ASSESSMENT OF CLIMATE CHANGES ON THE WINE SECTOR

PETRUȚA TUREK RAHOVEANU[1] , MAGDALENA TUREK RAHOVEANU[2]

(1) Research Institute for Agricultural Economics and Rural Development, bld. Marasti nr.61, sector 1, Bucharest, Romania, turek.petruta@iceadr.ro,

(2) "Dunarea de Jos" University from Galati, Faculty of Engineering and Agronomy, Calea Călărașilor no. 29, Braila, Romania,email: magdalena.turek@ugal.ro

author email: *turek.petruta@iceadr.ro,*

Corresponding author email: magdalena.turek@ugal.ro

Abstract

We evaluate the sustainability of the wine sector through bibliometrics at the European level in the last twenty years. This evaluation model is a new one in this sector and offers a bibliometric analysis at the European level where 169 types of research on sustainability in viticulture are analyzed with the help of the VOS viewer software, by linking the keywords, the author, and the titles of the documents.

The research aims to contribute to the knowledge of the current state of research by identifying the top clusters created from the coupling of documents. The results show the special perspectives at the level of companies and the involvement in the development of European rural communities. Our findings show that viticulture can bring added value, and the proposals are particularly focused on the development of viticulture-related activities, their diversification, health and environmental protection, and a range of social changes.

Keywords: *Durability, Environmental health, Business health, Viticulture, EU27*

INTRODUCTION

Sustainable viticulture is the academic niche that has become a European business practice [1], under the impact of a changing agricultural policy that is permanently subject to periodic evaluations [2].

Assessing the sustainability of viticulture, [3] by tracking the health of biodiversity, business, and community is the expression of introducing innovation and maintaining performance.

Sustainable viticultural management is the effect of integrated management, together with waste management that can provide economic benefits and ensure business sustainability.

Vineyards in a landscape with a cross-design of management (organic vs. conventional) and pesticide use (regular vs. reduced) are business models that can promote arthropod biodiversity.

Precision viticulture will play an important role by introducing smart inputs that will streamline and improve the quality of production with positive effects on companies and the environment [2].

Today the sustainability of viticulture is very important in companies, digitization as a communication tool describes the main way of informing consumers [1].

Also, many companies now try to be both efficient and sustainable, those in viticulture occur naturally [5].

Our assessment is timely and necessary because the sustainability of viticulture can be achieved through a combination of strategies [4].

Consequently, viticulture is one of the most representative economic activities in the EU27 in terms of employment and company income [5].

Because of these highlights, we formulate the following research questions for the current study:

1. Are the wine farms prepared for the sustainability of the activity?
2. Is precision viticulture an option for the sustainability of wine farms and rural areas?

The answers to these questions can be considered strongly embedded in the local community and can bring value to economic activities for both farmers and consumers,

supporting environmental protection and social behavior in the community.
The material and methods section presents our model to study European experiences in viticulture sustainability.
The final section provides further discussion, and a set of conclusions for future studies.

MATERIALS AND METHODS

To carry out this study, a bibliometric analysis was developed on the scientific research published in the studied field.
The information was obtained as a result of searching the database in the Scopus platform, which may contain information from scientific journals, scientific works, research, etc.
The software product VOSviewer (version 1.16.13), developed by Nees Jan van Eck and Ludo Waltman, within the Center for Science and Technological Studies of the University of Lei, was used to develop this quantitative data analysis.
The centralizations made resulted in a total of 230 research articles on sustainable viticulture published in 2000-2023 and indexed in Scopus.
The subject matter of the articles is particularly varied, represented by fields such as "Agronomy", "Agricultural and biological sciences" and "Environmental science".
The research territory presented in the papers included EU27 member states, but the main countries for SV research were Portugal, Italy, and Spain.

