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Front cover photography: Sveta Gora, a settlement with a franciscan monastery overlooking the Soča valley, renowned as a Marian pilgrimage site, is located near the Slovenia-Italy border, at the intersection of Alpine, Medditerranean and Dinaric landscapes (photograph: Jure Tičar).
Fotografija na naslovnici: Sveta Gora, naselje s frančiškanskim samostanom nad dolino Soče, ki je znano po marijanskem romarskem središču, leži na meji Slovenije in Italije ter na stiku alpskih, sredozemskih in dinarskih pokrajin (fotografija: Jure Tičar).

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THE TRENDS IN VITICULTURE AND WINEMAKING IN THE CONTEXT OF WINE TOURISM DEVELOPMENT IN BOSNIA AND HERZEGOVINA

Radomir Bodiroga, Tijana Banjanin, Dajana Vukojević Ateljević, Simon Kerma

SIMON KERMA

Vineyards and wine tourists at the Jungić winery estate – Markovac, northern Bosnia wine region.

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Radomir Bodiroga[1], Tijana Banjanin[1], Dajana Vukojević Ateljević[1], Simon Kerma[2]

The trends in viticulture and winemaking in the context of wine tourism development in Bosnia and Herzegovina

ABSTRACT: The article looks at viticulture, wine production and wine tourism in Bosnia and Herzegovina. The cluster analysis was carried out to identify the current situation and to explore the possibilities for the development of wine tourism as an additional segment that can contribute to a better positioning of both sectors and to the diversification of the income of wine producers in the country. The analysis identified three different groups (clusters) of wine producers with different capacities. Given the different structure of wineries, the possibility of diversifying agricultural and rural policy measures must be examined in order to contribute to a more intensive development of viticulture and winemaking which would also encourage the development of the tourist offer for each wine producer.

KEYWORDS: viticulture, wine production, wine tourism, cluster analysis, Bosnia and Herzegovina

Trendi v vinogradništvu in vinarstvu v kontekstu razvoja vinskega turizma v Bosni in Hercegovini

POVZETEK: Članek obravnava vinogradništvo, pridelavo vina in vinski turizem v Bosni in Hercegovini. Cluster analiza je bila izvedena z namenom ugotoviti trenutno stanje in raziskati možnosti za razvoj vinskega turizma kot dodatnega segmenta, ki lahko prispeva k boljšemu položaju obeh sektorjev in k diverzifikaciji prihodkov vinarjev v državi. Z analizo smo opredelili tri različne skupine (grozde) pridelovalcev vina z različnimi zmogljivostmi. Glede na različno strukturo vinarjev je treba preučiti možnost diverzifikacije ukrepov kmetijske in podeželske politike, da bi prispevali k intenzivnejšemu razvoju vinogradništva in vinarstva, kar bi spodbudilo tudi razvoj turistične ponudbe pri vseh vinarjih.

KLJUČNE BESEDE: vinogradništvo, pridelava vina, vinski turizem, cluster analiza, Bosna in Hercegovina

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[1] University of East Sarajevo, Sarajevo, Bosnia and Hercegovina
radomir.bodiroga@pof.ues.rs.ba (https://orcid.org/0000-0001-7863-8440), tijana.pekic@pof.ues.rs.ba (https://orcid.org/0000-0003-2450-322X), dajana.vukojevic@ues.rs.ba (https://orcid.org/0000-0001-9712-2626)

[2] University of Primorska, Faculty of Tourism Studies – Turistica, Portorož, Slovenia
simon.kerma@fts.upr.si (https://orcid.org/0000-0003-1368-6665)

1 Introduction

Viticulture and wine production have a long tradition in Bosnia and Herzegovina. According to Nurković (2017), the first grapevines were brought to this area by the Thracians, while there is evidence of grape cultivation and wine production dating back to Illyrian times. Today, viticulture, together with wine production, is considered an important branch of the agricultural and processing industry in Bosnia and Herzegovina. Compared to other crops (e.g. cereals and fodder plants), viticulture employs a larger number of people and achieves higher yields per unit area. The intensive development of viticulture is of undeniable importance for the economic progress of the entire country, especially in rural areas, for various reasons: economic contribution, tourism, sustainability, socio-cultural aspect, support for young producers etc. Although small vineyard areas may limit the economic contribution at the national level, they can have local and cultural benefits for the community. For further progress and planning, it is crucial to be familiar with vineyard areas, varietal structure, plant age, and the potential of different viticultural regions.

The viticulture sector in Bosnia and Herzegovina is dominated by small vineyards, with areas ranging from 0.3 to 0.4 hectares, and a very small number of vineyards exceeding 10 hectares in a single plot. Small vineyards are mostly owned by family farms, and there is little data available on their exact number, as there is still no register of grape and wine producers (Banjanin et al. 2016). According to data from the Ministry of Foreign Trade and Economic Relations of Bosnia and Herzegovina (2018), the number of agricultural estates – grape producers who mainly produce wine – is estimated at around 11,000, the majority of which are small producers for their own consumption and the local market with fluctuating prices. Just over half, i.e. 55%, of the wines produced are white wines, while the remaining part are red wines, and only a very small amount is processed into rosé wines, which accounts for less than 1% (Vukojević et al. 2022). Although many old grape varieties have been abandoned in favour of internationally recognized varieties, an analysis shows that current wine production is primarily focused on high-quality wines made predominantly from native grape varieties such as *Žilavka* (white) and *Blatina* (red). These two varieties are particularly suitable for cultivation in the local climatic conditions and are deeply rooted in local tradition and cultural heritage (Vukojević et al. 2022). Other important indigenous grape varieties that are cultivated here include *Krkošija, Bena, Trnjak, Dobrogostina*, and *Mala Blatina*. The autochthonous Montenegrin majority variety *Vranac* is also very common on the territory of Herzegovina. In addition to these varieties, larger wine producers also produce wines from international grape varieties such as *Cabernet Sauvignon, Merlot, Syrah, Chardonnay, Pinot Blanc, Pinot Noir, Cabernet Franc*, and *Sauvignon Blanc*. The vineyard area in Bosnia and Herzegovina amounts to 4,873 hectares (Figure 1).

The vineyard areas in Bosnia and Herzegovina are commercial plantations. There is no winery that produces its grapes and wine according to the principles of organic farming. Bosnia and Herzegovina has favourable locations with satisfactory agro-ecological and land conditions for the expansion of vineyard areas. In the wine region of Herzegovina, there are an estimated to 20,000 hectares of potential vineyards, while the wine region of northern Bosnia has the potential for about 50,000 hectares of vineyards (Beljo et al. 2018), which is considered a good prerequisite for the expansion of the total vineyard area in Bosnia and Herzegovina.

Wine tourism has been an important part of the wine industry in an increasing number of countries and regions for decades in different ways. The sector is not only important for the local and regional economy, but also preserves heritage, landscape, history, tradition and culture (Oltean and Gabor 2022). Wine tourism could therefore be the key element for the sustainable development of wine regions worldwide.

