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CONVENTIONAL OR ORGANIC WINE PRODUCTION? ESTABLISHING THE HIERARCHY OF VALUES IN THE PRODUCER'S DECISION-MAKING MODEL

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Purpose: The aim of this article is to understand how Polish winemakers make decisions about the type of production; to identify barriers of implementation of organic practices organic, to understand the values that are behind the decision-making process in the context of the three areas of sustainable development and present recommendations in relation to the conclusions.
Design/methodology/approach: Methodological approach is based on Analytical Hierarchical Process (AHP). The study included 18 values grouped according to belonging to the environmental, social and economic area. The importance of each value was compared by the respondents with the other values, which allowed to understand the course of the decision-making process in the context of the goals and importance of environmental, social and economic values represented by organic and conventional winemakers.
Findings: The research revealed significant differences in the approach to the environmental and economic values. Conventional and organic winemakers differ in the hierarchy of values in the context of the triad of sustainable development (economy, society, environment), and the key values taken into account by conventional winemakers are pecuniary values, in contrast to organic winemakers, for whom non-economic values are key, in particular from the area of environmental issues. Organic production is perceived by the surveyed winemakers in ideological rather than business terms. Conventional winemakers see the organic production as more complicated and problematic.
Practical implications: This is a significant problem showing the lack of education and awareness in relation to the theory and practice of an organic production. This situation should be alarming for agricultural advisory institutions and the entities of administration responsible for the implementation of sustainable development assumptions.

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Originality/value: This paper fills a gap in literature science, by the Authors' knowledge, this is the first article to use the AHP method to determine how winemakers make decisions about the type of production.

Keywords: organic wine**,** decision-making process, Analytical Hierarchical Process (AHP), value hierarchy, winemaking, organic production, Polish wine.

1. Introduction

In a world where biological survival has been put at risk, it is a matter of key importance to limit the negative impact of human activity on the ecosystem. Loss of biodiversity, disrupted biogeochemical cycles of nitrogen and phosphorus (biogeochemical flows), land system change, limitations on access to freshwater – all of the aforementioned problems (Steffen et al., 2015) are, to a large extent, related to the conventional mass production of food. One course of action that leads to limitation of the negative impact of humans on the environment is to implement organic farming principles. Many studies show that organic farming is more sustainable. According to Pimentel et al. (Pimentel et al., 2005), this type of production is associated with a higher level of organic matter in the soil (higher levels of carbon and nitrogen); higher levels of soil organic matter prove to be important in the conservation of soil and water resources during periods of drought; fossil energy inputs were around 30% lower for organic crop production than for conventional production; crop rotations and cover cropping used in organic agriculture reduce soil erosion, and also limit pest problems and pesticide use; the use of manure as fertilizer reduces pollution; and increases biodiversity. In comparative studies of conventional and organic systems, with reference to environmental phenomena, attention is drawn above all to the better condition of soil in organic farming, (Gomiero et al., 2008; Reganold et al., 1987; Reilly et al., 2013) the higher biodiversity associated therewith (Hole et al., 2005), and energy savings (Dalgaard et al., 2001; Smith et al., 2015). With reference to socio-economic aspects, studies cite the developing market for organic products worldwide, while pointing out that price premiums or subsidies are not only making organic systems profitable in many developed and developing countries, but are even spurring rural revitalization (Shennan et al., 2017). Organic production may also be related to a higher level of satisfaction with life and work among organic farmers (Mzoughi, 2014; Nauta et al., 2006). From an economic point of view, organic farms are generally found to have a lower efficiency of yield, though, at the same time, there are studies which suggest that this effect may be reduced based on economic considerations, thanks to the lower inputs of organic farming, less need for labor, premium prices on the market (Cisilino, Madau, 2007; Sgroi et al., 2015) and, in the case of the European Union, the possibility of obtaining subsidies (Naglova, Vlasicova, 2016). The benefits resulting from organic farming explain the growth in the popularity of that method among farmers, including winemakers in most countries of the

European Union. Table 1 shows the changing trend in the share of land farmed organically in EU countries and a Figure 1 shows area dedicated to organic farming in individual EU countries.

