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SELECTING THE PROPER WHITE WINE VARIETIES ACCORIDNG TO MULTIPLE-CRITERIA DECISION ANALYSIS: CASE STUDY SERBIA

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Abstract

Viticulture and winemaking are two interconnected lines of agri-food sector that over the centuries had, currently have and will have significant importance in human nutrition. Mainly pushed by requirements from the global market, trends in wine production represent a relatively changeable category. Nowadays, within the overall structure of vineyards, or further produced wines, such a small share has been taking by autochthonous (local) grapevine varieties, that usually act as rising stars at many of regional markets. Full utilization of their natural attributes and production capacities could induce growth and sustainability in certain local and even regional viticultural sectors. As mentioned above, the main goal of the paper is to assess through the multicriteria decision-making analysis (appliance of DiWeC and MABAC methods) what could be the best fitted alternative (there were confronted local versus commercial white wine varieties) for vineyard establishment, enlargement or replacement according to experts' opinions analysis. Derived results underline the criteria with decisive importance, while make the ranking of preselected white wine varieties, showing that commercial varieties (primarily Sauvignon Blanc and Chardonnay) still play crucial role in establishment of modern vineyards in Serbia and wider region.

Key words**:** *white wine varieties, MCDA, DiWeC & MABAC methods, Serbia*

INTRODUCTION

Globally, grape growing and winemaking are two significantly important activities within the sector of agriculture [69]. From ancient times, several civilizations have been considered the wine as drink (nectar) of Gods [12; 49], although nowadays it has still having very important role in many religious events of various religions [20; 21].

Someone can say that in line to current trends linked to viticulture (Table 1), wine could be observed as a drink of future. According the value of produced output, grapes are still ranked as one of the top horticultural crops worldwide [1].

Table 1. Global trends in viticulture and wine production production

Year/ Element	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average
Viticulture / grape production at global level											
Areas (000 ha)	7,027	7,024	7,108	6,900	6,835	6,875	6,909	6,919	6,882	6,730	6,921
Yield (t/ha)	10.9	10.5	10.8	10.8	10.8	11.6	11.2	11.1	11.2	11.1	11.0
Quantity (000 t)	76,508	73,906	76,594	74,517	73,601	80,097	77,055	76,828	76,751	74,943	76,080
Value (mld USD)	68.26	71.75	64.46	64.51	69.10	73.66	75.20	83.34	86.02	85.13	74.14
Wine production at global level											
Quantity (000 t)	28,907	28,268	28,689	27,652	25,410	29,460	26,931	27,073	26,871	-	27,696

Source: [18].

Having in mind that over 70% of grapes are processed into wine, while less than 30% is consumed as fresh or dried fruit [11]. Grapes could be grown in any country worldwide, except in polar and extremely cold climate. It could be grown even in greenhouses [8]. It grows the best in areas with temperate climate [29], while it is commercially grown in over than 80 countries [53].

Territorially, winemaking usually follows the grape growing areas [66]. In recent years, the wine industry, or rather the wine market has experienced a steady but constant growth in revenues (Table 2).

Table 2. Growth of wine industry revenues at global level (in mld. USD)

Year	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Total revenues	286.0	303.6	315.1	330.1	339.1	347.7	356.6	266.0	371.5	378.4

Source: [58].

According to some projections, it is expected that its overall growth during one decade could be over 32% (observed period 2020-2029.). The observed rise in revenues is mainly not the subject of growth in volume of produced grape, or wine, while it corresponds to certain changes in demand for wines at global market. Generally, demand structure moves to wines of better quality, as well as to some countries with growing economies that have experienced rise in middle class while previously they were not usual wine consumers (they are experiencing the certain changes in nutrition and life habits), [6; 37; 32].

In last 30 years, consumption of wine has been experienced significant growth in Asia, north of the Europe, USA and Canada, while simultaneously there has come to dramatic decrease at the south part of the Europe that was well-known as former wine consuming region [44]. Good example of mentioned could be France. Wine consumption per capita there was decreased for even three times during the period of between the WWs and nowadays (from 136 l/capita in 1926 to 40 l/capita in 2020), [57]. As top wine producers have still stayed the same (Spain, France, and Italy), [48], there come to intensification of wine export to certain rapidly growing wine markets, primarily China [19].