Carlsen and Charters (2006) have found that the benefits of wine tourism extend beyond the wine cellar, to virtually all sectors of the regional economy, including the urban areas from which most wine tourists originate. Wine, food, tourism and art are the key elements of wine tourism and provide the lifestyle package that an increasing number of tourists aspire to and want to experience (Carlsen 2004). According to O'Neill and Palmer (2004), this form of tourism is recognized as one of the few tourism sectors that is truly concentrated outside of metropolitan areas and therefore plays an important role in regional tourism development, employment, business growth, and corporate investment. In fact, food and wine are often the primary reason for travelling to a particular region and are not necessarily a secondary activity of the visit, as some commentators suggest (Cava Jimenez et al. 2022). Wine tourism is a rapidly growing industry worldwide, attracting over 40 million travellers (Giacosa et al. 2019; Oltean and Gabor 2022). In recent decades, research interest has focused on the changes in consumer markets in which tourism plays significant role (Sun and

Drakeman 2022). Wine tourism, as one of the special interest tourisms, is often associated with relaxation, socialising with friends, and hospitality with travellers wanting to enjoy a diverse rather than monocultural environments (Carmichael 2005; Castillo-Canalejo et al. 2020; Oltean and Gabor 2022).

According to Hall et al. (2000) and Nedelcu et al. (2018), this form of tourism can be defined as tourism that includes visits to vineyards, wineries, wine exhibitions, and wine festivals, where the main motivation of tourists is to experience attractions in the wine-growing region and to consume different wines.

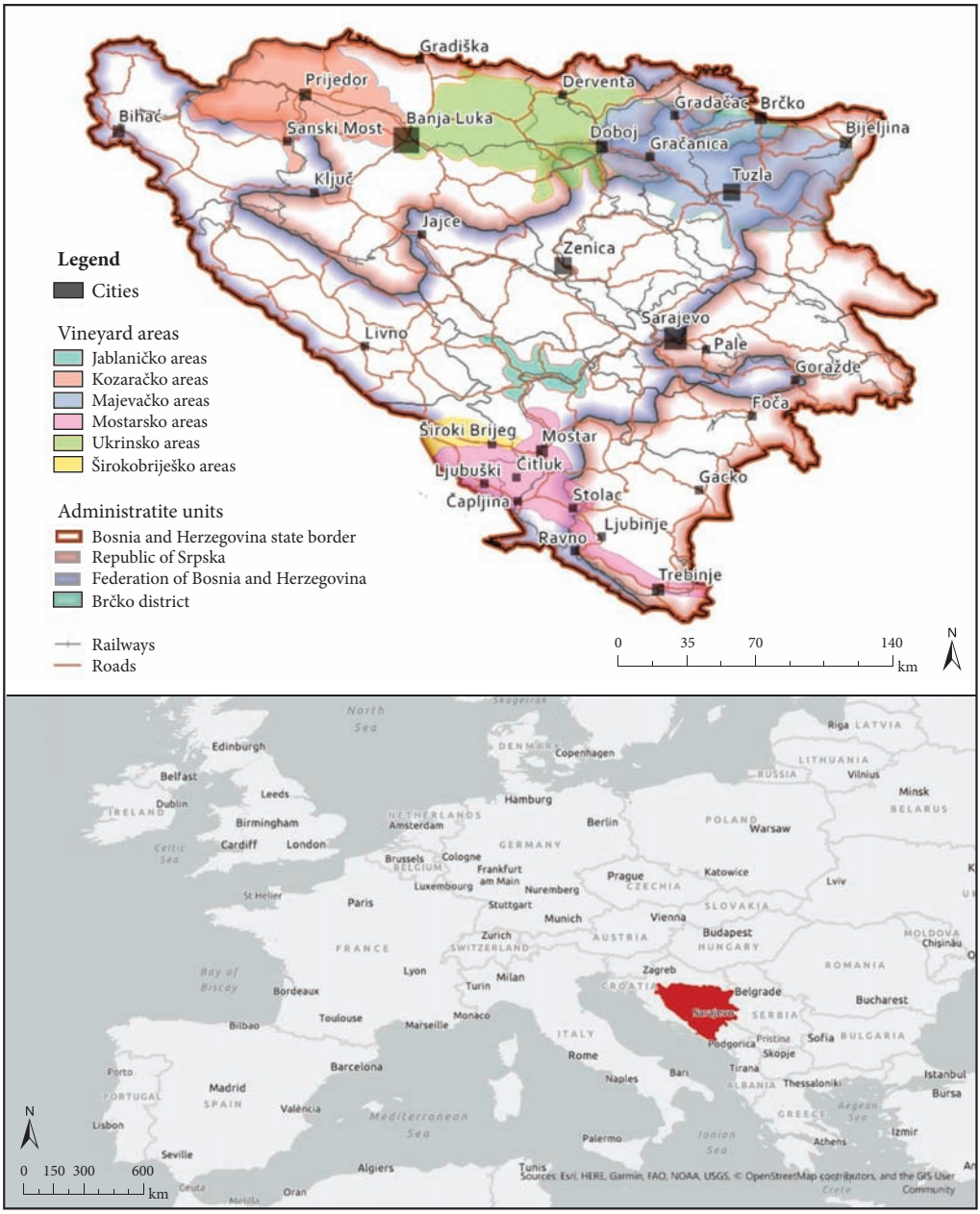

Figure 1: Vineyard areas of Bosnia and Herzegovina (Vukojević et al. 2022).

Wine is an agricultural product that is inherently linked to the rural environment, and wine tourism is closely linked to rural tourism. Wine tourism is most developed worldwide in the form of wine routes, which can be defined as a specific form of promotion agricultural, hospitality and tourism products in a wine region, where family farms together with other legal and natural persons offer their products (primarily wine and homemade brandy, but also other autochthonous products and specialities). On the other hand, as Kerma and Gačnik (2015) note, we can also see paradoxical examples of wine tourism in urban centres outside wine-growing areas.

Wine tourism offers an educational dimension that allows visitors to learn about different grape varieties, winemaking techniques, and the geographical, ethnographic and historical characteristics specific to a particular wine region (Vukojević and Pivac 2022). In addition, the growth of wine tourism plays an important role in positioning and promoting a particular tourist area, establishing its reputation, and creating a competitive advantage in the tourism industry (Hall et al. 2000).

The development of wine tourism enhances rural areas by creating new jobs and reducing migration to urban areas, as well as increasing profits for other traders and producers (Maksimović et al. 2021). Therefore, the involvement of agricultural producers and other stakeholders from rural communities in the development is of great importance given its multifaceted impact.

Participation in wine tourism is of great importance for producers, as it allows them to generate higher income through direct sales that enable immediate payment for their products. Family members are also employed in the off-season when labour in the vineyard and winery is minimal, helping to improve their livelihoods. They can also offer visitors additional services such as the sale of other agricultural products, accommodation, catering and more (Pivac et al. 2020).

Although Bosnia and Herzegovina can look back on a long tradition in viticulture and winemaking, only a few authors have analysed the status and potential for improvement in these sectors. This is all the more true if the context of wine tourism is also taken into account when reviewing the literature. In their study, Vukojević et al. (2021) argue that Bosnia and Herzegovina has considerable potential in both the catering and wine sectors, but the research results show that the country is not well presented abroad and the potential has therefore not yet been fully exploited.

Jalić et al. (2021) analysed the trade exchange of wine products between Bosnia and Herzegovina and the most frequent countries of destination, namely the countries of the former Yugoslavia (Serbia, Croatia, North Macedonia, Slovenia, and Montenegro). These countries account for 60–95% of total trade. The most significant import partner is Serbia with a share of 28.2%, while the largest export partner is Croatia with 52.3% of total exports from Bosnia and Herzegovina. In order to improve the competitiveness of this sector, the authors recommend the application of marketing approaches in production and distribution. They also emphasise that in addition to the production of quality wines, packaging, design, branding and wine names also contribute significantly to the competitiveness of the sector.