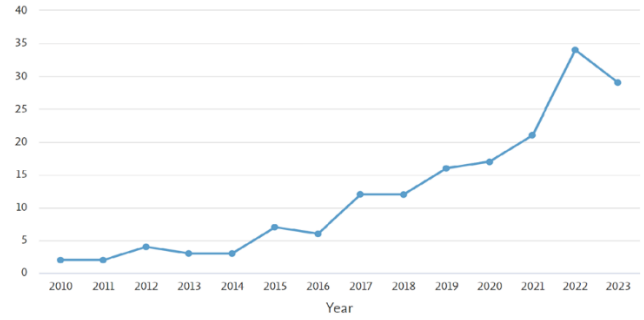

Fig. 1. Evolution of research themes after SV in the period 2010-2023 Scopus query). Copyright © Elsevier BV[4]

SV research has appeared in journals such as *Sustainability (Switzerland), Acta Horticulture, and Agronomy*.
The research methods used are interview-based investigations, and systematic analysis of the documents for the case study carried out using the Focus Group.

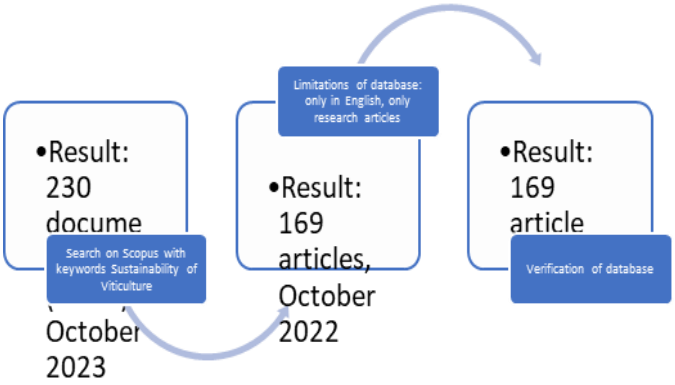

Fig. 2. Staping data selection

For subsequent analysis with the help of Vosviewer, we exported 169 articles from Scopus in CSV Excel format.

The table below shows the parameters that were used for the co-occurrence analysis of SV research domain keywords.

Table 1. Criteria for co-occurrence analysis of SV words.

Criteria	Features for SV
Data typology	Bibliographic map
Data source	Scopus files
Method	Co-occurrence
Unit of analysis	All Keywords
Numbering	Fracțională
Minimum occurrences of the keyword	5
Number of keywords selected	56
Normalization method	Association power (between keywords)
Minimum cluster size	5
Combining small groups	Yes
Other	Implicitly

Sursa [5]

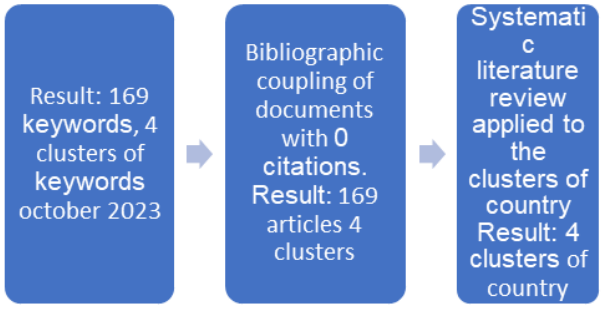

Fig. 3. Data selection phasing

RESULTS AND DISCUSSIONS

The research allowed us to form 4 groups (clusters) based on studies in the period 2010-2023 in this network, because most of them are very recent, especially from 2022.
The new keywords for the first group of keywords are "climate change", and "alternative agriculture", and the second group of keywords, are "sustainability", "viticulture", "ecosystem service", and "Portugal".
These keywords can represent the actual models of SV research, such as carbon footprint, and agriculture land.
Cluster 1 (red): **"The dimension of climate change in viticulture"** is representative in terms of the number of citations and the largest content.
Among the most influential practical works, attention is drawn to the fact that global warming and air drying will hurt vine physiology and ultimately yields.
The potential to adapt mulching to maintain current grapevine production levels is evaluated. [6]
The research results [7], showed that the design of climate-smart food systems (using wine as a model productive sector) involves considerable problems for the sustainability of enology in several geographical regions, endangering the typicality of wine:

(i) increase in unwanted microbial proliferation;
(ii) the content of improved sugars and, consequently, of ethanol;
(iii) reduced acidity and increased pH;
(iv) unbalanced perceived sensory properties (eg, color, flavor); and
(v) heightened safety concerns (eg, mycotoxins, biogenic amines).