There are several wine grapevine varieties that rule the world for many decades, such are Cabernet Sauvignon and Franc, Merlot, Tempranillo, Chardonnay, Syrah, Sauvignon Blanc, Pinot Noir, Sangiovese, Riesling, etc. [2].

In recent couple decades, no matter to type of wine, there has happened certain segmentations of wine production and consumption at global level. Wines are extremely pronounced grouped into the cheap and expensive [10], or premium and less quality wines [9], branded or those that brings the cult of small domestic wineries [67], organic than conventionally produced wines [61], globally well-known (commercial) contrary to local (autochthonous) wines [26], etc. As a part of marketing strategy, performed wine segmentation is rather complex issue, usually involving few elements at specific moment in shaping final decision of wine producer/seller.

What is happening in Serbian viticulture and wine production sector? Briefly, in previous decade there has come to slight decrease in areas under the vineyards (Table 3), while in observed period started certain trend as the clearing of old and establishment of new, small but intensive vineyards (followed by adequate family wineries), that implies implementation of contemporary growing technology, mechanization and equipment, as well as involvement of both commercial or local wine varieties. They are usually turned to production of quality wines, while with produced volume, unfortunately, they cannot cover the current demand at the domestic market [22; 51; 3]. Although Serbia has on disposal well natural and climate conditions for viticulture [68], achieved yields are far behind those gained at global level, underlining still extensive production at small estates [33]. Meanwhile, value of wine market at national level is slightly increasing, but mostly due to high ranking of Serbia related to annual wine consumption per capita, and much higher value of import than export of wines [47; 5].

Nowadays, at national level there are produced 224 grapevine varieties, while 31 of them represent local wine varieties [25]. International commercial grapevine varieties dominate in Serbia and over the years, vineyards with old local grapevine varieties have been largely cleared [62]. Their share in the total vineyard area (excluding the widespread local variety Grašac) is just over 15%, with a share in the total number of vineyards being slightly less than 34% [23].

Table 3. Trends in viticulture and wine production in Serbia

Year/ Element	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Average
Viticulture / grape production at Serbian level											
Areas (000 ha)	21.2	21.2	21.2	21.2	21.2	20.3	20.5	19.8	20.1	20.0	20.7
Yield (t/ha)	9.4	5.8	8.1	6.9	7.8	7.4	8.0	8.1	7.7	8.1	7.7
Quantity (000 t)	200.0	122.5	170.6	145.8	165.6	149.4	163.5	160.3	155.7	162.5	159.6
Value (mil USD)	120.0	110.7	110.7	82.6	115.5	80.1	109.8	128.4	150.5	132.3	114.1
Wine production at Serbian level											
Quantity (000 t)	23.1	19.8	24.1	24.1	36.0	34.8	30.2	27.3	26.6	-	27.3

Source: [18].

In line to white wine varieties, in Serbia are mostly grown Riesling, Sauvignon blanc, or Chardonnay as commercial varieties, as well as Smederevka, Tamjanika bela, or Bagrina, as local varieties [30]. According to relatively diverse assortment of grown wine varieties, the most commonly grown wine varieties at national level are usually results derived both, from the requests at national and regional market, or they represent the dictate of locally known wine producers that could perceive and affect the trends at national wine market.

Focusing primarily on local wine varieties, making them globally well-known could not be based just on natural preconditions, tradition in wine growing, or gained habits in wine consuming at certain territory. Local variety could be a promising star out the national market just in case if it involves in itself sincere and proved story about specific terroir, underlying intensive branding. As highly desirable concept, current trends in wine sector highlight the terroir as it truly describes sensory attributes of produced wine (previously grapes) that perfectly corresponds to local environment. Wines labeled with adequate terroir proves that they are produced in predefined location and under the specific and predictable circumstances, while remaining the same over the long time. Briefly, it serves as proof of wine quality, and necessary step to wider recognition of specific wine [64; 50; 24].