Table 1.
Organic farming area in selected EU countries, 2012-2019

	2012	2013	2014	2015	2016	2017	2018	2019	2012-2019 % change
Belgium	4,48	4,67	5,00	5,17	5,80	6,28	6,56	6,85	55,9
Bulgaria	0,76	1,13	0,96	2,37	3,20	2,72	2,56	2,34	200,9
Czechia	13,29	13,47	13,44	13,68	14,00	14,09	14,76	15,19	14,2
Denmark	7,31	6,44	6,25	6,33	7,81	8,60	9,75	11,09	46,6
Germany	5,76	6,04	6,18	6,34	6,82	6,82	7,34	7,75	34,5
Estonia	14,86	15,65	15,96	15,68	18,02	20,01	20,98	22,33	55,4
Ireland	1,16	1,20	1,16	1,65	1,72	1,66	1,65	1,63	40,1
Greece	9,01	7,36	6,71	7,69	6,51	7,96	9,32	10,26	14,3
Spain	7,49	6,85	7,26	8,24	8,48	8,73	9,28	9,66	34,1
France	3,55	3,66	3,87	4,54	5,29	5,99	7,01	7,72	117,4
Croatia	2,40	3,13	4,03	4,94	6,05	6,46	6,94	7,19	238,9
Italy	9,30	10,60	10,91	11,79	13,99	14,67	15,17	15,16	70.7
Cyprus	3,38	4,03	3,63	3,72	4,94	4,61	4,55	4,98	59,1
Latvia	10,63	9,89	10,86	12,29	13,42	13,92	14,47	14,79	48,1
Lithuania	5,51	5,74	5,57	7,11	7,50	7,98	8,13	8,14	54,7
Luxembourg	3,14	3,39	3,43	3,21	3,47	4,15	4,39	4,42	40,8
Hungary	2,45	2,45	2,34	2,43	3,48	3,73	3,92	5,71	132,1
Malta	0,32	0,06	0,29	0,25	0,21	0,35	0,41	0,47	48,6
Netherlands	2,61	2,65	2,67	2,67	3,03	3,31	3,50	3,75	41,7
Austria	18,62	18,40	19,35	20,30	21,25	23,37	24,08	25,33	26,0
Poland	**4,51**	**4,65**	**4,56**	**4,03**	**3,72**	**3,41**	**3,33**	**3,49**	**-22,6**
Portugal	5,48	5,31	5,74	6,53	6,74	7,04	5,93	8,16	46,0
Romania	2,10	2,06	2,09	1,77	1,67	1,93	2,43	2,86	37,1
Slovenia	7,32	8,07	8,55	8,85	9,12	9,60	10,01	10,35	41,4
Slovakia	8,53	8,18	9,37	9,47	9,75	9,90	9,85	10,31	20,2
Finland	8,65	9,07	9,29	9,91	10,47	11,41	13,09	13,48	55,0
Sweden	15,76	16,50	16,53	17,14	18,30	19,16	20,29	20,43	28,5
United Kingdom	**3,41**	**3,24**	**3,02**	**2,89**	**2,82**	**2,85**	**2,64**	**2,62**	**-22,2**

Source: ec.europa.eu/Eurostat, 21.05.2021.

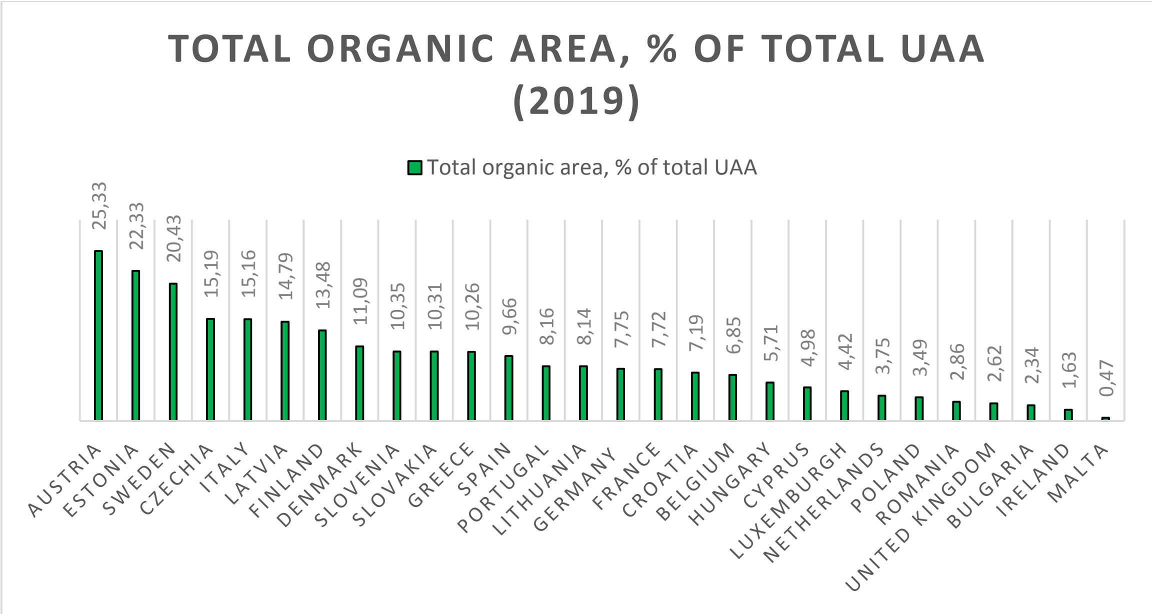

Figure 1. Total organic area (including in conversion area), % of total UAA. Source: ec.europa.eu/ Eurostat, 21.05.2021.

In almost all countries of the European Union, in the period from 2012 to 2019, there was an increase in areas farmed organically. The only country in which that process went in the opposite direction, and where the area farmed organically actually shrank, was Poland and UK.

In the context of the above, the aims of this article are as follows:

- Construction of a decision-making model to understand making a choice process between conventional or organic production.
- Indication of the factors conditioning the decision-making process of pioneers in Polish winemaking regarding production method.
- Indication of barriers to the implementation of principles of organic production, in the context of values and beliefs based on the example of Polish winemakers.

The research question are:

- Why is organic wine production not very popular, despite growing popularity of organic wine?
- On what values is the winemakers decision-making process based?
- What are barriers and motivators of conversion into organic wine production?
- What actions can be taken to support the conversion towards organic production?

2. Organic Wine and Winemaking

A wine can be defined ‘organic’ when it is produced to the Regulation of the European Commission (EC) 203/2012.The principles of organic wine production apply to activities both in the vineyard and in the winery. According to the European Commission's definition, organic production *is an overall system of farm management and food production that combines best environmental practices, a high level of biodiversity, the preservation of natural resources, the application of high animal welfare standards and a production method in line with the preference of certain consumers for products produced using natural substances and processes. The organic production method thus plays a dual societal role, where it on the one hand provides for a specific market responding to a consumer demand for organic products, and on the other hand delivers public goods contributing to the protection of the environment and animal welfare, as well as to rural development* (EU, 2007). The basic rules for the organic cultivation of vineyards are:

- Ban on use of synthetic chemicals and GMOs.
- Prophylactic measures to lower the sensitivity of crops to pest attacks prior to any use of natural plant protection or biological control products.
- Use of agronomic treatments: cultivation by hand, mulching, weeding, etc.
- Use of only natural fertilizers, such as green manure or compost.