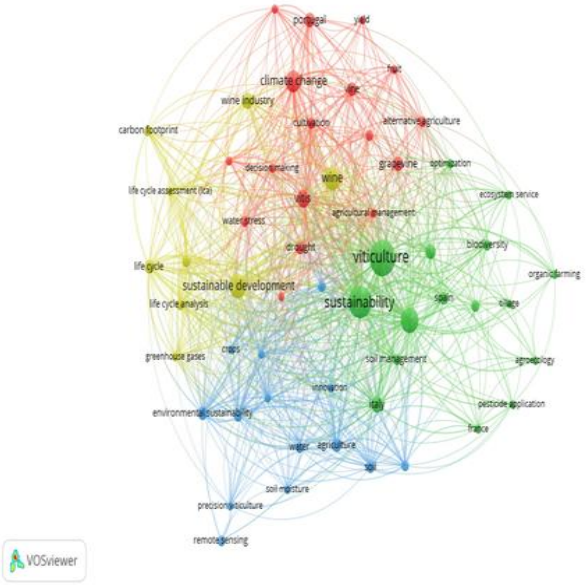

Figure 4. Bibliometric map by data co-occurrence

Cluster 2 (green): **"Access to resources in viticulture"** is the oldest network cluster considering the most cited works.
Several 14 works in this group are empirical works in the field of viticulture management and the optimization of the demand and

supply of inputs in rural areas. In addition, the social demand for organic products is increasing, and the brands of the wines name of protected origin are built starting from the specific soil resources, which must be maintained.

Maintaining biodiversity is admitted by the academic world, and the simplification of the landscape is a major factor here [8]. Three phases have been identified, which are responsible for 70-80% of the equivalent of CO2 (CO2 equivalent), the use of cumulative energy, the acidification potential (expressed in equivalent SO2), and eutrophic (expressed in equivalent PO4), ie harvesting, protection of crops.

Cluster 3 (blue): **"Precision Viticulture as an engine of sustainability"** is the youngest cluster on the map. At the same time, it is the third largest in the network: it has grown rapidly since 2020.

Among the most cited articles [9] in the group, it appreciates an acceleration of requests for geospatial information and the accessibility of geodata to support the management of vineyards using new technologies at the European level. Currently, carbon footprint (CF) analysis is gaining a role of primary interest in the extensive literature on wine sustainability issues.

It aims to quantify greenhouse gas emissions that underlie the life cycle of wine, from viticulture and winemaking to wine bottling, distribution, consumption, and end-of-life waste.

This critical review looks at several methodological and conceptual aspects behind wine carbon footprinting, such as calculation approaches, labeling, and standardization purposes, combinations with other methods and theories, and CF trends in the wine sector.

Most studies only addressed specific methodological issues from the perspective of the assigned life cycle or directly reported the CF profile of a specific wine product, indicators, greenhouse gas emissions, and the use of product life cycle assessment methodology.

Cluster 4 (yellow): "Access to sustainability", similarly to cluster 3, is very young in the field, and slightly reduced in size compared to cluster 3.

The map (figure 1) shows the increasing interest in the field of cluster application. the wine industry is certainly committed to sustainability: stakeholder interest in the subject is constantly growing and a large number of sustainability programs have been launched in recent years[10].

Most of these programs focus on environmental aspects such as environmental sustainability indicators, greenhouse gas emissions, and the use of product life cycle assessment methodology.