In recent time, there are examples of establishing new vineyards in Serbia, that in one part are under some of local (autochthonous) grapevine varieties (no matter to purpose or color of grown grape). In seeking for sustainability and additional profit, with re-introduction of local varieties in larger volume, producers are expecting to satisfy previously set goals, to maximize the profit while to contribute the recognizability of region they belong through the production and processing of grapes from local grapevine varieties [7; 28; 26].

Decision-making is the essence in exercising the entrepreneurial ideas or running a business in wine sector, or agriculture at all [55]. Among the many methods that can be used to support decision-making in agriculture, no matter to their complexity, modernity, precision, or overall purpose [38], Multiple-Criteria Decision Analysis (MCDA) could serve as one of the most reliable [54].

Specifically, some of previously developed MCDA methods could be used for trimming the optimal level of irrigation in plant production [59], finding the crop that fits the best to available agricultural land [17], selection of adequate input supplier [40; 39], assessing the optimal level of crops fertilization [35], selection of the most suitable crop species or variety to given production circumstances [56; 41; 42; 43], testing the possibility to use the renewables in agriculture [27], selecting the most suitable table grape variety for organic agriculture [16], grouping and organizing the most useful wine grape harvest operations that will maximize the gained yields [65], decreasing the diseases infestation risk in grape growing [36], etc.

Within the available literature sources, there are lack of papers based on the use of established MCDA methods or their hybrids (experts' opinions analysis) focused to viticulture, especially to selection of the best possible grapevine (wine or/and table) variety that fits the natural and production conditions of certain territory, or more specifically making the proper

choice between available commercial and local grapevine varieties.

The main goal of the paper is presentation of possible support to decision-making at the farm level (testing of adequate MCDA model established for that purpose that will support generation of the best possible decision). The decision should include selection of the most suitable wine variety that will be the base for establishment of new vineyards (and later wine production) that will in future contribute to strengthening of farm sustainability and enlargement of gained profits.

MATERIALS AND METHODS

In line to performed research it has been applied the model based on multi-criteria decision-making. For this purpose, it was used the expert decision-making based on predefined criteria and pre-set alternatives from which was selected optimal one. Research was conducted through following stages: a) Starting (initial) phase; b) Data collecting; c) Overview of research done so far; d) Presentation of derived research results with discussion; and e) Formalization of concluding remarks.

In initial phase, there has been done contacting and later selection of experts from the observed field (professionals and scientists recognized at regional level, while involved in viticulture and winemaking). They would have to assess (give relevant opinion) to producers' doubt (what wine grapevine variety is currently the best solution for vineyard establishment), according to preselected criteria and defined alternatives. After the selection of experts, by the Delphi technique there have been selected the criteria and alternatives required for further research exercising.

In following tables (Table 4 and Table 5) is presented the brief overview of used criteria and alternatives.

Table 4. Criteria for expert assessment

ID	Criteria	Description	Cost/Benefit
C1	Yieldness of the variety	Average output per unit of measure (hectare, square meter, vine, etc.)	Benefit
C2	Size of individual grape berries in cluster	Average size of individual grape berries (from very small to vary large)	Benefit
C3	Compactness (density) of grape berries in cluster	Formation and movable of the berries and visibilities of the pedicles (from very lax to very dense)	Benefit
C4	Aromaticity of grape (grape must of a given variety)	Specific aroma and taste intensity of grapes, or later produced wine	Benefit
C5	Balance of total acids and sugars in grape (grape must of given variety)	Total sugar - total acid ratio could indicate expected level (potential) of wine quality	Benefit
C6	Impact of leading vine rootstock (*B x R* Kober 5BB) on grape quality	Used rootstock is usually a guarantee of grapevine vitality and resilience to certain external factors	Benefit
C7	Sensitivity of variety to extreme ecological conditions (e.g. high/low temperature, frost, drought, etc.)	Measure of volume and quality of gained output due to expected occurrence of climate extremes	Benefit
C8	Resistance of the variety to pests and diseases	Measure of volume and quality of gained output due to exposure to health risks	Benefit
C9	Suitability of variety for processing into the wine (thickness of berry skin, firmness of flesh of berry, must yield in wine production, etc.)	Variety potential due to gained wine quality	Benefit
C10	General marketability and sales price of grape of given variety	Profit capacity of produced grape	Benefit
C11	General marketability and sales price of wine produced from grape of given variety	Profit capacity of produced wine	Benefit
C12	Costs of vineyard establishment and maintaining (grape producing)	Level of economic efficiency for vineyard running	Cost
C13	Processing costs (wine production)	Level of economic efficiency for winery running	Cost
C14	Suitability of variety for production of wines with geographical indications (limited conditions for high-quality grape and wine production)	Capacity for gaining the extra profit	Benefit