The following principles then apply in the winery:

- 100% of all ingredients of agricultural origin used must be certified organic.
- Limits or ban on use of certain physical procedures (e.g. dealcoholization, electrodialysis, filtration).
- Limited list of permitted oenological additives and processing aids.
- Limits on the amount of SO2. (IFOAM EU Group, EU Rules for Organic Wine Production: Background, Evaluation and Further Sector Development).

One organic product for which the market is systematically growing is wine. In 2019, the global organic wine market was worth \$ 334.5 million, compared to \$ 341.31 million in 2020, and the coming years are expected to see continuing dynamic growth up to the level of \$ 416.23 million in 2024 (Technavio, 2020). Just in case of organic still wine increase by 48.3% during the period from 2012 to 2017 was noted (IWSR, 2018). It is expected one billion bottles of organic wine to be consumed around the world by 2023, in compare with 441 million bottles recorded in 2013. According to ‘Organic Wine Market by Product, Distribution Channel, and Geography - Forecast and Analysis 2020-2024’ the organic wine market is expected to grow by USD 5.23 billion in 2020-2024, reaching the compound annual growth rate at the level of 8% in the forecast period The market is fueled by the growing trend of organic wine tourism and growing demand from millennials (TechNavio, 2020). These forecasts seem to be realistic in the context of the dynamically growing amount of organic vineyards and their predicted ongoing growth worldwide (cf. Fig. 2).

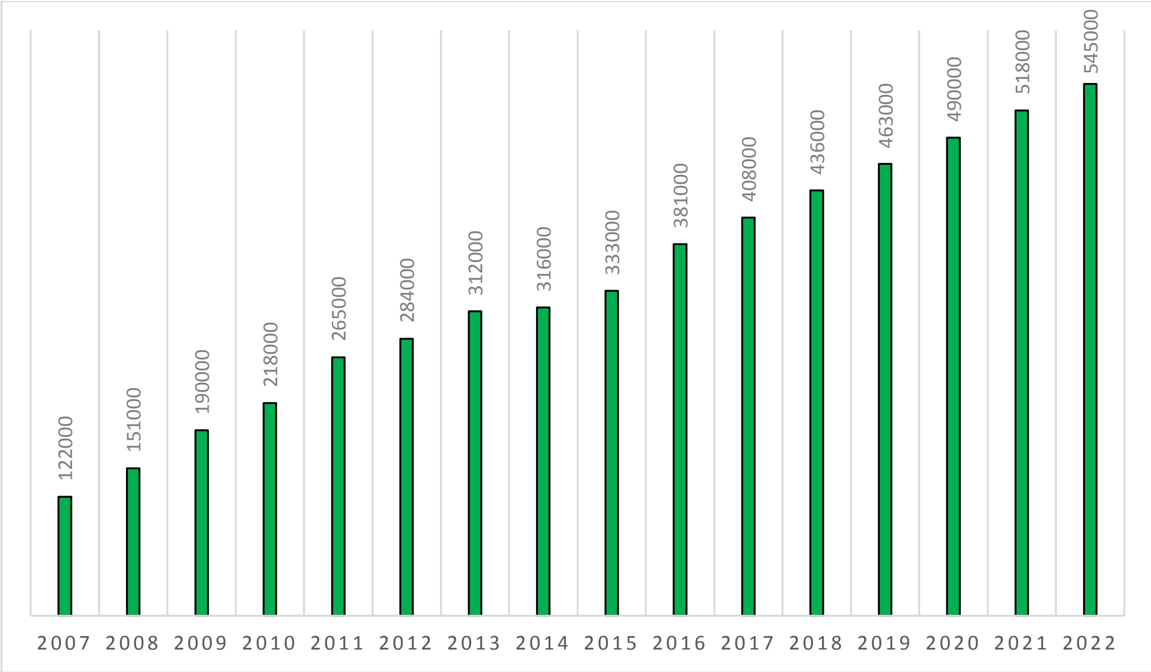

Figure 2. Organic vineyards worldwide, 2007-2022 (forecast). Source: (MillesimeBio, 2019).

This process is clearly visible in the European Union. A common trend in traditional winemaking countries of the EU is a stabilization in total vineyard area accompanied by growth in the share of organically farmed areas, a phenomenon which is illustrated based on the example of selected traditional winemaking countries in Table 2.

Table 2.
Total vineyard area compared to area of organic vineyards in selected EU countries

Spain			France			Italy			Austria		
Vineyard area/organic vineyard area (ha)											
2016	2017	2018	2014	2015	2018	2016	2017	2018	2015	2016	2018
775000/ **106509**	968000/ **106529**	969000/ **113098**	789 000/ **64610**	785000/ **68579**	793000/ **94020**	693000/ **101289**	699000/ **103,207**	705000/ **106447**	45000/ **4626**	46000/ **5088**	49000/ **6000**

Source: own elaboration based on: FiBL (2018); MillesimeBio (2019).