Hudelson (2014) analysed wine tourism in Bosnia and Herzegovina and concluded that this country has decisive advantages for its development, including favourable labour and production costs, natural beauty, and the region's ability to produce distinctive wines. The author concludes that most of the problems facing the sector can be solved with sufficient investment of time, money, expertise, and willingness.

Ivanković et al. (2012) analysed the economic feasibility of establishing vineyards on reclaimed land in Bosnia and Herzegovina. They identified suitable areas for reclamation, such as flat terrain and scrubland with sporadic forest vegetation. The authors emphasise that profitable production is achieved under the condition of expected yields and successful wine sales. They also conclude that the applied model is inefficient when it comes to the sale of bulk wine, which is often the case in Herzegovina.

Jahić (2016) analysed the state and prospects of wine tourism and wine routes in the Herzegovina-Neretva Canton and found that this part of Bosnia and Herzegovina has vineyards with an area of 977.8 hectares, with the most commonly cultivated grape varieties being *Žilavka* and *Blatina*. The author identified poor transportation connections between the vineyards, wine cellars and the main urban centres of the canton as a major obstacle to the further development of wine routes.

When it comes to predicting the further development of the sector, it is important to mention the research conducted by Trbić et al. (2021), which analyses the impact of climate change on grapevines in Bosnia and Herzegovina. The authors found that, in addition to the predominantly negative effects of climate change on agricultural production, positive effects on grapevines can also be expected due to a longer growing season as a result of higher temperatures. This can lead to higher yields and greater ripening potential as

heat storage is improved. The authors also predict the introduction of new grape varieties in the future, which are characteristic of regions with drier and warmer climates and therefore offer greater opportunities for the development of the sector.

The aim of this study is to examine and analyse the trends of viticulture and wine production in Bosnia and Herzegovina in terms of production capacities and market conditions during the observed period. The study also aims to analyse the current situation and explore opportunities for the development of wine tourism (in terms of expanding the existing tourist offer, the types of wine produced, development in the technical and technological sense) as an additional segment that can contribute to the better positioning of both sectors and the diversification of wine producers' income.

2 Material and methods

In order to determine the development trends in viticulture and winemaking in terms of production capacity and market conditions during the observed period, methods were used as primary analytical tools in addition to basic descriptive statistical indicators. Trend modelling using trend functions was carried out with Microsoft Excel.

The field research was conducted in a sample of 34 wineries (33 from the Republic of Srpska and one from the Brčko District), out of a total of 38 identified in this area. The data was collected using an electronic questionnaire in the period from August to October 2020. The structure of the questionnaire used can be divided into two parts. The first part of the questionnaire (approximately 57%) consisted of questions focussing on the production capacity of vineyards and wineries, the production structure, and the production results achieved. The second part of the questionnaire analysed the commitment to wine tourism and the structure of the tourism offer. Based on the data collected and the application of cluster analysis techniques (Kruzlicova et al. 2013; Stevanović et al. 2016; Birovljev et al. 2017; Stevanović et al. 2018; Zapryanova 2019; Svoboda et al. 2020), groups of wineries with similar characteristics were formed within each cluster. For each of the 34 observed objects, 26 different qualitative variables (categorical variables) were considered, resulting in an initial matrix of size 34 × 26. The hierarchical clustering method was used, which involves the calculation of similarity measures for all observation units and the subsequent formation of groups. The groups were formed using agglomerative techniques, with squared Euclidean distance serving as a measure of similarity. As these were qualitative variables, the correlation coefficient between the r-th and s-th rows of the matrix was calculated according to the formula (Kovačić 1994):

$$q_{rs} = \frac{\frac{f_{rs}}{K} - \left(\frac{p}{K}\right)^2}{\frac{p}{K}\left(1 - \frac{p}{K}\right)}$$

Where:
K – the number of artificial variables resulting from the sum of all modalities out of a total number of p variables used;
f_{rs} – the number of qualitative variables for which the observed two rows contain the same quality (pair 1-1), and the squared Euclidean distance was calculated using the following formula:

$$d_{rs}^2 = 2K(1 - q_{rs}) = 2K\left(\frac{p}{K} - \frac{f_{rs}}{K}\right) = 2(p - f_{rs})$$

The statistical software Statistica 12 was used for data analysis purposes.

3 Results and discussion

In accordance with the defined research objectives, the results of the research are presented in two parts. In the first part, the state of viticulture and winemaking in Bosnia and Herzegovina was analysed, while in the second part a cluster analysis was used to group the wineries according to commonalities in terms of wine tourism development.

3.1 The state of viticulture and the wine market in Bosnia and Herzegovina

Viticulture and winemaking in Bosnia and Herzegovina are underdeveloped and characterised by fragmentation and a large number of small agricultural producers. As such, they have a predominantly local or regional market character and contribute only weakly to both the country's own development and its high potential. Its international reputation is underdeveloped (Ivanković et al. 2018).

According to the International Organization of Vine and Wine (OIV) in 2021, Bosnia and Herzegovina had a vineyard area of 4,873 hectares, putting it in 62nd place in the world ranking. The countries with the largest vineyard area are Spain with 1,123,644 hectares, followed by China (797,935 ha), France (752,837 ha), Italy (675,818 ha), and Turkey (417,041 ha) (Yüzbaşioğlu 2021).

In the period from 2001 to 2020, the average vineyard area in Bosnia and Herzegovina was 4,904.75 hectares, while the average yield in the same period was 5,540.13 kg/ha (Figure 2).

Vineyard area did not vary significantly in the period mentioned, as the coefficient of variation of 13.30% shows. The development trend of vineyard area is defined by a polynomial equation (fourth-degree polynomial) which accounts for approximately 60% of the total variation ($R^2 = 0.6056$). Grape yields showed a slightly higher coefficient of variation (33.94%), and the increase in vineyard area can be defined by a polynomial equation (second-degree polynomial) with a high coefficient of determination ($R^2 = 0.9224$). In contrast to the vineyard area, which showed no growth in the second half of the period, but rather the opposite, grape yields increased with occasional fluctuations from 2010 onwards. Some of the possible reasons for this are a more efficient implementation of agrotechnical measures and the introduction of more productive grape varieties in the production process. In addition to the factors mentioned above, grape yield is significantly influenced by inter-row and intra-row spacing in newly established vineyards coming into production, harvest conditions, grape variety, age of grapevines, climatic conditions, and more (Jones et al. 2005; Risco et al. 2014; Irimia et al. 2018; Perria et al. 2022). Based on the predicted values of the trend line and the most recent yield values in the last years of the observation period, it is realistic to expect yields of over 8 tons per hectare in the next period.