Source: Developed by authors.

It should be noted that this study did not consider the specific ecological requirements of each white wine variety necessary to achieve optimal oenological potential and produce high-quality wines, or characteristics of wines from studied varieties.

Within the phase of data collecting, a survey questionnaire was defined. Later, questionnaire has been sent to preselected experts (9 persons) to be filled in. On this way there have been gained assessments prepared for further processing and presentation in the form of research results.

Table 5. Used alternatives (white wine varieties)

ID	Alternatives	Local (autochthonous /regional)/ international grapevine varieties
Local varieties		
A1	Smederevka	Autochthonous
A2	Tamjanika bela	Regional
A3	Bagrina	Autochthonous
Commercial varieties		
A4	Riesling	International
A5	Sauvignon blanc	International
A6	Chardonnay	International

Source: Developed by authors.

It has to be underlined that in previous period there have been done insufficient number of researches linked to same or similar thematic field, while their overview involves few published papers. Some authors were examined the suitability of land parcels for viticulture in Serbia using the GIS [46; 24]. In some other countries, such as Italy, Iran or Turkey, due to their importance in spatial planning, and later sustainability in performing the production activities, the MCDA-GIS model was used [34; 63; 36]. Other were selected the most suitable grapevine genotypes in Brazil, due to development of novel table grapevine variety primarily characterized by higher yields and better fruit quality, using the Promethee MCDA method [14].

Aouadi and associates (2021) were used the ELECTRE Tri-C and ELECTRE III MCDA methods, in order to perceive the production system in viticulture that fits the best to current global agro-ecological requirements [4], while Macary (2023) has been examined advancing the sustainability in exercised practices in sector of viticulture by the use of ELECTRE Tri-C MCDA method [31].

Meanwhile, Tsafarakis and associates (2010) were used MCDA trying to advance marketing and e-commerce in wine selling [60].

In phase of research results presentation and discussion, there are considered all results derived by the appliance of preselected multi-criteria decision-making methods (MCDAs). This research has been involved Direct Weight Calculation (DiWeC) method and Multi-Attributive Border Approximation Area Comparison (MABAC) method.

The use of the DiWeC method serves to calculate the weights of the pre-set criteria [13] that were previously evaluated through a survey questionnaire by selected experts (Table 6.).

Table 6. Scale of weight values

Weight	Value
Weight	Value
Very Low	1
Low	2
Moderate	3
High	4
Very High	5

Source: [13].

Used MCDA method is innovative, while developed by Puška and associates (2024), [52]. It represents easy and quite a usable way to calculate the weights of criteria, following the next steps:

Step 1. Assessment of criteria importance by experts

$$X_{ij} = x_1, x_2, \dots, x_n \quad (1)$$

Step 2. Calculating the aggregate score for the criteria

$$v_{ij} = \sum_{j=1}^{n} x_{ij} \quad (2)$$

Step 3. Calculating criteria weights

$$w_{,} = \frac{x_{ij}}{\sum_{j=1}^{n} x_{ij}} \quad (3)$$

In order to rank the assessed alternatives, it was used the Multi-Attributive Border Approximation Area Comparison (MABAC) multi-criteria decision-making method. The method was developed by Pamučar and Ćirović (2015), while it is characterized by relatively easy to use [45]. Appliance of mentioned method considers next steps:

