long period of time that new products typically need to enter the market when compared to other industries.

Strategy and tourism are connected to the research on marketing innovation in the wine industry

Marketing innovation

Marketing innovation is directly influenced by developments in products and organizational structures. As seen earlier, the topics of strategy and tourism are also connected to research on marketing innovation in the wine industry. This is a reasonable finding, given the relevance that wine tourism has in the marketing mix of a number of wineries and wine regions across the globe. Of course, the marketing strategy will depend on the current supply and the product innovation in which firms or other actors have engaged, but in our results there is no direct relationship between both types of innovation.

Organizational innovation

Organizational innovation seems to be the core of the innovation approach in the wine sector, building a network linking it to the others. As a strategy subset of organizational innovation, our data show that its size makes it large enough to gain a place of its own on our map of relevant topics. It has a bilateral link to other aspects of organizational innovation, and also to developments in marketing and processes. Surprisingly, research on the competitiveness of this sector seems to be linked only to organizational innovation. An explanation of this result might be connected to the study of Appellations d’Origine (and other labels) and its impact on boosting the competitiveness of a given wine region or of particular wine firms.

Product innovation

It appears, as mentioned, as a *rara avis*, and we have no features to clarify the way in which researchers from our sample have conducted their analyses. This could be explained by a number of factors: first, our sample has not included journals that focus on the agronomical or biochemical aspects of wine studies, and we could expect to find abundant research on product innovation in these journals. Second, this field can be particularly prone to secrecy, as **Dries et al.** (2014) found in the Hungarian wine sector.

3.2.3. Methodological approaches

Considering the continuous increase in wine literature, particularly that which is connected to innovation, we would like to offer future wine researchers a current picture (Graph 4) of the methodology approaches that have been used to describe wine innovation.

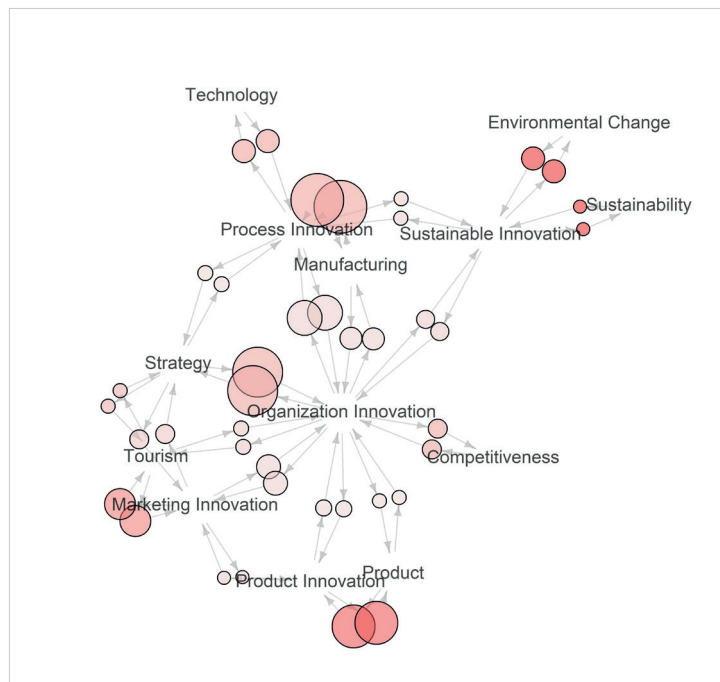
In our sample, we found that 95% of the articles are based on quantitative studies, while qualitative approaches are used in 13% of the papers (7.5% of the articles apply both methodologies). There is only one bibliometric study among them analyzing wine literature (**Bonn et al.**, 2018).

Multivariate and cluster analyses are the most widely used quantitative techniques, based on the small samples of wineries or other agents that have been included to conduct the research.

