Research on wine and climate change. A bibliometric analysis

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Keywords: climate change, wine, bibliometric analysis

Abstract

Introduction

Grapevine and wine are probably two of the agricultural productions that are most dependent on geographical characteristics. Indeed, a distinctive factor taken into consideration when evaluating wines (especially high-quality ones), is the concept of *terroir* which, as stated by the International Organisation of Vine and Wine (OIV), "includes specific soil, topography, climate, landscape characteristics and biodiversity features." In particular, climate plays an important role regarding the timing of the grape ripening in the seasons, thus affecting the final wine produced in terms of acidity, sugars and aromas (van Leeuwen, 2010).

However, in the next decades, climate change (and rising temperatures) could alter favorable climatic conditions in many areas of the world, possibly affecting the timing of fruit ripening or even the possibility to grow grapevines. Some studies have shown how future higher temperatures could make it extremely difficult to maintain current quality levels in many European regions (Jones, White, Cooper, & Storchmann, 2005). Others have also reviewed the economic implications on the wine sector of rising temperatures, agreeing with previous studies that European producers will be the ones most affected (Ashenfelter & Storchmann, 2016).

Recently, Sacchelli et al. (2016) have provided a quantitative literature review about the adaptation strategies to climate change in the wine sector. Additionally, Alonso Ugaglia and Peres (2017) have also realized a literature review about the scientific recommendations and strategies for wine producers. Nevertheless, it appears that the literature review about the relationship between wine and climate change has still not been thoroughly explored. For this reason, this paper aims to use the instruments provided by bibliometrics to analyze the scientific literature on wine and climate change, in order to contribute in trying to fill a gap.

Methodology and data

As already mentioned, the method used in this paper is part of the so-called "bibliometric analysis", which was mostly developed during the 1950s and 1960s by Garfield (1955) and de Solla Price (1965). When employing this methodology, bibliometric data (e.g., the number of publications in a year or that of citations of a work) are analyzed through a set of statistical methods, with the purpose of evaluating research on specific topics. The bibliometric analysis is mainly divided in two categories: *performance analysis* (which evaluates the impact of the bibliographic contributions of different factors such as researchers, countries, etc.) and *science mapping* (which focuses on showing relationships and networks between authors, institutions, research areas, etc.). For this work, science mapping will be realized through the co-citation analysis and bibliographic coupling. The bibliographical data used in this paper were exported from Clarivate's Web of Science (WoS), using

as keywords the terms "wine" and "climat* chang*"[1]. The period considered is from 2007 to 2021 and only scientific articles are included. The final dataset consists of 1,040 publications.

Results and conclusion

From the data obtained, we found out that both the number of publications and the number of authors of papers regarding wine and climate change has increased between 2007 and 2021. We also used the data to analyze the geographic distribution of the research on these topics. Among the top 15 most productive countries by number of publications, Australia occupies the first position, contributing to nearly 16% of total researches found in the database; Spain and Italy are the second and third most productive countries. It is also interesting to notice that, among the top 15 most productive countries, 7 (that is, nearly half of them) are part of the so-called "New world wine" producers.

We also decided to consider the different research areas and journals that are most involved in the research on wine and climate change. Data show that the *Australian Journal of Grape and Wine Research* is the top source, accounting for more than 6% of the total publications, thus confirming the overall interest and relevance in Australia for these research subjects. Regarding the most common research areas associated to publications on wine and climate change, "Food science and technology" occupies the top spot (13.2%), followed by "Environmental sciences" and "Horticulture".

In order to carry out a scientific mapping of our data, we used, as already mentioned, the so-called co-citation analysis, proposed by Small (1973) as a method for document coupling by linking two documents that are cited together by a third document. This allows to find the most relevant publications in a specific research field (Donthu, Kumar, Mukherjee, Pandey, & Lim, 2021). Firstly, we found out that Mira de Orduña (2010) is by far the most cited publication (447 citations); it focuses on the effects of climate change on the quality of grapes and wine production. However, through a graphic illustration of the network of the co-citation analysis (realized with VOSviewer), we were able to see that the 3 publications with the strongest link strength (that is, the publications which are more strongly related to the others in the dataset) are Jones et al. (2005), Jones and Davis (2000), and Duchêne and Schneider (2005).

Lastly, we used bibliographic coupling, first proposed by Kessler (1936); a method that takes into consideration publications that share common references, thus probably also sharing similar research subjects. From this analysis, the resulting publications with the highest "link strength" were: Cabré et al. (2016), Bernardo et al. (2018) and Neethling et al. (2017); all of them are about climate change adaptations and stress assessment for grapevines.

This bibliometric analysis still presents some downsides. Despite allowing to analyze large quantities of data, this does not make it possible to go too much in-depth regarding the publications considered, thus allowing to give only a superficial account about the main topics. Also, many authors tend to cite their previous works, and this may cause a bias in the representation of the networks of citations.

[1] The asterisk (*) allows to include all possible endings for the words "climat-" and "chang-", e.g., climatic and changing

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