Step 1. Development of initial decision-making matrix (X)

$$X = \begin{array}{c} \\ A_1 \\ A_2 \\ \dots \\ A_m \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \dots & C_n \end{array} \\ \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1n} \\ x_{21} & x_{22} & \cdots & x_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} \end{array} \quad (4)$$

Step 2. Normalization of initial decision-making matrix (N)

$$N = \begin{array}{c} \\ A_1 \\ A_2 \\ \dots \\ A_m \end{array} \begin{array}{c} \begin{array}{cccc} C_1 & C_2 & \dots & C_n \end{array} \\ \begin{bmatrix} n_{11} & n_{12} & \cdots & n_{1n} \\ n_{21} & n_{22} & \cdots & n_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ n_{m1} & n_{m2} & \dots & n_{mn} \end{bmatrix} \end{array} \quad (5)$$

a) For Benefit criteria

$$n_{ij} = \frac{x_{ij} - x_i^-}{x_i^+ - x_i^-} \quad (6)$$

b) For Cost criteria

$$n_{ij} = \frac{x_{ij} - x_i^+}{x_i^- - x_i^+} \quad (7)$$

Step 3. Calculating the weight matrix

$$V_{ij} = w_i g(n_{ij} + 1) \quad (8)$$

Step 4. Determining the matrix of marginal approximative surfaces (G)

$$g_i = \left(\prod_{j=1}^{m} v_{ij}\right)^{\frac{1}{m}} \quad (9)$$

Step 5. Calculating the elements of alternative matrices distance from marginal approximative domain (Q)

$$Q = \begin{bmatrix} q_{11} & q_{12} & \cdots & q_{1n} \\ q_{21} & q_{22} & \cdots & q_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ q_{m1} & q_{m2} & \cdots & q_{mn} \end{bmatrix} \quad (10)$$

Step 6. Ranking the alternatives

$$S_i = \sum_{j=1}^{n} q_{ij} \quad j = 1,2,\ldots,n \quad i = 1,2,\ldots,m \quad (11)$$

It has to be mentioned that in concluding remarks is briefly described contribution of performed research, while there are defined possible paths for some future research.

RESULTS AND DISCUSSIONS

Does the maxim „think globally, act locally" correspond to sector of viticulture? Considering the wine as a lifestyle, mentioned is surely true [15]. No matter to socio-economic system, both local and global wine markets are mainly segmented in certain extent. Nowadays, contrary to more demanding consumers, that are generally willing to step-out the adopted common patterns in wine consuming, producers have to be the trendsetting side that will offer something new related to wine and wine culture. Much like in haute couture, trends within wine industry have a cyclical nature, with new styles often echoing past fashions. To appeal to a contemporary audience, the offerings must strike a balance between diversity and tradition, introducing subtle yet meaningful advancements that can draw new enthusiasts while deepening connections with existing aficionados. In this context, autochthonous (local) wine varieties can serve as a distinctive advantage for a particular region, adding unique value to the local producers' repertoire and enhancing community's cultural image.

Tourism, and the "silent exports" it engenders, plays a crucial role in promoting local varieties beyond their native borders, with every bottle consumed abroad potentially is converting new admirers to these distinctive regional flavors. The development of new tastes in a specific area is not merely a result of the new grapevine clones or technological innovations in winemaking. It could be also a result of reminding, primarily the new generations to some old and proved tastes that are part of national tradition and material heritage, momentarily forgotten or out of sight. Similar scenario could be carried out with local wine varieties from Serbia, or wider region (Balkan), that have been retreated in some moment upon the gust of commercial varieties. Today's search for diversity in tastes, quality, color, way of packaging, or time of consuming, etc., may be the ideal time for their return with a style. Serbia and the Balkans have available some old autochthonous (local) varieties that deserve to be in a focus, letting to consumers to decide what will be with their future.

In line to main goal of the paper, there are presented the potential of MCDA in decision-making process in the sector of viticulture. More precisely, hybrid method based on DiWeC and MABAC methods have been served as support to grape and wine producer in making proper decision related to selection of the most suitable white wine variety (choice between commercial and local varieties) which would dominate in newly established vineyard.