3.2.4. Geography of wine innovation: a world industry, with a local approach

Beyond the geographical pattern of the institutions whose researchers are active in wine innovation, we have also considered the territorial innovation models (TIMs) that have been used in wine innovation literature (see Graph 5). In this section, we will focus on the models discussed by **Doloreux et al.** (2019).

Coherent with the peculiarities of the industry, wine innovation research shows strong local and regional roots: in our sample, there are 75 papers based on a regional or national analysis. Both industrial districts and clusters are the main



Graph 3. Innovation types in wine literature

territorial models mentioned in this literature. However, country approaches are also mentioned, particularly in papers referring to legislation, global wine trade and main consumer markets.

While cluster and RIS (regional innovation systems) approaches appear to be the most widely used in TIM literature nowadays (Doloreux *et al.*, 2019), research on wine-related topics seems to be centered on industrial districts. We should bear in mind the initial configuration of an industrial district as a region in which firms are related to the same industry and share the same type of knowledge through formal and informal relationships, which might be consistent with the structure of wine regions mentioned by Larreina (2006). This effect could also be influenced by several researchers' Italian origins due to the fact that industrial districts have mainly been analyzed and boosted by Italian scholars. This can also be extrapolated to the other two large traditional wine-producing countries, Spain and France.

Continuing with the analysis of the wine literature database, we have made a map of the world in order to identify the regions most frequently mentioned in the research on wine innovation (see Figure 2). In order to produce the map, we extracted data from the NLP, and then we used *SPMAP* (Pisati, 2007). This image shows the countries where these regions are located.

The countries whose regions have been most cited are the USA (13.9% of the papers in the subsample conducting regionalised research), Australia (9.6%) and Spain (8.3%). It is noteworthy that Italy, which is the second country in terms of author affiliation, as seen earlier (Table 7), appears as the eighth country in this analysis. This discrepancy merits focused future research to provide an explanation.

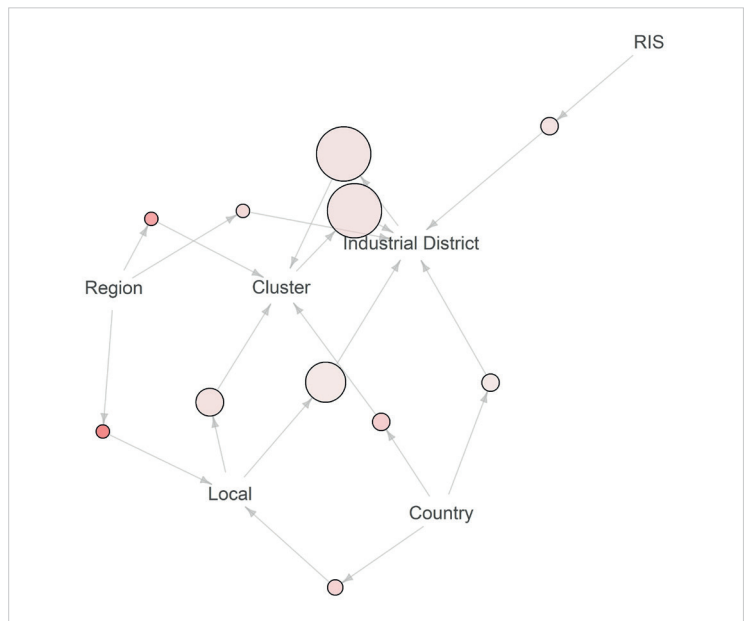
4. Conclusions

Wine business research and particularly innovation in the wine sector seem to be relatively young areas in the literature. The latter seems to still have a long way to go if it is to become a relevant research area for the industry although in recent times it has experienced a significant increase in the number of published papers. Continuous monitoring in the years to come may be necessary to determine whether this is a momentary spike or becomes a longer trend.

