



Dynamics of vineyard areas in the world – Comparative study for the 2015 – 2024 period

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Abstract: The dynamics of vineyard areas by country and in the world were analyzed for the period 2015 – 2024, within the framework of this study. The OIV database (2024) was accessed for the data source. The data series presented a normal distribution, with low variability. Values ranging from 129±6.24 kha in India (2015) to 975±4.49 kha in Spain (2016) were recorded. In the other countries category, values ranging from 2357 – 2544±20.51 kha were recorded. In the case of the global record, values ranging from 7066 – 7446±38.08 kha were recorded. The ANOVA test and the Kruskal-Wallis test confirmed the difference between the mean and median values, within statistical safety conditions. Dunn's Post Hoc test highlighted the level of statistical safety for differentiating countries, in relation to vineyard areas. Mann-Kendall trend test showed a decreasing trend in vineyard areas in most countries and in the world ($p < 0.05$), and an increasing trend in Italy and India ($p < 0.001$), and in France ($p > 0.05$).

• Introduction

The vine geography has experienced a series of variations in recent decades, associated with climate change [17]. Climate change has brought a series of challenges to the wine sector, from spatial variability of wine-growing areas, to adaptations of current technological practices, the profitability of vineyards and the sustainability of winegrowers [13]. Associated with climate change, new wine-growing areas may appear (exposed to different levels of pressure for integration into wine-growing systems), but at the same time, established wine-growing areas may be affected by climatic factors [23], [21]. Associated with climate evolution, changes have been reported in areas dedicated to vine cultivation (variable disturbances), vine conditions have been recorded in new areas, and the area under vine cultivation has expanded [23], [26], [2], [12].

• Material and method

The study analyzed the dynamics of vineyard areas during the period 2015 - 2024, based on the values recorded in the annual assessment in the field of vines and wine [15]. According to the records made, statistical data was accessed for countries such as Spain, France, China, Italy, Turkey, USA, Argentina, Romania, India, Portugal, Other countries, and the World [15]. Statistical data on vineyard areas, according to the records in the database, were considered for analysis in this study. Vineyard areas were expressed in kha (kha – kilo hectare; 1 kha = 1000 ha). According to the purpose of the study, a statistical description of the data series over the study period was made (Descriptive Statistical Analysis).

• Results and discussions

The area cultivated with vines varied differently during the analysis period, at the level of each country, as well as at the global level, Table 1. Values ranging from 129±6.24 kha in India were recorded, up to 975±4.49 kha in Spain. At the level of other countries, values ranging from 2357 – 2544±20.51 kha were recorded. In the world, values ranging from 7066 – 7446±38.08 kha were recorded. The average value of the vineyard area, during the analysis period, is presented graphically in Fig. 2. Multivariate analysis of (PCA) was considered to describe the correlation of countries with years in the study period, based on vineyard areas, Fig. 4. Also, based on PCA, the loading of countries (as factors) was recorded in the Principal Components, Table 6. The main two components (PC1, and PC2) explained 91.083% of the total variance, Fig. 4. The cluster analysis showed the level of similarity between the countries considered and the years of the study period, with the cluster diagram in Fig. 5 (Coph.corr. = 0.891 in relation to the countries; Coph.corr. = 0.694 in relation to the years). The diagram showed clear differentiation between countries and low differentiation between years of study, in the case of the same country. This result is consistent with the result of the ANOVA and Kruskal-Wallis tests at the level of years of study ($p = 1$). Regarding the countries, according to the cluster diagram, Figure 5, two independent clusters were differentiated, with several subclusters, respectively four areas (based on color) in relation to the viticultural area. Spain positioned itself independently, with the highest viticultural area (during the study period – red color). France, China and Italy were grouped based on similarity in a subcluster (orange - yellow colors). Four countries (India, Portugal, Romania, Argentina) were positioned in a subcluster (dark blue color - different shades), and the USA and Turkey were positioned in a subcluster with lower values of the vineyard area (light blue).