In Table 7 it is presented the importance of individual criteria, whose values were obtained by applying the subjective method of multi-criteria decision-making, i.e. DiWeC.

Specifically, experts have been given the greatest importance to the fifth criterion (C5), i.e. "Balance of total acids and sugars in grape (wider of given variety)". It is also interesting that the most of observed criteria have been gained the same values, i.e. the same significance or importance according to assessment of preselected experts.

Table 7. Calculation of criteria's weights

Element	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
E1	4	4	4	5	5	3	4	3	4	4	5	3	3	4
E2	4	3	4	5	5	3	5	4	4	4	5	3	3	3
E3	2	3	3	4	4	3	3	3	3	4	4	4	4	3
E4	4	3	3	4	5	5	5	5	4	5	5	4	2	3
E5	5	4	4	4	5	4	4	4	4	4	5	4	4	4
E6	4	3	4	5	5	2	4	3	2	3	3	3	1	4
E7	3	3	3	5	5	4	4	5	5	5	5	4	4	4
E8	5	3	3	3	5	3	5	5	5	4	4	4	4	4
E9	5	3	3	4	5	4	5	5	5	4	3	4	4	3
Sum	36	29	31	39	44	31	39	37	36	37	39	33	29	32
w_j	0.07	0.06	0.06	0.08	0.09	0.06	0.08	0.08	0.07	0.08	0.08	0.07	0.06	0.07

Source: According to authors calculations.

Conditionally with the lowest value were assessed the criteria C2, C3, C6 and C13, i.e. „Size of individual grape berries in cluster", "Compactness (density) of grape berries in cluster", "Impact of leading rootstock (B x R Kober 5BB) on grape quality", and "Processing costs (wine production)".

Further research steps consider performing of ranking process of observed alternatives (preselected white wine alternatives), while through calculations defined by MABAC method there would come to final rank of alternatives (Tables 8, 9, 10, 11).

Table 8. Decision matrix

Element	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
Weights	0,07	0,06	0,06	0,08	0,09	0,06	0,08	0,08	0,07	0,08	0,08	0,07	0,06	0,07
C/B	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*C*	*C*	*B*
A1	3.89	3.67	3.44	2.67	3.00	3.33	3.11	3.78	3.11	2.89	2.78	2.00	2.11	3.22
A2	3.89	3.44	3.56	4.44	3.44	3.44	3.33	3.67	4.33	4.67	4.56	2.00	2.44	1.67
A3	3.33	3.00	3.22	3.22	3.56	3.22	3.11	3.44	3.67	4.11	4.11	2.56	2.44	1.89
A4	3.44	3.11	3.56	4.11	4.44	3.44	4.11	3.78	3.67	3.89	3.67	2.44	2.22	2.44
A5	3.67	3.22	3.89	4.44	4.44	3.33	3.89	3.89	4.11	4.44	4.22	2.44	2.22	2.22
A6	3.67	3.33	3.67	3.89	4.33	3.44	3.67	4.00	4.22	4.44	4.22	2.22	2.00	2.33
Max.	3.89	3.67	3.89	4.44	4.44	3.44	4.11	4.00	4.33	4.67	4.56	2.00	2	3.22
Min.	3.33	3.00	3.22	2.67	3.00	3.22	3.11	3.44	3.11	2.89	2.78	2.56	2.44	1.67

Source: According to authors calculations.

Table 9. Normalized decision matrix

Element	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
Weights	0.07	0.06	0.06	0.08	0.09	0.06	0.08	0.08	0.07	0.08	0.08	0.07	0.06	0.07
C/B	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*C*	*C*	*B*
A1	1.00	1.00	0.33	0.00	0.00	0.50	0.00	0.60	0.00	0.00	0.00	0.00	0.25	1.00
A2	1.00	0.67	0.50	1.00	0.31	1.00	0.22	0.40	1.00	1.00	1.00	0.00	1.01	0.00
A3	0.00	0.00	0.00	0.31	0.38	0.00	0.00	0.00	0.45	0.69	0.75	0.99	1.01	0.14
A4	0.20	0.17	0.50	0.81	1.00	1.00	1.00	0.60	0.45	0.56	0.50	0.79	0.51	0.50
A5	0.60	0.33	1.00	1.00	1.00	0.50	0.78	0.80	0.82	0.88	0.81	0.79	0.51	0.36
A6	0.60	0.50	0.67	0.69	0.92	1.00	0.56	1.00	0.91	0.88	0.81	0.40	0.00	0.43

Source: According to authors calculations.