In this research, we have made use of natural language processing techniques to extract the key topics being discussed in each of the



Graph 4. Methodology approaches



Graph 5. Geographical approach to wine innovation

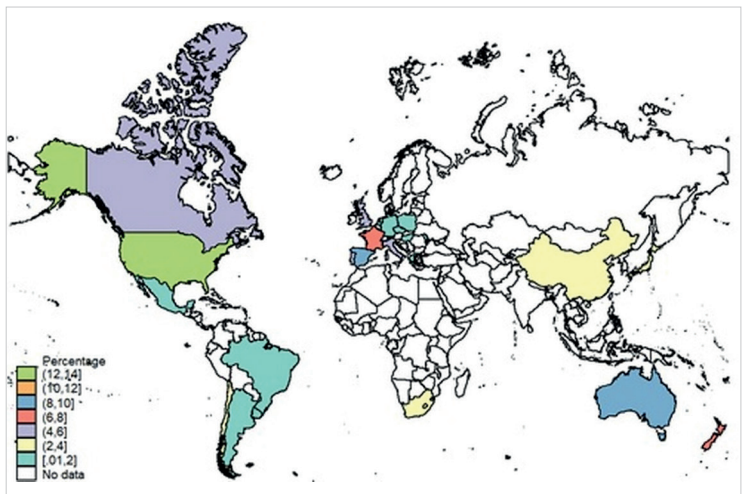


Figure 2. Countries researching wine innovation

articles. To do so, we have extracted the whole text of each paper and identified its keywords according to the context, thus obtaining the meta-keywords. The main advantage of this methodology compared with a traditional systematic review of the literature is the speed with which we can analyse a large number of documents in order to obtain these meta-keywords. Furthermore, we have personalized this extraction based on the peculiarities of the sector.

“The institutions leading research on wine innovation are located in those countries where either wine consumption or production is significant”

Once the meta-keywords were extracted, we were able to develop a set of bubble charts in which we can identify the relationships between the words and their relevance. In addition, we made a heat map of the world, which has allowed us to detect where the relevant research on wine innovation is being carried out.

Not surprisingly, there is a clear geographic pattern: based on author affiliation, the institutions leading research on wine innovation are located in those countries where either wine consumption or production is significant. It would be interesting to identify the home countries of the researchers themselves but we have no direct information on this.

Considering our sample, we have found that non-technological is the most researched category of wine-related innovation. Meanwhile, product innovation seems to be focused on the consumer demand for wine, with limited interest in enlarging the portfolio with other possible products. Finally, process innovation is linked to the new technology that can possibly be used in the winery, to changes in the manufacturing process, and to changes in wine value chain stakeholders.

A relevant finding in our research is that sustainable innovation is emerging as a distinct type of innovation, related to those involving process and organizational changes. Sustainability has been gaining relevance in wine business research in the last 5 years, while previously there was not a clear focus on this issue. As in many other fields, global warming is an increasing concern in wine literature, the analysis of its likely impact on the industry, and the opportunities and threats it is creating. As an industry based on a particular combination of *terroir* and climate, changes to the second variable deeply affect the status quo.

Moreover, the preferred territorial innovation models in wine business innovation literature differ from what is more common in other industries, giving a preeminent role to industrial districts. Although still in use in the case of research related to Italy, this concept is no longer as frequent as before in current territorial innovation models (TIM) literature. On the contrary, a widely used approach like regional innovation systems (RIS) is seldom used in wine business research.

We have also found that a large fraction of wine business literature is regionally based, which makes sense given the characteristics of the industry. The countries most frequently analyzed (either at the regional or national level) have also been identified, and are in line with those hosting active researchers in this field, with the exception of Italy. This country is the second in terms of the number of papers its researchers have published, while the field ranks 8th as a subject of study.

Like all research, this project has also several limitations that should be mentioned. First of all, we should underline that the choice of the *Web of Science* for the database search is, per se, one limitation that we should consider. Although this source is highly relevant, other platforms such as *Scopus* or *Dimensions* could have been analyzed in order to have a complete view of wine literature. *Google Scholar*, which is becoming more important in bibliometric research, can also be used for this purpose.