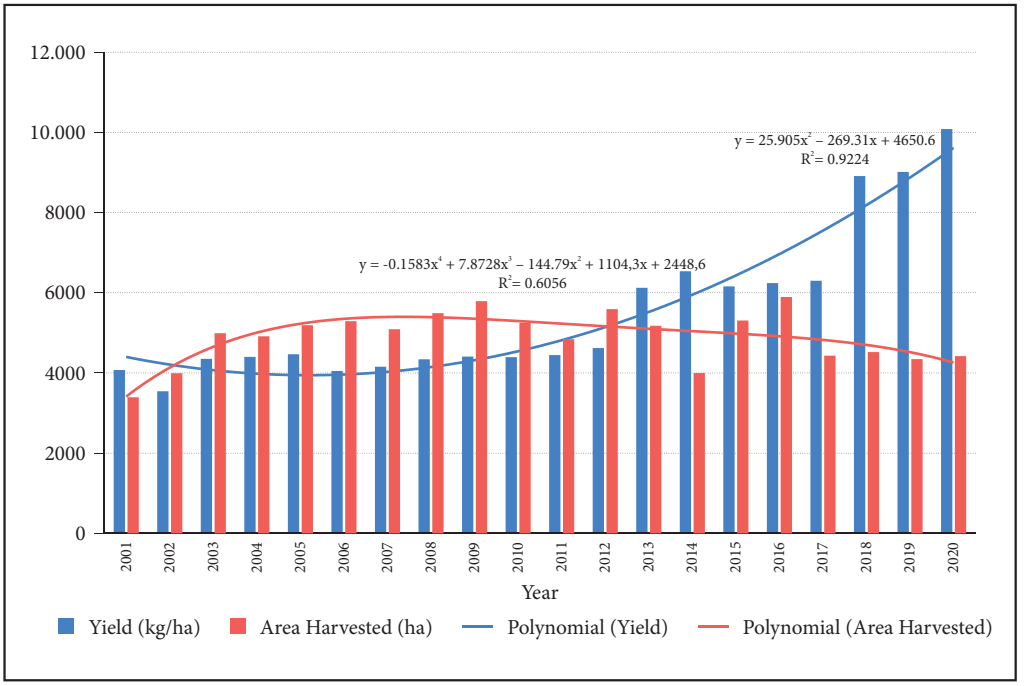

Figure 2: Vineyard areas and grape yields in Bosnia and Herzegovina 2001–2020 (provided by FAOSTAT).

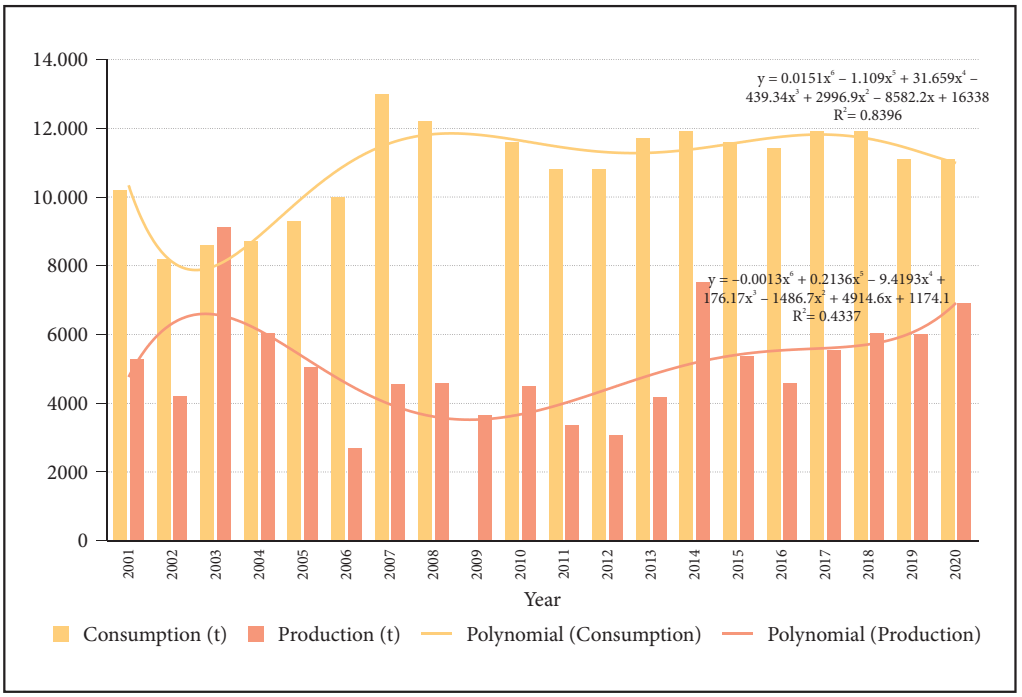

Figure 3: Production and consumption of wine in Bosnia and Herzegovina 2001–2020 (provided by FAOSTAT, OIV).

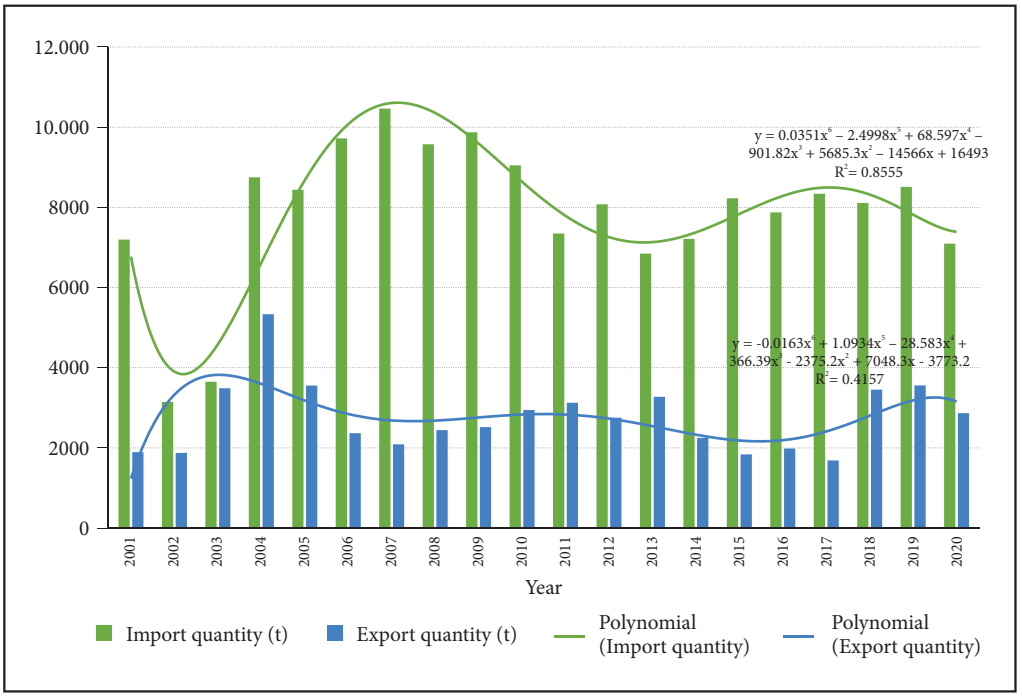

Figure 4: Wine export and import volumes, Bosnia and Herzegovina (2001–2020) (provided by FAOSTAT).

According to the Food and Agriculture Organization (FAO), wine production in Bosnia and Herzegovina fluctuated from year to year during the past twenty-year period (2001–2020), reaching an average of 5,112.62 tons with a coefficient of variation of 30.51% (Figure 3).

The lowest production in this period was recorded in 2006 with a volume of 2,695 tons, while the year with the highest production volume was 2003 with 9,125 tons. Due to the frequent fluctuations in production volumes during the observed period, the trend function (6th-degree polynomial) has a relatively low coefficient of determination ($R^2 = 0.4337$) which makes it difficult to make accurate predictions for wine production in the coming period.