Table 10. Weighted normalized matrix

Element	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
Weights	0.07	0.06	0.06	0.08	0.09	0.06	0.08	0.08	0.07	0.08	0.08	0.07	0.06	0.07
C/B	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*C*	*C*	*B*
A1	0.14	0.12	0.08	0.08	0.09	0.09	0.08	0.13	0.07	0.08	0.08	0.07	0.08	0.14
A2	0.14	0.10	0.09	0.16	0.12	0.12	0.10	0.11	0.14	0.16	0.16	0.07	0.12	0.07
A3	0.07	0.06	0.06	0.11	0.12	0.06	0.08	0.08	0.10	0.14	0.14	0.14	0.12	0.08
A4	0.08	0.07	0.09	0.15	0.18	0.12	0.16	0.13	0.10	0.13	0.12	0.13	0.09	0.11
A5	0.11	0.08	0.12	0.16	0.18	0.09	0.14	0.14	0.13	0.15	0.15	0.13	0.09	0.10
A6	0.11	0.09	0.10	0.14	0.17	0.12	0.12	0.16	0.13	0.15	0.15	0.10	0.06	0.10
Gi	0.11	0.09	0.09	0.14	0.15	0.10	0.11	0.13	0.11	0.14	0.14	0.11	0.09	0.10

Source: According to authors calculations.

Table 11. Distance of Alternatives from the BBA

Element	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
Weights	0.07	0.06	0.06	0.08	0.09	0.06	0.08	0.08	0.07	0.08	0.08	0.07	0.06	0.07
C/B	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*B*	*C*	*C*	*B*
A1	0.03	0.03	-0.02	-0.06	-0.06	-0.02	-0.04	0.00	-0.05	-0.06	-0.06	-0.04	-0.02	0.03
A2	0.03	0.01	-0.01	0.02	-0.03	0.01	-0.02	-0.02	0.02	0.02	0.02	-0.04	0.02	-0.04
A3	-0.04	-0.03	-0.04	-0.04	-0.03	-0.05	-0.04	-0.05	-0.02	-0.01	0.00	0.03	0.02	-0.03
A4	-0.03	-0.02	-0.01	0.00	0.03	0.01	0.04	0.00	-0.02	-0.02	-0.02	0.01	-0.01	0.00
A5	0.00	-0.01	0.02	0.02	0.03	-0.02	0.02	0.01	0.01	0.01	0.00	0.01	-0.01	-0.01
A6	0.00	0.00	0.00	-0.01	0.02	0.01	0.00	0.03	0.01	0.01	0.00	-0.01	-0.04	-0.01

Source: According to authors calculations.

In Table 12, it is shown the final rank of preselected, i.e. observed white wine varieties.

Table 12. Ranking of alternatives

S_i	Rank	Alternative
-0.35	6	A1
-0.02	3	A2
-0.32	5	A3
-0.03	4	A4
0.09	1	A5
0.02	2	A6

Source: According to authors calculations.

It could be seen that the alternative A5, i.e. the variety Sauvignon blanc was chosen as the best solution for vineyard establishment, while it is followed by the alternatives A6 and A2, i.e. the varieties Chardonnay and Tamjanika bela. Adequate visualization of the performed ranking of white wine varieties has been done in Figure 1.