The increase in organic wine production is related to the growing demand. The research of organic wine consumers clearly shows their specific hierarchy of values. Organic wine is the product of choice for environmentally conscious consumers, for whom environmental responsibility is one of the key drivers (Brugarolas et al., 2005; Olsen et al., 2012; Schäufele, Hamm, 2017; Galati et al., 2019; Rabadán, Bernabéu, 2021). Sensitivity to environmental issues is confirmed by the willingness to pay higher price for organically produced wine (Wiedmann et al., 2014; Ay et al., 2014; Galati et al., 2019). Nevertheless, the organoleptic features (Pagliarini, 2013; Wiedmann et al., 2014; Kim, Bonn, 2015) and the belief in health (Mann et al., 2012; Bonn, 2016) values also remain an important criterion. Di Vita et al. (2019) indicate the importance of consumer curiosity. Therefore, we are dealing with a growing market and quite precise knowledge about consumer expectations. The sense of organic production, including wine is confirmed by many studies: the organic winemakers are obtaining premium prices, they have lower costs, higher level of capitalization, better general economic situation compared to conventional winemakers (Dainelli, Daddi, 2019; Vlasicova, Naglova, 2015).

3. Poland as a wine country

Poland has a tradition of viticulture that stretches back to the 10th century and is associated with the adoption of Christianity. In the early Middle Ages, vineyards stretched from Kraków in the south to Pomerania in the north and from the Subcarpathian region in the east across the Vistula River Gorge [*Przełom Wisły*] to the area of Zielona Góra in the west. The development of trade routes and competition from other countries combined with the effects of the Little Ice Age, the phylloxera epidemic, and finally also Poland's unstable situation led to this tradition of winemaking becoming forgotten. The situation started to change at the end of the 20th century. By 2000, there were 16 wineries in operation in Poland (Pink, 2015). At the beginning of 2021, according to the internet portal for Polish winegrowers winogrodnicy.pl[1], there were nearly 530 wineries producing wine in Poland, though not all owners register their wineries and sell wine commercially, whereby it should be emphasized that, in many cases, these are garage wineries, where wine is offered as a product only as part of agritourism activities. According to data from the Polish National Support Centre for Agriculture [*Krajowy Ośrodek Wsparcia Rolnictwa – KOWR*], in 2020, there were 330 registered producers in operation, growing vines over an area covering 551 ha. The vineyard area and number of winemakers are relatively low. However, if one takes the dynamics of the trend into consideration, viticulture and the production of wine in Poland give grounds to consider the emerging winemaking sector as a phenomenon with important potential in the development of rural areas and changes in alcohol consumption habits in Poland. In 1999, the vineyard area in wine-producing countries was 3,400,567 ha, while in 2009, it was 3,196,597 ha, and in 2015 – 3,230,241 ha (Eurostat, 2017), which means that there has been a slight contraction in total vineyard area. In contrast, in the period from 2009 to 2020, the total vineyard area in Poland has experienced dynamic growth at an average rate over the period of 30% per year (Fig. 3), while the number of persons deciding to operate wineries has grown at a similar rate (Fig. 4).

[1] This is a database concerning winemaking in Poland created by grassroots users. Information about wineries and wine production are provided by winemakers, who can add their own project themselves.

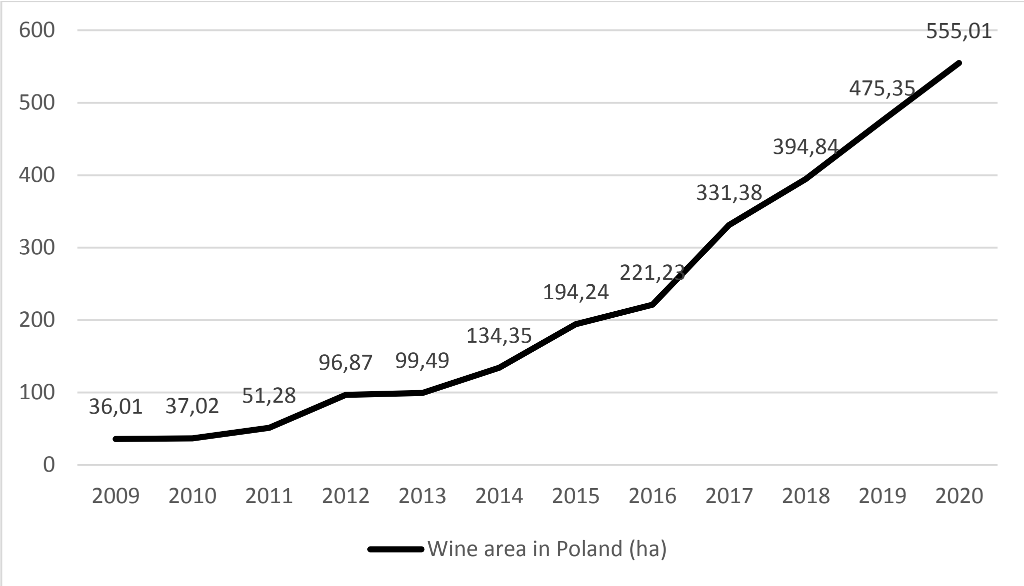

Figure 3. Vineyard area in Poland, 2009-2020. Source: (Krajowy Ośrodek Wsparcia Rolnictwa, 2020).