In the same period, wine consumption in Bosnia and Herzegovina was twice as high as production, averaging 10,890 tons, according to data from the OIV. Wine consumption showed less fluctuation, as evidenced by the coefficient of variation of 12.13%. The trend function that best describes the development trend is a sixth-degree polynomial which explains about 84% of the total variations.

From the available consumption data, it can be concluded that the wine market is relatively small. For comparison, wine consumption in Bosnia and Herzegovina in 2020 accounted for only 0.48% of total wine consumption in France, 0.46% in Italy and 0.56% in Germany, which are among the largest wine consumers on the European continent. Although the wine sector can be considered relatively small, it is important for western and southern parts of Herzegovina due to its geographical distribution in several municipalities and cities of the country (Goncharuk and Figurek 2017).

The average amount of imported wine in the mentioned period (2001–2020) was 7,879.46 tons, while the average export was 2,771.04 tons (Figure 4).

The coefficient of variation for wine imports was 23.17%, while the trend function that best describes the development trend is a sixth-degree polynomial which accounts for approximately 86% of the total variation ($R^2 = 0.8555$). Wine exports showed a higher variability (CV = 31.53%), and the trend function explains only 41.57% of the total variations, making it difficult to project future values.

The fact that wine consumption is twice as high as production, with an average import-export coverage of about 35.17%, and that approximately 54.2% of the volume of wine produced is exported, is a positive signal for domestic wine producers to increase production volumes without significant risks in terms of product placement.

Another important factor for the increase in wine production and the development of wine tourism is the fact that the neighbouring countries Croatia and Slovenia have a significantly higher per capita wine consumption, and tourists from these countries like to visit Bosnia and Herzegovina. According to the data from OIV (2021), the per capita consumption of wine in Slovenia is 37.3 litres, in Croatia 25.8 litres, in North Macedonia is 15.0 litres and in Serbia 13.3 litres, which is nine, six and three times higher, respectively, than in Bosnia and Herzegovina, where the average per capita consumption is 4 litres. It is important to mention that the potential for prosperity on the international tourism market requires a precise definition of the tourism product and a well-structured tourist destination that is compatible with international standards and adequately supported by marketing measures (Tasić 2018).

Since wine tourism is multidimensional by nature, it is necessary to recognise and connect all involved stakeholders such as farms, wineries, tourist destinations, private and public enterprises and associations, environmental NGOs, protected areas management, cultural heritage institutions, government and local self-government units through clustering and involve them in marketing planning and the process of developing a wine tourism destination (Popović and Živanović-Miljković 2012).

Various wine-related events can contribute to the attractiveness and quality of wine tourism. In this regard, it is important to strive to improve existing events of this type and promote them appropriately, as well as organise new events in the coming period.

3.2 Cluster analysis of production and tourism capacities of the selected wine cellars

The field research on the production and tourism potentials of wine cellars was conducted by analysing wineries on the territory of the Republic of Srpska, one of the entities of Bosnia and Herzegovina, and the Brčko District. The individual differences between these wineries, both in terms of production capacities and the structure of the tourist offer, make it a challenge to classify them into a smaller number of groups due to the numerous criteria variables taken into account. Therefore, cluster analysis was applied to identify homogeneous groups of wineries, taking into account a large number of criteria for their comparison, as shown in the Table 1.

By applying cluster analysis and identifying homogeneous groups, it is possible to gain a clearer understanding of the existing differences between them and to recognise the limitations and shortcomings of members belonging to specific groups. The following dendrogram illustrates the linking of wine cellars into groups.

The distances between the individual groups were determined using the Complete Linkage method. There are no standard procedures for determining the optimal number of clusters that guarantee optimal results. The distance between the groups being merged in each step is a useful indicator. It allows the number of

Table 1: The structure of the variables used for the cluster analysis.

Question	Variable type	Number of possible answers
Q1: Legal form of the winery	categorical variables	4
Q2: Employment of trained workers (oenologists and agronomists)	categorical variables	2
Q3: Previous experience in the wine industry	categorical variables	3
Q4: Planned capacity expansion	categorical variables	2
Q5: Method of wine sales	categorical variables	3
Q6: Training needs for wine tourism (different seminars)	categorical variables	2
Q7: Equipped tasting rooms – facilities	categorical variables	2
Q8: Accommodation services	categorical variables	2
Q9: Inclusion in tourism packages	categorical variables	2
Q10: Visitor structure	categorical variables	2
Q11–Q16: Accessibility and availability of tourism services	categorical variables	2
Q17–Q26: Methods of winery promotion	categorical variables	2

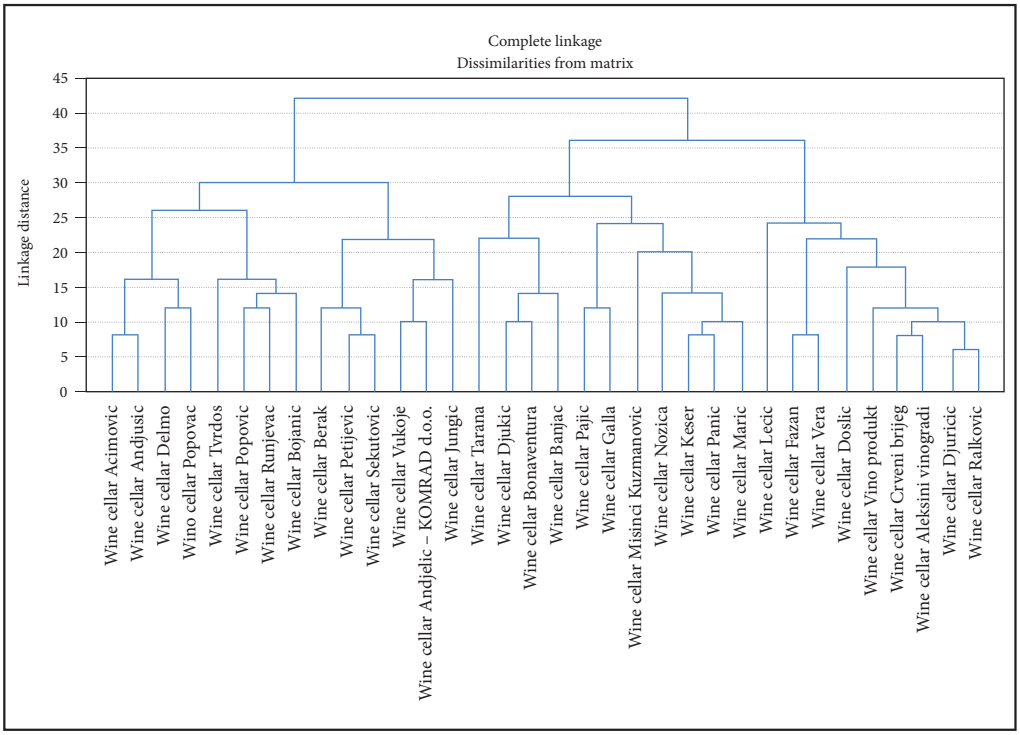

Figure 5: Dendrogram of the linking of wine cellars into groups.

groups to be adjusted by observing the step when the aggregation distance exceeds a certain threshold (Gatti et al. 2002) or when it suddenly increases its value compared to the existing trend, as is the case in this study. Figure 5 shows that the linkage distance jumps from a value of 30 to 36 in the 32nd step. Therefore, the merging process was stopped at this step.