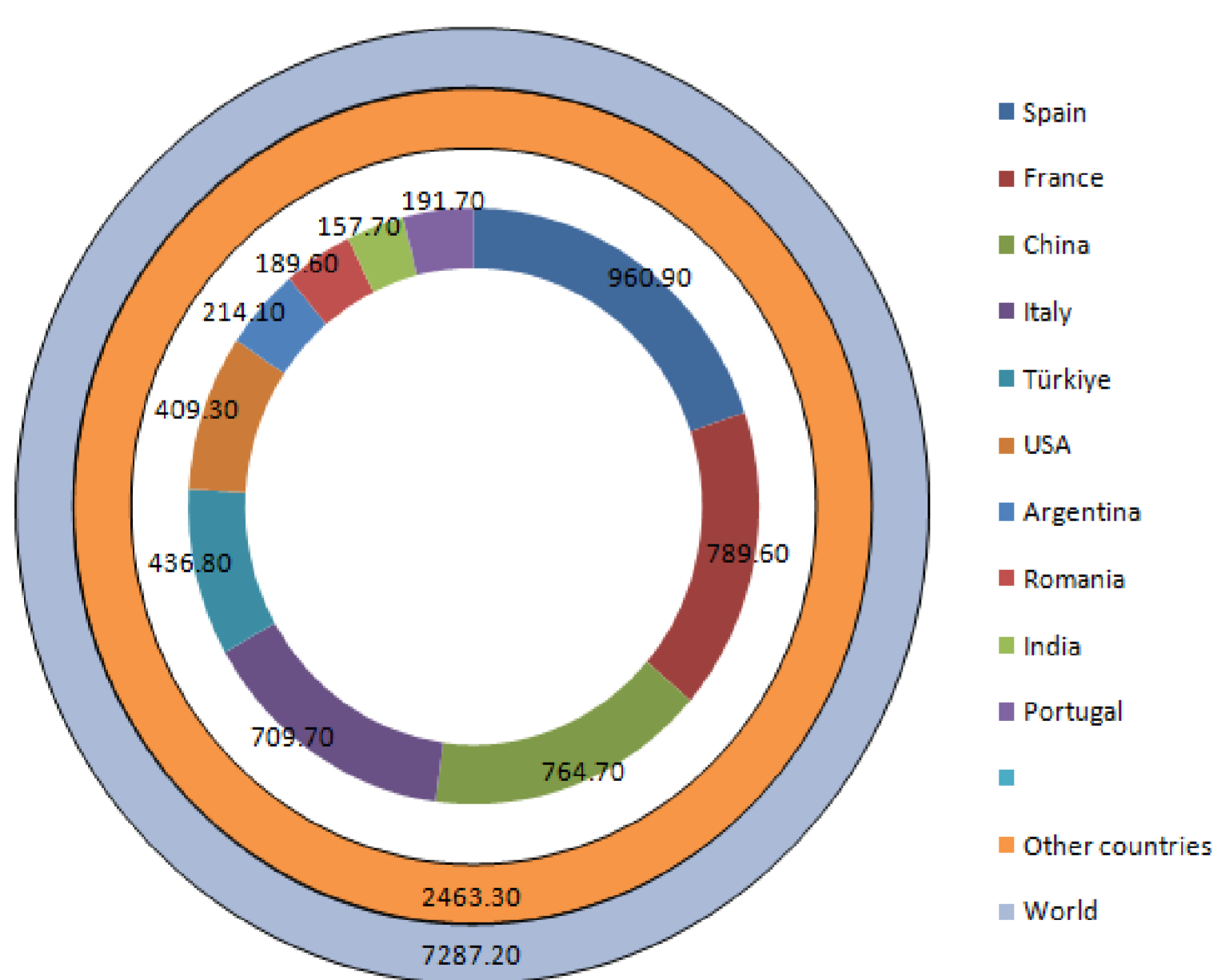


Figure 2. Viticultural area (kha), average value by country and in the world, during the analysis period