CONCLUSIONS

The research has an extremely narrow topic (only 169 researches at the European level in the last twenty years for which the selection criteria are met), but it shows an increase in the interest shown by researchers in the last 2 years (Figure 1). The annual number of SV publications increased almost fifteenfold in 2022.

Our analyses demonstrate that SV is a multidisciplinary field because it attracts the attention of researchers from different disciplines, including agronomy, management, and environmental studies (to name a few). Based on the SV phenomenon, issues such as digitization, IoT, the behavior of households, SMEs, rural development and the environment can be addressed, significant phenomena in the present and future for the study of transparent and multidisciplinary SV[4].

REFERENCES.

1. Cejudo, A.B.; Aldama, I.Z.; Sanchez, A.I. Communicating sustainability to wine tourists, the next “big thing” for the landmark wineries: The case of Emilio more wineries. In Handbook of Research

on Sustainability Challenges in the Wine Industry; IGI Global, 2023; pp. 1–15 ISBN 9781668469446.
2. Beaumelle, L.; Giffard, B.; Tolle, P.; Winter, S.; Entling, M.H.; Benítez, E.; Zaller, J.G.; Auriol, A.; Bonnard, O.; Charbonnier, Y.; et al. Biodiversity conservation, ecosystem services, and organic viticulture: A glass half-full. Agric. Ecosyst. Environ. 2023, 351, 108474, doi:10.1016/j.agee.2023.108474.
3. Döring, J.; Friedel, M.; Hendgen, M.; Stoll, M.; Kauer, R. Soil management in sustainable viticultural systems: an agroecological evaluation. In Improving Sustainable Viticulture and Winemaking Practices; Elsevier, 2022; pp. 85–103 ISBN 9780323851503.
4. Rahoveanu, M.M.T.; Serban, V.; Zugravu, A.G.; Rahoveanu, A.T.; Cristea, D.S.; Nechita, P.; Simionescu, C.S. Perspectives on Smart Villages from a Bibliometric Approach. Sustain. 2022, 14, doi:10.3390/su141710723.
5. Petrea, S.M.; Coadă, M.T.; Cristea, V.; Dediu, L.; Cristea, D.; Rahoveanu, A.T.; Zugravu, A.G.; Rahoveanu, M.M.T.; Mocuta, D.N. A Comparative Cost – Effectiveness Analysis in Different Tested Aquaponic Systems. Agric. Agric. Sci. Procedia 2016, 10, 555–565, doi:10.1016/j.aaspro.2016.09.034.
6. Helder, F.; João A., S. Vineyard mulching as a climate change adaptation measure: Future simulations for Alentejo, Portugal. Agric. Syst. 2018, 164, 107–115, doi:10.1016/j.agsy.2018.04.006.
7. Berbegal, C.; Fragasso, M.; Russo, P.; Bimbo, F.; Grieco, F.; Spano, G.; Capozzi, V. Climate changes and food quality: The potential of microbial activities as mitigating strategies in the wine sector. Fermentation 2019, 5, 85, doi:10.3390/fermentation5040085.
8. Guenser, J.; Bourgade, E.; Vergnes, M.; Dufourcq, T.; Mary, S. Assessment of biodiversity and agronomic parameters in two Agroforestry vineyards. E3S Web Conf. 2018, 50, 01013, doi:10.1051/e3sconf/20185001013.
9. T., D.F.; L., R.; E., F.; L., G. A WebGIS application for precision viticulture: From research to operative practices. Int. Arch. Photogramm. Remote Sens. Spat. Inf. Sci. - ISPRS Arch. 2010, 38, 2010.
10. Lamastra, L.; Balderacchi, M.; Di Guardo, A.; Monchiero, M.; Trevisan, M. A novel fuzzy expert system to assess the sustainability of the viticulture at the wine-estate scale. Sci. Total Environ. 2016, 572, 724–733, doi:10.1016/j.scitotenv.2016.07.043.