Based on the information provided, three clusters were determined as the optimal number, the structure of which is shown in Table 2.

It can be seen that the most extensive cluster is Cluster 1, which comprises 41.18% of the wineries. This is followed by Cluster 2 with 32.35%, while the smallest cluster is Cluster 3 with 9 wineries (26.47%).

Regarding the variables used, Cluster 1 has a perfect or almost perfect homogeneous structure. For example, more than 3/4 of the wineries (78.57%) belonging to this cluster have an annual wine production of

Table 2: Structure of the obtained clusters.

The name of the wine cellar	Cluster 1		Cluster 2		Cluster 3	
	Aćimović	Bojanić	Tarana	Kuzmanović	Lečić	Crveni Brijeg
	Anđušić	Berak	Đukić	Nožica	Fazan	Alexa's vineyards
	Đelmo	Petijević	Bonaventura	Keser	Vera	Đuričić
	Popovac	Sekulović	Banjac	Panić	Dostić	Ratković
	Tvrdoš	Vukoje	Pajić	Marić	Vino produkt	_____
	Popović	Andjelić	Gala	_____	_____	_____
	Runjevac	Jungić	_____	_____	_____	_____

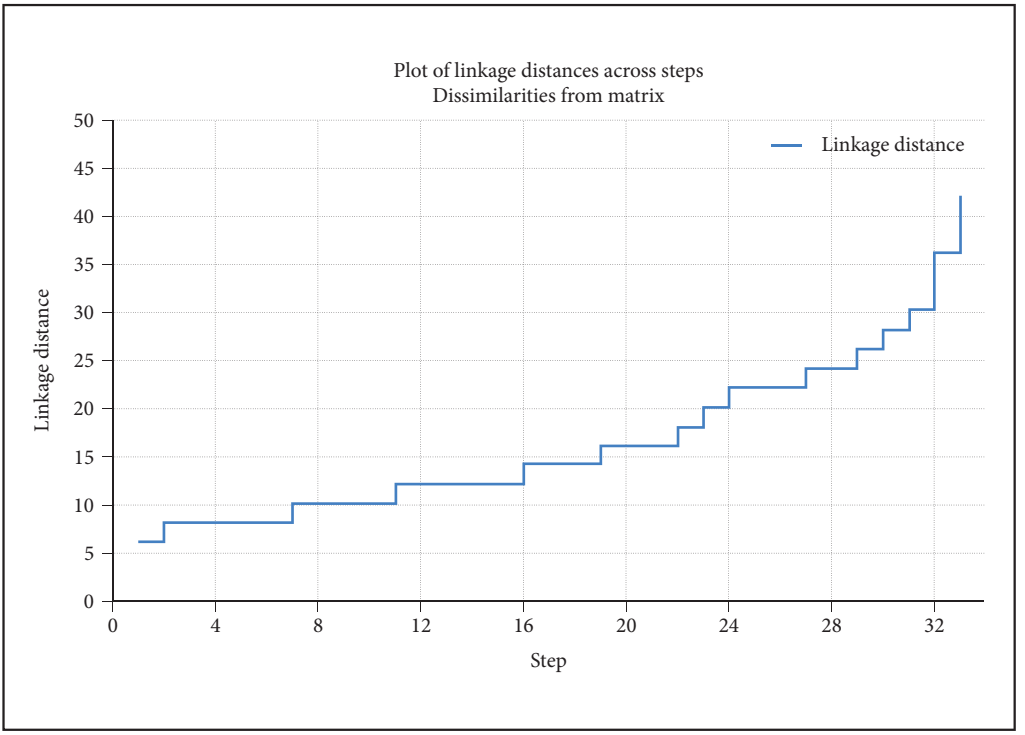

Figure 6: Plot of the linkage distances over steps.

more than 15,000 litres and at least 1 ha of vineyards (85.71%). Most of the wineries in the first cluster (85.71%) belong to the eastern part of Herzegovina region (south of the Republic of Srpska). All owners of wineries belonging to the first cluster are trained in wine tourism (through various seminars organised by local and state institutions and international organizations) and have vineyards and wineries open for visits (100%). In addition, all wineries belonging to this cluster promote their products and services and are open for tastings and sales, while 92.86% of them have a tasting room (Table 3). In terms of promotion methods, 92.86% of the wineries belonging to this cluster use internet presentations (own websites and other types of internet presentations), TV and radio advertising for promotion and participate in various wine fairs.

In addition, more than 3/4 of the wineries in Cluster 2 (90,91%) are involved in some of the various tourism arrangements and produce their own brochures as one of the advertising methods of promotion. In Cluster 2, 81.82% of wineries have a smaller annual wine production of 30,000 litres, while 63.64% of the wineries have a smaller production of 15,000 litres. Cluster 2 also shows a homogeneous structure for certain variables. In terms of visitor structure, 90.91% of wineries are visited by domestic tourists, and the same percentage of wineries are open for visits and tastings and use available methods to promote their services, including participation in fairs. All wineries have a tasting room, but none of them offer accommodation

Table 3: Characteristics of production and tourism in the clusters obtained.

Indicator	Relative participation (%)		
	Cluster 1	Cluster 2	Cluster 3
Vineyard area (<1 ha)	14.29	27.27	33.33
Vineyard area (1–3 ha)	50.00	54.55	44.44
Vineyard area (>3 ha)	35.71	18.18	22.23
Annual wine production (<15,000 l)	21.43	63.64	77.78
Annual wine production (15,000–30,000 l)	28.57	18.18	0.00
Annual wine production (>30,000 l)	50.00	18.18	22.22
Legal form (limited liability company – LLC)	64.29	27.27	33.33
Legal form (family farm)	35.71	18.18	55.56
Legal form (sole proprietorship and cooperative)	0.00	54.55	11.11
Employed trained staff (oenologists and agronomists)	50.00	45.45	66.67
Experience in the domestic wine industry	14.29	27.27	0.00
Professional experience in the foreign wine industry	14.29	0.00	44.44
No previous experience in the wine industry	71.42	72.73	55.56
Type of wine sales (direct)	42.86	81.82	55.56
Type of wine sales (direct + distributor)	57.14	18.18	44.44
Training for wine tourism activities	100.00	27.27	44.44
Availability of tasting rooms	92.86	100.00	22.22
Inclusion in tourist packages	78.57	18.18	0.00
Visitor structure (domestic visitors)	50.00	90.91	88.89
Openness to guided tours	100.00	90.91	11.11
Openness to tastings and sales	100.00	90.91	11.11
Sale of other products	71.43	9.09	11.11
Hospitality services	42.86	45.45	0.00
Meetings, weddings, and similar events	50.00	18.18	0.00
Accommodation and lodging services	35.71	0.00	11.11
Wine cellars without service promotion	0.00	9.09	0.00
Participation in (trade) fairs/exhibitions	92.86	90.91	66.67
Promotion through self-produced brochures	78.57	63.64	22.22
Brochures from tourism organizations	64.29	18.18	11.11
Promotion via email	21.43	9.09	0.00
Internet presentations	92.86	36.36	33.33
Information boards	50.00	9.09	11.11
Wine magazines	71.43	9.09	22.22
TV and radio advertising	92.86	18.18	22.22
Other advertising methods	7.14	27.27	0.00

services or have experience in the foreign wine industry. The most common sales method of the wineries in this cluster is direct wine sales (81.82%). About 3/4 of the wineries belonging to Cluster 2 (72.73%) are located in the northern part of the Republic of Srpska. More than 3/4 of the wineries in Cluster 3 (77.78%) have an annual wine production of less than 15,000 litres. All members of this cluster state that they promote their products and services by available means, mainly by participating in fairs (2/3 of the total), while they are usually not open for visits, tastings and sales. They do not offer accommodation services, do not sell other goods and have a small number of informative signs (11.11%). In this cluster, there are no wineries with experience in the domestic wine industry, nor do they provide hospitality services, organization of meeting, weddings and similar services.