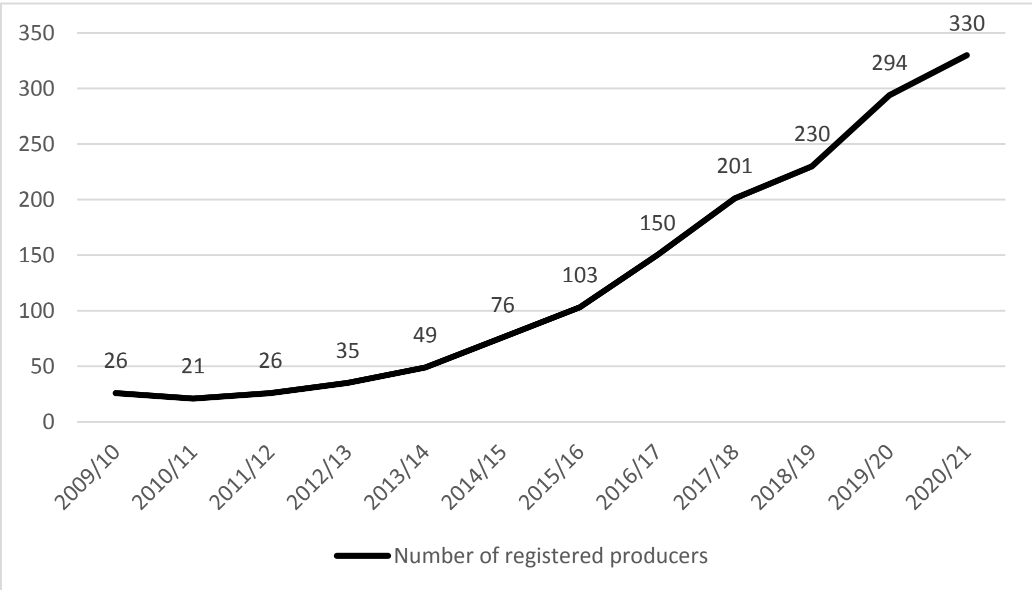

Figure 4. Number of registered winemakers, 2009/10-2020/21. Source: (Krajowy Ośrodek Wsparcia Rolnictwa, 2020).

It is worth underlining that, among several hundred producers, there are only 10 which have organic or in conversion vineyards, which, in the context of trends in adaptation to organic farming in Poland hardly comes as any surprise, though it does raise questions about what premises Polish agricultural producers base their decisions on when choosing their method of production.

4. Materials and Methods

4.1. Research Process

The research instrument was an AHP questionnaire in the form of a 30-minute telephone interview conducted by trained moderators. In addition to this, another questionnaire was completed by telephone interview, in order to diagnose attitudes with regard to organic and conventional production, the values declared by winemakers and the reasons for decisions regarding specific production methods, consisting of 9 questions based on a 5-point Likert scale and 5 metric questions. The interviews were conducted during the course of one telephone conversation with the respondent. The selection of the research sample and sample subjects was purposeful. Those winemakers whose production is registered and whose product is officially on sale on the commercial market were selected for the sample (N = 123, based on: winogrodnicy.pl), everyone was contacted, but only 56 winemakers took part in the survey, including 7 organic and 3 in the conversion process. However, these 10 respondents account for nearly 90% of the population of certified or seeking certification winemakers.

4.2. Description of the Applied AHP Method

The comparative method was first used by the 13th-century philosopher Ramon Llull in the context of social choice theory and the theory of electoral systems and was based on simple binary comparisons (Colomer, 2013). The Pairwise Comparison (PC) method was improved upon by main scholars, including the 18th-century French mathematician and philosopher Nicolas de Condorcet, and other researchers in the modern era, such as L. Thurstone, Y. Takane, R.D. Luce, R.A. Bradley and M.E. Terry (Kułakowski et al., 2019).

Multi-criteria methods are the most well-known application of the PC method, and include the Analytic Hierarchical Process (AHP) and its extension, the Analytic Network Process (ANP). Both methods were developed in 1970s by the American mathematician Thomas L. Saaty to facilitate decision-making processes (Saaty, 2008).

The Analytic Hierarchical Process (AHP) is one of the most widely used methods in complex decision making. This method is one of "measurement through pairwise comparisons and relies on the judgments of experts to derive priority scales" (Russo & Camanho, 2015). The AHP method can be carried out in several phases. These include (Schmidt et al., 2015):

1. Creation of a hierarchical model – definition of: goals, criteria and alternatives.
2. Judgment of criteria – pairwise comparison.
3. Weighing of priorities.
4. Combination of the alternatives' priorities.
5. Analysis of inconsistency and sensitivity.

Step 1: Use of the AHP method allows for the creation of an appropriate structure of the decision-making process, the functioning of which is influenced by many independent factors. The analysis makes it possible to specify the main problem, as well as sub-problems situated at hierarchical levels. Each level is characterized by a group of criteria related to each specific sub-problem (Khashei-Siuki et al., 2020). In this way, a model is created, with the main goal at the top while alternative decisions are at the bottom of the hierarchy. The criteria are then located in the middle between the goal and the decision variants (alternatives) (Abastante et al., 2019).

Step 2: After preparation of the hierarchy tree, it is possible to move onto the next step related to the pairwise comparison of criteria. At this stage, criteria are compared in pairs on a one-to-one basis. Experts taking part in the study make a comparative judgment of each pair of criteria taking the specific goal into account (Baffoe, 2019). In order to be able to complete this step, it is necessary to employ the numeric scale known as the Saaty scale (Table 2). It is used to determine which criterion of the pair is dominant with reference to the goal of the comparison (Saaty, 2008).

Table 3.
Structure of AHP responses

Importance	Equal importance	Moderate importance	Strong importance	Very strong importance	Extreme importance
Value	1	3	5	7	9

Step 3: With the help of the subjective judgment, the decision maker makes a choice between the individual criteria, and also specifies what relations there are between them. If the relations between the judgments are reversible, they become the inverse of integer functions. In this way, it is possible to create the matrix A = $[a_{ij}]$ (dimensions: n x n) (Saaty, 2002):

$$A = \begin{bmatrix} 1 & a_{12} & \cdots & a_{1n} \\ \frac{1}{a_{12}} & 1 & \cdots & a_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ \frac{1}{a_{1n}} & \frac{1}{a_{2n}} & \cdots & 1 \end{bmatrix} \tag{1}$$