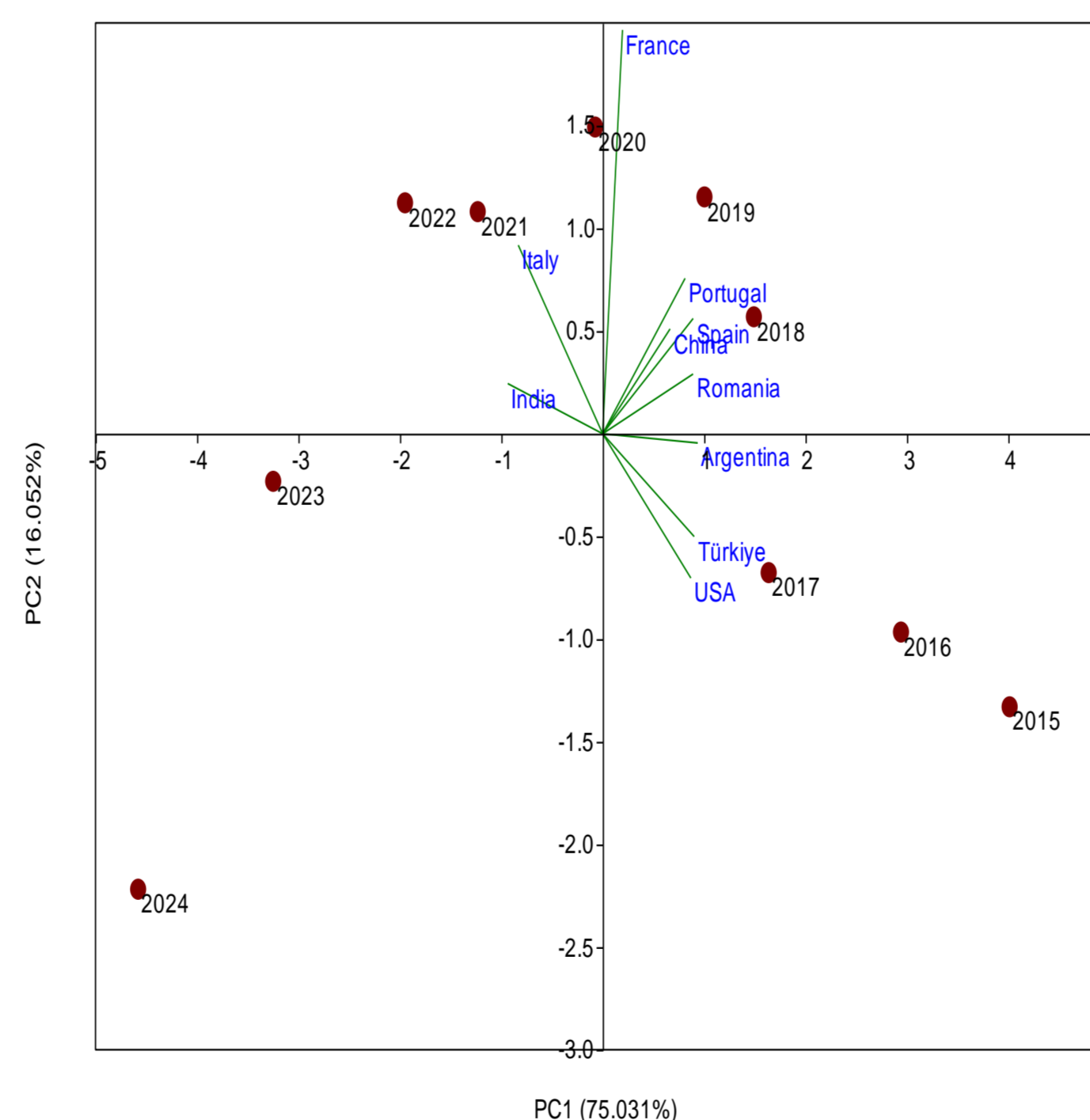


Figure 4. PCA diagram, for countries and years according to vineyard area in study period