From the data presented, it can be concluded that the most frequent producers in Cluster 1 have larger production capacities, while the opposite is true for Cluster 3. Cluster 1 differs significantly from the others, as 71.43% of wineries also sell other goods on their premises. The members of Cluster 1 are also distinguished by a high-quality and comprehensive tourist product as well as various methods of promoting it. The fact that all members of Cluster 1 are trained in wine tourism certainly contributes to this. In contrast, the members of Cluster 2 are characterised by the fact that they are mainly involved in direct wine sales without selling other goods. The promotion of products and services is not particularly pronounced. They rely mainly on wine fairs for promotion, occasionally accompanied by their own brochures, while advertising through wine magazines, informative signs, email, TV and radio is less common. Apart from the characteristics already mentioned, Cluster 3 is characterised by the fact that they mainly sell wine to domestic visitors without offering other goods or additional tourist services. It is often wholesale or bulk wine sales, which means that value maximization is not achieved by bottling and marketing the final product on the domestic and foreign markets. About 2/3 of the members of Cluster 3 are individuals, who are usually registered as family agricultural households for viticulture and wine production.

4 Conclusion

Despite favourable locations with satisfactory agro-ecological and land conditions, the vineyard area in Bosnia and Herzegovina has not increased significantly in the twenty-year period observed. It fluctuated around an average of 4,904.75 hectares. The negative trends in the viticulture and winemaking sector have causes that can be found in the entire production, processing, and wine marketing chain.

The wine market in Bosnia and Herzegovina is characterised by consumption that is twice as high as production and is less than 0.5% of wine consumption in France and Italy, the largest European consumers. The average coverage of imports by exports is 35.17%.

The products imported into the domestic market receive considerably more support in exporting countries, which creates additional competitive pressure. In addition, the sector's competitiveness in foreign markets is hampered by numerous non-tariff protection mechanisms such as regulations on quality and food and safety in the environment.

The application of cluster analysis allowed for a detailed analysis of the state of both production capacity and wine tourism in the studied area, which is a key prerequisite for its further improvement. The results indicate the existence of heterogeneous production systems, in particular three different groups of wine producers that differ significantly from each other. Given the different structure of wineries in terms of production and tourism capacities, the possibility of diversifying agricultural and rural policy measures must be examined in order to contribute to a more intensive development of viticulture and winemaking and ultimately to achieve a higher level of competitiveness. A diversification of measures to improve the situation in the wine tourism sector would also encourage the development of the tourist offer for each wine producer.

Producers registered as family agricultural households (mostly Cluster 3) have limited sources of support. As individuals, they are often unable to apply for funding from European and other development programmes for viticulture, wine tourism and the improvement of rural tourism. They are mostly dependent on the support of state and local institutions for vineyard production, which in combination with their own resources is not sufficient to increase competitiveness. This key limiting factor needs to be addressed through additional local and state support. For producers belonging to Cluster 2, it is necessary to organise educational (training) activities on wine tourism and activate additional promotional activities and offer

more complex products and services through supportive measures. Within each of the mentioned clusters, there are opportunities to improve the existing level of production and tourism capacities. However, the greatest impact is possible if the restrictions mentioned for Cluster 1 are lifted.

Factors limiting the research are the narrowing of the research focus to only one entity in Bosnia and Herzegovina (together with Brčko District) when it comes to cluster analysis on the state of wine tourism. Therefore, it would be desirable to include the wineries of another entity in Bosnia and Herzegovina (the Federation of Bosnia and Herzegovina) in further research in order to get a clearer and comprehensive picture of wine tourism at the state level and the possibilities of improving its development.

5 References

Banjanin, T., Berjan, S., Milić, V., El Bilali, H. 2016: State of and conditions for viticulture development in Bosnia and Herzegovina. *Agro-knowledge Journal* 17-3. https://doi.org/10.7251/AGREN1603279B

Beljo, J., Bašić, Ž., Blesić, M., Dragić, B., Ivanković, M., Jovanović-Cvetković, T., Leko, M. et al. 2018: 130 years of organized viticulture and winemaking in Bosnia and Herzegovina. *Report.* Federal Agro-Mediterranean Institute, Mostar and Faculty of Agriculture and Food Technology, University of Mostar.

Birovljev, J., Đokić, D., Matkovski, B., Kleut, Ž. 2017: Economic performances of agriculture of CEFTA and former CEFTA countries. *Economics of Agriculture* 64-4. https://doi.org/10.5937/ekoPolj1704413B

Carlsen, J., Charters, S. (eds.) 2006: Global wine tourism: Research, management and marketing. CABI. https://doi.org/10.1079/9781845931704.0000

Carlsen, P. J. 2004: A review of global wine tourism research. *Journal of Wine Research* 15-1. https://doi.org/10.1080/0957126042000300281

Carmichael, B. 2005: Understanding the wine tourism experience for winery visitors in the Niagara region, Ontario, Canada. *Tourism Geographies* 7-2. https://doi.org/10.1080/14616680500072414

Castillo-Canalejo, A. M., Sánchez-Cañizares, S. M., Santos-Roldán, L., Muñoz-Fernández, G. A. 2020: Food markets: A motivation-based segmentation of tourists. *International Journal of Environmental Research and Public Health* 17. https://doi.org/10.3390/ijerph17072312

Cava Jimenez, J. A., de la Torre, M. G. M. V., Millán, M. G. D. 2022: Enotourism in southern Spain: The Montilla-Moriles PDO. *International Journal of Environmental Research and Public Health* 19. https://doi.org/10.3390/ijerph19063393

Gatti, S., Incerti, F., Ravagli, M. 2002: Wine and tourism: New perspectives for vineyard areas in Emilia-Romagna. *Cahiers d'Economie et de Sociologie Rurales* 62. https://doi.org/10.22004/ag.econ.206122

Giacosa, E., Rossi, M., Festa, G., Ferraris, A. 2019: Wine and the »spirit« of the territory: The Langhe case as a successful wine tourism destination »system«. *Tourism Analysis* 24-3. http://dx.doi.org/10.3727/108354219X15511864843821

Goncharuk, A., Figurek, A. 2017: Efficiency of winemaking in developing countries: Evidence from the Ukraine and Bosnia and Herzegovina. *International Journal of Wine Business Research* 29-1. https://doi.org/10.1108/IJWBR-02-2016-0007

Hall, M., Sharples, L., Combourne, B., Macionis, N. 2000: Wine tourism: An introduction. In: Wine Tourism Around the World: Development, Management and Markets. Butterworth Heinemann.