Matrix A contains values showing the degree to which decision makers prefer x_i to x_j when viewed from the perspective of the higher-ranking goal. For each of the matrices, a vector of preferences should be indicated – the last of these is referred to as the weight vector. This is what decides the importance and influence of the criteria. The higher it is, the more important it is, and influence increases. It can be expressed as follows (Wojnarowska et al., 2021):

$$w = [w_1, w_2, \dots, w_n]^T \tag{2}$$

Step 4: The step allows for all the judgments of decision makers to be aggregated to obtain an overall priority. This can be done by: the Aggregation of Individual Judgments (AIJ) for sets of pairwise comparisons, the Aggregation of Individual Priorities (AIP) and the aggregation of priorities of units at each node of the hierarchy (Forman, Peniwati, 1998). When a group of decision makers forms a homogenous structure and expresses a willingness to function collectively as a single entity, AIJ is used. Each of them compares the criteria on their own, and, by taking the geometric mean, it is possible to obtain a group judgment. However, if the decision makers do not feel like acting as a single whole and compare the criteria individually using their own personal value systems, a consensus may be reached using AIP (Ossadnik et al., 2016).

Step 5: The results obtained from the comparison matrix refer to the relative importance of each criterion. They give a weight to each of the individual criteria ($w_1, w_2 \dots w_n$), which has to be checked for consistency (Bojórquez-Tapia et al., 2001). The consistency index of the individual values assigned by the decision makers depends on the deviation between λ_{max}, and n. The closer the deviation is to zero, the higher the consistency between decision makers is. This may be shown as follows (Fiore et al., 2020):

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad (3)$$

Perfect consistency of the square matrix can be achieved when the highest eigenvalue of the matrix (λ_{max}) is equal to the number of compared criteria (n). The following equation shows this property (Saaty, Vargas, 1985):

$$\lambda_{max} \ = \ n \ for \ each\text{:} \ a_{ij} \ = \frac{w_i}{w_j} \quad (4)$$

On the basis of the above dependencies, it is possible to calculate the consistency ratio in the last step. It is the quotient of the Consistency Index (CI) and the Random Consistency Index (RI), which is dependent on the size of the comparison matrix (Wang et al., 2020):

$$CR = \frac{CI}{RI} \quad (5)$$

The matrix may be considered to be consistent if the value of the Consistency Ratio is less than or equal to 0.1 (Park et al., 2020).

4.3. Analysis of Results Using the AHP Method

For the analysis of empirical data, the Pairwise Comparison (PC) method was used to assess the preferences (importance) of items or criteria in a relational database and single out the most effective solution. The hierarchical model was prepared by breaking down the decision-making problem and presenting it as a hierarchical sequence. Next, all the possible pairs were analyzed according to a special, bipolar scale of comparison, and the results were then put into the matrix and weight ratios, as known as priorities, were specified. The program Super Decision was used to make the relevant calculations. For each matrix, the Consistency Ratio (CR) was also calculated to show if the respondents were consistent in their judgments. The Consistency Ratio (CR) was estimated for each expert (reported for each matrix). The creator of the method, Saaty, set the acceptable value of CR at 0.10 (10%), which means that a matrix with a CR > 0.10 should be considered to be inconsistent and discarded or repeated (Saaty, 2008). However, in practice, this requirement is difficult to meet, and the threshold value for matrix acceptance proposed by Saaty provoked such controversy that many scientists considered it too restrictive. In this article, a limit of CR ≤ 0.20 has been adopted.

This model was developed to assess the choice of method of wine production. The structure of the model is divided up in the conventional way, taking into account the stated main goal, the main criteria, the sub-criteria and possible solutions. The main criteria were taken to be areas of sustainable development, i.e. economic, environmental and social criteria. To provide more accurate data on the factors taken into consideration in the decision-making process regarding the choice of wine production method, based on a review of the literature, sub-criteria representing appropriate factors for each main criterion were also taken into account. In the case of economic criteria, costs of production, subsidy system, market development, farming efficiency, profits on sales, labor intensity and competition were taken into account. Sub-criteria taken into account in the social area included a sensory judgment of the wine by the winemaker, the risk of lack of product acceptance, institutional controls, sensory judgment according to the consumer and judgments of responsibility of production. For the environmental criterion, sub-criteria such as the following were singled out: environmental safety of farming method, expression of terroir, attacks of parasites, quality of raw material (grapes), frequency of spraying and frequency of agronomic treatments. The alternatives adopted were determined on the basis of the possible wine production methods, i.e.: organic or conventional farming and winemaking.

Table 3 shows the calculated values of local priorities for the main judged criteria, broken down into conventional and organic winemakers. The aggregated average values for both surveyed groups is also presented. The analysis conducted shows there to be divergences in the levels of the criteria taken into account among groups of conventional and organic winemakers. Among conventional winemakers, the key criterion taken into account in the process of choice of production method is the economic criterion with a local priority value of 0.5047 while among organic winemakers that criterion was judged to be of the lowest importance i.e. 0.0574. A similar divergence can be seen in the judgment of the organic criterion, which was considered to be of key importance by organic winemakers with a local priority value of 0.6673 while, among the group of conventional winemakers, the local priority value was 0.2788. No such fundamental differences were shown only for the social criterion.

Table 4.
Local priority values for main criteria

CRITERION	Local priorities (aggregated)	Local priorities (conventional)	Local priorities (organic)
1 economic	0.3929	0.5047	0.0574
2 social	0.2312	0.2165	0.2753
3 environmental	0.3759	0.2788	0.6673

Table 4 shows the values of local and global priorities for the judged sub-criteria, broken down into conventional and organic winemakers, as well as average values for those groups. The economic sub-criterion judged by conventional winemakers to be most important, i.e. with the highest local priority value (0.2105) was profits on sales, which, based on the judgments of organic winemakers, was in second place after market development. Both among organic and conventional winemakers the lowest level of local priority for the analyzed criterion was assigned to the factor of competition.