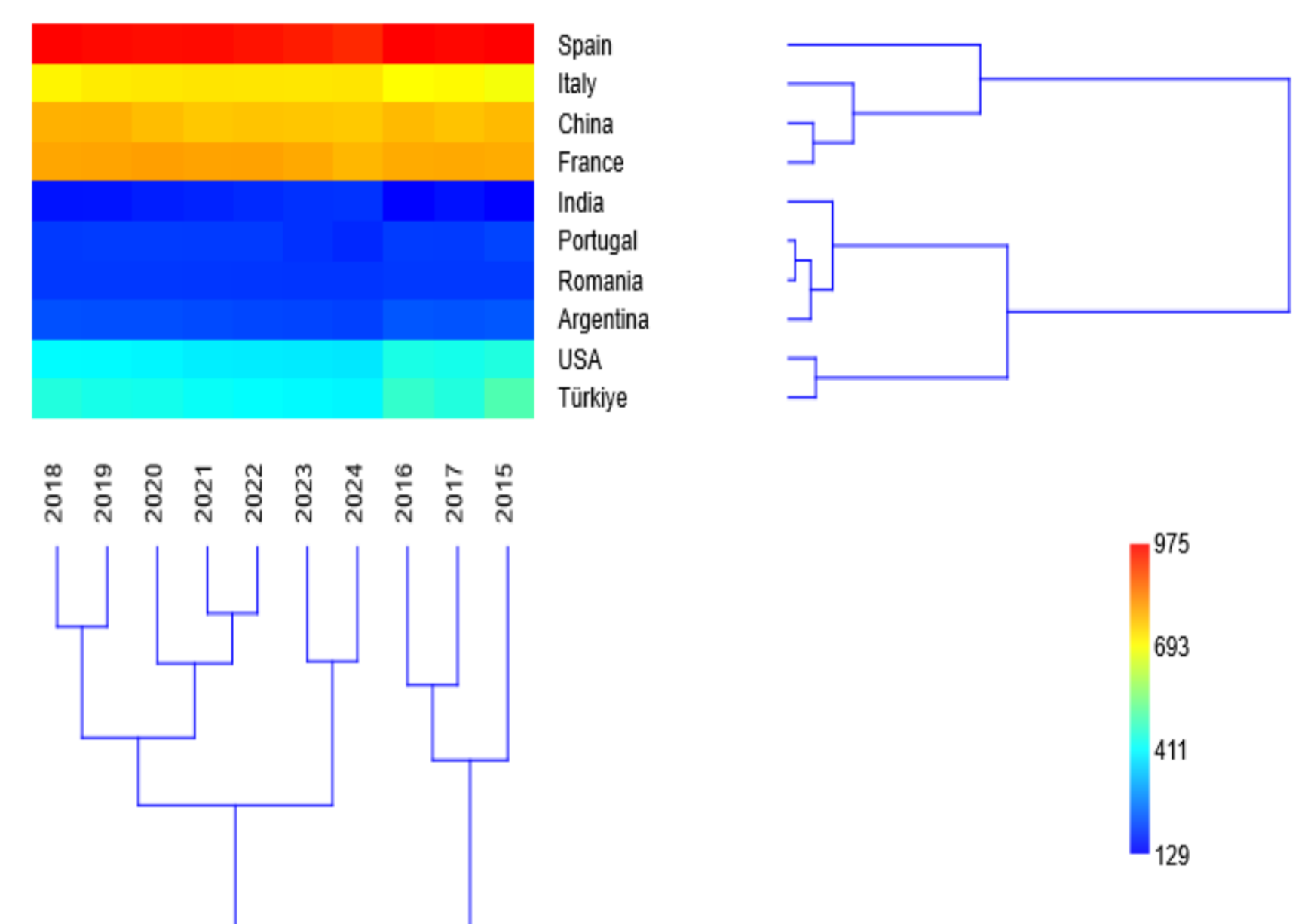


Figure 5. Cluster diagram based on vineyard areas

• Conclusions

The vineyard areas recorded between 2015 and 2024 showed variations over the study period, with a decreasing trend in most of the countries considered in the study, and in the world, except for Italy and India, where an increasing trend was recorded in conditions of statistical safety ($p < 0.001$), and in the case of France ($p > 0.05$). Mathematical models in the form of linear equations (in the case of India) and polynomial (for the other cases) described in conditions of statistical safety the variation of the vineyard areas over the study period. The comparative analysis showed obvious differences between the mean and median values between most countries, but differences without statistical significance were also found in some cases (according to Dunn's Post Hoc test). Multivariate analysis (PCA) explained the variance based on the two main components (PC1 = 75.031%; PC2 = 16.052%) and highlighted the correlation of countries with the years of the study period, based on the values of the vineyard areas.

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