Similarly, we conducted the search considering innovation related to business categories. Therefore, relevant research areas for the wine sector were excluded –biology, chemistry and agriculture–, which also include papers on business innovation. For instance, the paper “Tradition and innovation in Italian wine family businesses” (Vrontis et al., 2016) was published in the *British food journal* which is indexed under the category “Food Science and Technology”. In this sense, future research could provide a more complete picture of wine R&D and innovation literature by extending the area of analysis to other fields.

“Non-technological is the most researched category of wine-related innovation”

The three largest wine producers are Italy, France and Spain, whose languages are also used frequently by scientists in order to distribute their research. Hence, focusing on papers written in English can leave out of the analysis scientific production on wine business innovation that happens to be written in these three languages or in any other. In this sense, language limitation appears as a significant restraint of our analysis. In this paper we have only employed articles extracted from the *WoS*, published in English, so possible bias of our results arises from this limitation. Therefore, as further research, we propose the use of context-based systems, replacing this language limitation. Also, other kinds of documents, such as conference papers or books could be taken into account, which would be done in further analysis.

Our literature review has opened up other avenues for further analysis in areas of seemingly great interest: Process Innovation, the involvement of research centers in wine R&D, wine marketing, as well as sustainability and environmental production along the value chain.

Another topic of interest could be the relationship between authors and the regions or countries that are analyzed, to find specific patterns. How international collaborative networks are boosted in this field could also be examined.

Finally, the link between the different types of innovation related to wine literature could be contrasted with empirical analysis in different geographical regions and clusters in different life cycle stages. Whether or not the literature focuses on different innovation types when analysing regional realities in different stages of the cluster life-cycle could also be studied. For instance, mature clusters could be more prone to technological process innovations as proposed by **Karagouni and Papadopoulos (2007)**.

Product innovation seems to be focused on the consumer demand for wine, with limited interest in enlarging product-portfolio

Notes

1. According to *WTO* data, while wine represented in 2013-2018 around 1.46% of Portuguese merchandise exports, textile products represented 0.84% of British merchandise exports in the same period. On the other hand, Portuguese textile products accounted for around 3.5% of its exports, and British wine exports were negligible.
2. The European Union accounts for 45% of global land under vines, 65% of wine production, 60% of its consumption and 70% of its exports.
3. The details of the procedure followed in each of these algorithms are provided in sections 3.3, 3.4 and 3.5 below.
4. This tool was developed for the European project *Dante (Detecting and analysing terrorist-related online contents and financing activities)*. The *Dante* project aims to deliver more effective, efficient, automated data mining and analytics solutions and an integrated system to detect, retrieve, collect and analyse huge amount of heterogeneous and complex multimedia and multi-language terrorist-related contents, from both the surface and the deep web, including dark nets. <http://www.h2020-dante.eu>
5. In 2019, the database only considered articles being published between January and October 2019. Therefore, additional articles could raise the final data for this year in the remaining months.
6. We include only journals that have published two or more articles on the subject. There are 119 journals that have published only one paper on wine innovation.
7. As there are several collaborative papers between the authors in the table, we do not provide the total of table 6 (75 papers).

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REVISAS 9.618 | DOCUMENTOS 4.928.574 | ALERTAS 28.860.455 | USUARIOS 1.552.740 | TESIS 45.101

Dialnet Plus

Descubre la versión avanzada de Dialnet que le ofrece todas las herramientas necesarias para optimizar las búsquedas y trabajar con los fondos disponibles. (Ver más)

Inclusión de contenidos en Dialnet

Instrucciones para autores | Instrucciones para editores

Noticias

19/01/2015
Dialnet logra la clasificación CAPRUS Plus+ 2014.

19/12/2014
Dialnet Plus aumenta a 20 las búsquedas gratuitas. (Ver más)

Colaboradores

Instituciones colaboradoras
Colaboradores con página institucional

Últimas incorporaciones

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