In the case of the second criterion, i.e. the social criterion, responsible production was considered to be of key importance, receiving the highest local priority values both among conventional and organic winemakers, of 0.3490 and 0.4484 respectively.

In the group of environmental sub-criteria, both the groups of conventional and organic winemakers considered the factors of environmental safety of farming method and quality of raw material (grapes) to be of most importance.

Table 5.
Local and global priority values for judged sub-criteria

CRITERION	Local priorities (aggregated)	Global priorities (aggregated)	Local priorities (conventional)	Global priorities (conventional)	Local priorities (organic)	Global priorities (organic)
1.1 costs of production	0.1596	0.0627	0.1536	0.0775	0.1791	0.0103
1.2 subsidy system	0.0643	0.0253	0.0645	0.0325	0.0637	0.0037
1.3 market development	0.1962	0.0771	0.1631	0.0823	0.3037	0.0174
1.4 farming efficiency	0.1622	0.0637	0.177	0.0893	0.1142	0.0066
1.5 profits on sales	0.2039	0.0801	0.2105	0.1063	0.1825	0.0105
1.6 labor intensity	0.1596	0.0627	0.1787	0.0902	0.0974	0.0056
1.7 competition	0.0541	0.0213	0.0525	0.0265	0.0594	0.0034
2.1 sensory properties of wine according to the winemaker	0.1471	0.0340	0.1290	0.0279	0.1907	0.0525
2.2 risk of lack of product acceptance	0.1447	0.0335	0.1684	0.0365	0.0879	0.0242
2.3 institutional controls related to organic production	0.1217	0.0281	0.1558	0.0337	0.0400	0.0110

Cont. table 5

2.4 sensory properties of wine according to the consumer	0.2083	0.0481	0.1979	0.0429	0.2330	0.0641
2.5 responsible production	0.3782	0.0874	0.3490	0.0756	0.4484	0.1234
3.1 environmental safety of farming method	0.2680	0.1007	0.2790	0.0778	0.2076	0.1385
3.2 expression of terroir	0.1291	0.0485	0.1255	0.0350	0.1491	0.0995
3.3 risk of pest attacks	0.1048	0.0394	0.1099	0.0307	0.0763	0.0509
3.4 quality of raw material (grapes)	0.2366	0.0890	0.2297	0.0640	0.2748	0.1834
3.5 frequency of spraying	0.1562	0.0587	0.1565	0.0436	0.1542	0.1029
3.6 frequency of agronomic treatments	0.1053	0.0396	0.0993	0.0277	0.1380	0.0921

Table 6 presents the percentage values for sub-criteria according to their importance for the achievement of the selected main goal.

Table 6.
Sub-criteria according to their importance for achievement of goal

Sub-criteria according to their importance for achievement of goal	Conventional	Organic
1.1 costs of production	7.8%	1.0%
1.2 subsidy system	3.3%	0.4%
1.3 market development	8.2%	1.7%
1.4 farming efficiency	8.9%	0.7%
1.5 profits on sales	10.6%	1.0%
1.6 labor intensity	9.0%	0.6%
1.7 competition	2.7%	0.3%
2.1 sensory properties of wine according to the winemaker	2.8%	5.2%
2.2 risk of lack of product acceptance	3.6%	2.4%
2.3 institutional controls related to organic production	3.4%	1.1%
2.4 sensory properties of wine according to the consumer	4.3%	6.4%
2.5 responsible production	7.6%	12.3%
3.1 environmental safety of farming method	7.8%	13.9%
3.2 expression of terroir	3.5%	10.0%
3.3 risk of pest attacks	3.1%	5.1%
3.4 quality of raw material (grapes)	6.4%	18.3%
3.5 frequency of spraying	4.4%	10.3%
3.6 frequency of agronomic treatments	2.8%	9.2%

An analysis of values shows there to be large divergences in the judgment of sub-criteria between conventional and organic winemakers. It is worth noting that, in the case of conventional winemakers, profits on sales (10.6%) are the most important, while, for organic winemakers, it is quality of raw material (18.3%).

4.4. Analysis of the Results of the Behavioral Survey

The purpose of the behavioral survey conducted to complement the AHP method was to precisely indicate differences in preferences, values and perception of conventional and organic farming and production. The survey questions concerned an assessment of the organic certification system, factors influencing the decision regarding method of production and an assessment of the organic method.

In analyzing the survey questionnaire based on the Likert scale[2], a comparison of the arithmetic means of the responses of organic winemakers, those in conversion, those declaring organic production and conventional winemakers, was used. The responses of winemakers, who claim to apply organic farming principles and have organic production, but who are not certified and do not plan to seek certification, were discarded. A graphic representation of the responses concerning the perception of organic certification is shown in Figure 5.

The statistical significance of mean differences was verified on basis of the following formula:

$$t = \frac{\bar{x}1 - \bar{x}2}{\sqrt{\frac{(n1\, s1^2) + (n2\, s2^2)}{n1 + n2 - 2}\left(\frac{1}{n1} + \frac{1}{n2}\right)}} \tag{6}$$

where the critical area is found in Student's t-test tables for *n1+n2-2* degrees of freedom of Student's t-test distribution.