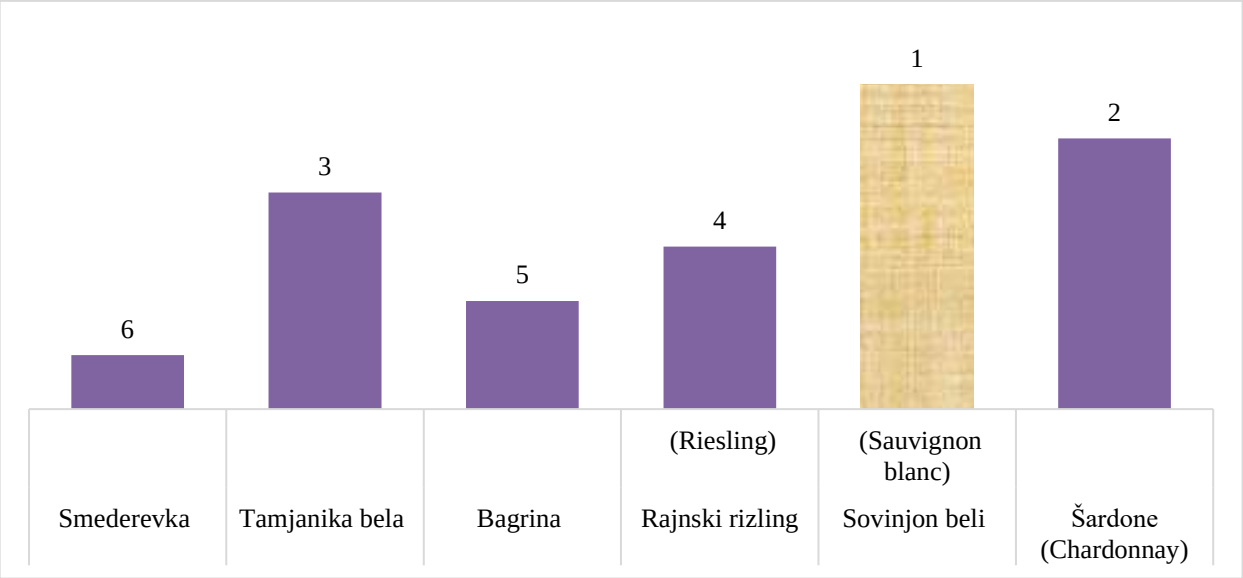

Fig. 1. Ranking the white wine varieties
Source: According to authors calculations.

CONCLUSIONS

Grapes and wine are among the most valuable agri-food products at the global market. Global market recognizes various grapevine varieties, while in previous decade there come to strengthening in confrontation between the commercial, globally well recognized wine varieties, and local (autochthonous) one. Observing the grapevine as perennial crop with the mighty impact on further wine production, determining the adequate structure of grapevine varieties in vineyard seems to be strategic decision for any farmer (additional changes in vineyard structure are costly in any aspect).

The research was performed in order to examine which white wine variety stands out as the best possible alternative (confrontation of commercial vs. local varieties) for wine producers and further spreading of vineyards at national level, related to assessment of presets criteria made by viticulture-oenology experts active in observed sector of agri-food production (viticulture and wine production). Besides, through the successful application of multi-criteria decision-making (MCDM), there are determined the ranges of weighting coefficients for individual

(preselected) criteria. Thus, the criterion Balance of total acids and sugars in grape (wider of given variety) stands out by its importance as the most significant, while several others have equal by significant importance too. As one of results derived from the MCDM analysis, Sauvignon blanc has been marked as the most promising variety, while the Chardonnay and Tamnjanka bela are quite behind it. In these types of research, the use of MCDM provides overall importance to researched topic, while it serves as excellent tool for further development and selection of future varieties of grapevines and wines, i.e. it could have impacted the on science-based change in structure of vineyards and wine assortment at the national level or wider region in upcoming mid-term period.

Derived research results could serve both to professionals (grape and wine producers) and policy makers. First to shape and use in the best manner available potential of the local offer at wine market, while the second one to actively support current market trends. Future research could be directed to selection of the best fitting red wine varieties, or it could involve the same alternatives but under changed circumstances (change in used criteria for assessment).

In emerging economies, prioritizing locally produced wines, especially those made from local (autochthonous) grapevine varieties, supports economic stability and cultural identity. Serbian wines produced from local varieties can act as cultural ambassadors, showcasing the nation's rich traditions and unique terroir. Thus, promoting local varieties and wines is not only an economic initiative but also a celebration of the country's authentic heritage and diversity.

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