Hudelson, J. 2014: Sustainable mountain tourism: An analysis of Bosnia-Herzegovina's wine tourism and its future. In: 4th International Conference on Tourism Research (4ICTR). https://doi.org/10.1051/shsconf/20141201020

Irimia, L. M., Patriche, C. V., Murariu, O. C. 2018. The impact of climate change on viticultural potential and wine grape varieties of a temperate wine growing region. *Applied Ecology & Environmental Research* 16-3. http://doi.org/10.15666/aeer/1603_26632680

Ivanković, M., Beljo, J., Prusina, T. 2018: The economic and social role of viticulture and winemaking in Bosnia and Herzegovina. In: 130 Years of Organized Viticulture and Winemaking in Bosnia and Herzegovina. Federal Agro-Mediterranean Institute Mostar, Faculty of Agriculture and Food Technology, University of Mostar.

Ivanković, M., Vaško, Ž., Figurek, A., Lasić, M., Leko, M. 2012: Ocjena isplativosti investicija – podizanje vinograda na rekultiviranim tlima Hercegovine. *Agro-knowledge journal* 13-3. https://doi.org/10.7251/AGRSR1203449I

Jahić, H. 2016: Wine tourism and wine roads in Herzegovina-Neretva Canton – situation and prospects. *Acta geographica Bosniae et Herzegovinae* 6.

Jalić, N., Ostojić, A., Ivanković, M. 2021: Advantage and competitiveness of Bosnia and Herzegovina's wine foreign trade. *Agro-Knowledge Journal/Agroznanje* 22-1. https://doi.org/10.7251/AGREN2201001J

Jones, G. V., White, M. A., Cooper, O. R., Storchmann, K. 2005: Climate change and global wine quality. *Climatic Change* 73. https://doi.org/10.1007/s10584-005-4704-2

Kerma, S., Gačnik, A. 2015: Wine tourism as an opportunity for tourism development: Examples of good practice in Slovenia. *Journal of International Food & Agribusiness Marketing* 27-4. https://doi.org/10.1080/08974438.2014.940122

Kovačić, Z. 1994: Multivariate analysis. Faculty of Economics, University of Belgrade.

Kruzlicova, D., Fiket, Ž., Kniewald, G. 2013: Classification of Croatian wine varieties using multivariate analysis of data obtained by high resolution ICP-MS analysis. *Food Research International* 54-1. https://doi.org/10.1016/j.foodres.2013.07.053

Maksimović, M., Pivac, T., Đorđević, J. 2021: History of wine tourism in Serbia. *Turizam* 25-4. https://doi.org/10.5937/turizam25-34174

Nedelcu, A., Privitera, D., Ivona, A., Ganusceac, A. 2018: Wine tourism as a vector of local and regional development: Case study Prahova County. In 3rd International Thematic Monograph – Thematic Proceedings: Modern Management Tools and Economy of Tourism Sector in Present Era. Association of Economists and Managers of the Balkans. https://doi.org/10.31410/tmt.2018.341

Nurković, R. 2017: Geographical distribution of the vineyards and wine production in rural areas of Bosnia and Herzegovina. *Folia Geographica* 59-2.

O'Neill, M. A., Palmer, A. 2004: Wine production and tourism: Adding service to a perfect partnership. *Cornell Hotel and Restaurant Administration Quarterly* 45-3. https://doi.org/10.1177/0010880404263075

Oltean, F. D., Gabor, M. R. 2022: Wine tourism – A sustainable management tool for rural development and vineyards: Cross-cultural analysis of the consumer profile from Romania and Moldova. *Agriculture* 12-10. https://doi.org/10.3390/agriculture12101614

Perria, R., Ciofini, A., Petrucci, W. A., D'Arcangelo, M. E. M., Valentini, P., Storchi, P., Carella, G., Pacetti, A., Mugnai, L. 2022: A study on the efficiency of sustainable wine grape vineyard management strategies. *Agronomy* 12-2. https://doi.org/10.3390/agronomy12020392

Pivac, T. Maksimović, M., Blešić, I. 2020: The importance of digital marketing for wineries and development of wine tourism: Case study of Serbia. In: 5th International Thematic Monograph – Modern Management Tools and Economy of Tourism Sector in Present Area. Association of Economists and Managers of the Balkans. https://doi.org/10.31410/tmt.2020.241

Popović, V., Živanović Miljković, J. 2012: Wine tourism and sustainable rural development in the Danube Basin area in Serbia. In: International Scientific Meeting Sustainable Agriculture and Rural Development in Terms of the Republic of Serbia Strategic Goals Realization Within the Danube Region. Institute of Agricultural Economics.

Risco, D., Pérez, D., Yeves, A., Castel, J. R., Intrigliolo, D. S. 2014: Early defoliation in a temperate warm and semi-arid Tempranillo vineyard: Vine performance and grape composition. *Australian Journal of Grape and Wine Research* 20-1. https://doi.org/10.1111/ajgw.12049

Stevanović, S., Milanović, M. R., Dimitrijević, B. 2016: Regional characteristics of market production of sugar beet and sunflower in Serbia. *Marketing* 47-2. https://doi.org/10.5937/markt1602137S

Stevanović, S., Stevanović, S., Janković-Šoja, S. 2018: Regional characteristics of market production of fruit and grapes in Serbia. *Economics of Agriculture* 65-1. https://doi.org/10.5937/ekoPolj1801201S

Sun, Y. Y., Drakeman, D. 2022: The double-edged sword of wine tourism: The economic and environmental impacts of wine tourism in Australia. *Journal of Sustainable Tourism* 30-4. https://doi.org/10.1080/09669582.2021.1903018

Svoboda, J., Lososová, J., Zdenek, R. 2020: Analysis of costs and their effectiveness in the EU agrarian sector. *Custos Agronegocio Line* 16.

Tasić, J. 2018: Future trends and directions of development of rural tourism in Serbia and the world. *Auditor* 4-3. https://doi.org/10.5937/Oditor1803007T

Trbić, G., Djurdjević, V. I., Mandić, M. V., Ivanisević, M., Cupac, R., Bajić, D., Zahirović, E. et al. 2021: The impact of climate change on grapevines in Bosnia and Herzegovina. *Euro-Mediterranean Journal for Environmental Integration* 6. https://doi.org/10.1007/s41207-020-00206-7

Vukojević, D., Berjan, S., El Bilal, H., Čarkadžić, J. 2021: State and perspectives of gastronomic tourism in Bosnia and Herzegovina: Case of Herzegovina region. *Turizam* 25-4. https://doi.org/10.5937/turizam25-29591

Vukojević, D., Pivac, T. 2022: Izazovi i šanse za razvoj vinskog turizma u Trebinju. In: Turizam u savremenom evropskom i evroazijskom prostoru-stanje, problemi, izazovi, perspektive: Zbornik radova sa međunarodne naučne konferencije. Visoka škola za turizam i hotelijerstvo.

Vukojević, D., Tomić, N., Marković, N., Mašić, B., Banjanin, T., Bodiroga, R., Đorđević, T., Marjanović, M. 2022: Exploring wineries and wine tourism potential in the Republic of Srpska, an emerging wine region of Bosnia and Herzegovina. *Sustainability* 14-5. https://doi.org/10.3390/su14052485

Yüzbaşioğlu, R. 2021: An econometric analysis of table grape in Turkey. *Custos e Agronegocio* 17-2.

Zapryanova, I. 2019: Evaluation of some effectiveness elements of the pig breeding industry in Bulgaria, through cluster analysis. *Biotechnology in Animal Husbandry* 35-1. https://doi.org/10.2298/BAH1901025Z