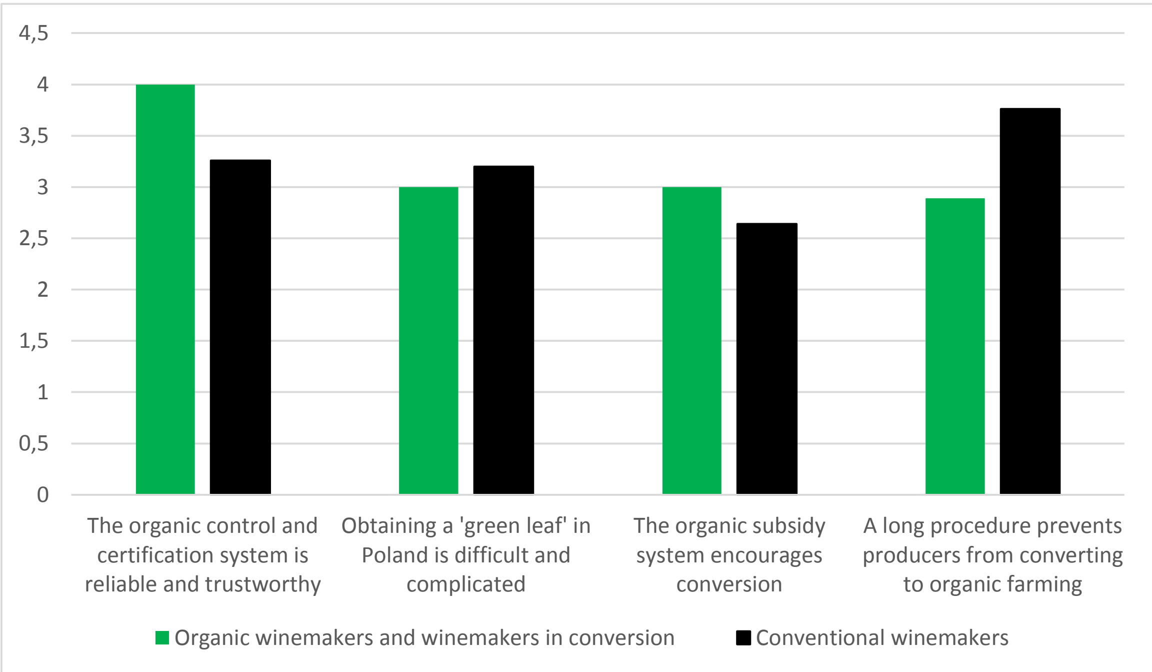

Figure 5. Assessment of conventional and organic winemakers regarding the economic and institutional context of organic certification

[2] Responses: 1 – strongly disagree, 2 – disagree, 3 – neither agree, nor disagree, 4 – agree, 5 – strongly agree.

The differences in mean responses between groups are not large, though all of them are statistically significant. Organic winemakers and those in conversion on average display a higher level of trust in certifying institutions. They consider the procedure of obtaining a certificate to be difficult and complicated to a lesser degree than conventional winemakers. The time needed for conversion is more rarely considered to pose a problem than in the case of conventional producers in the process of deciding on the method of production. At the same time, organic producers and those in conversion are more positive in their assessment of the subsidy system.

As far as the relations of winemakers with their environment and social factors are concerned, a comparative set of results is presented in Figure 6.

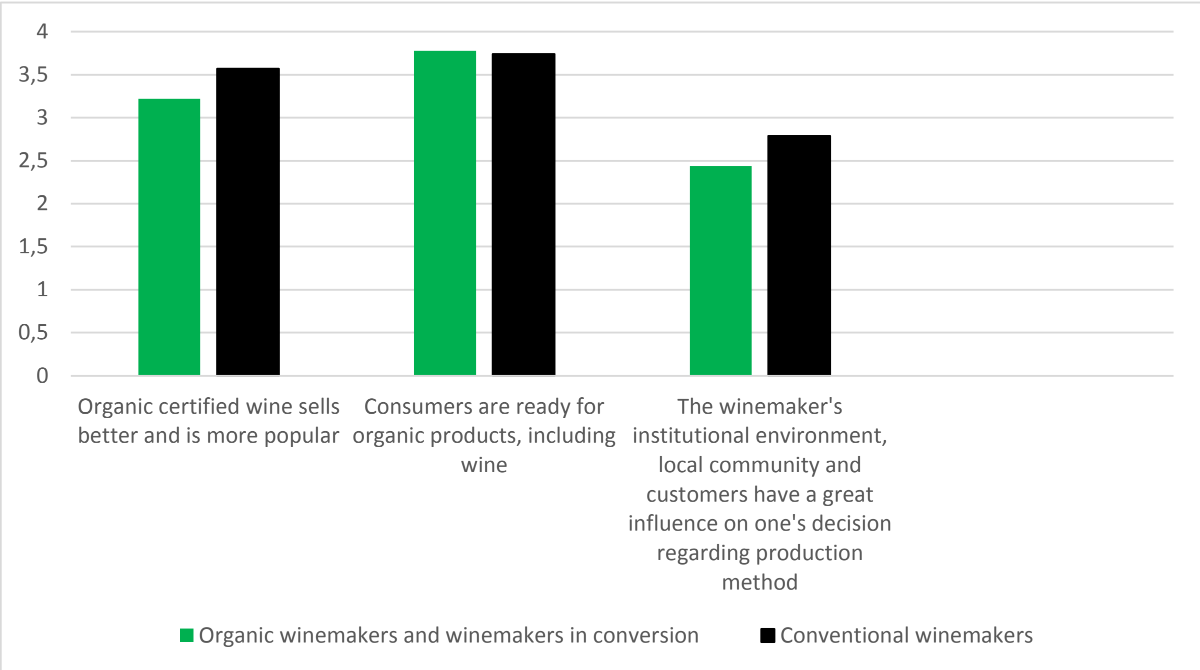

Figure 6. Assessment of conventional and organic winemakers regarding the social environment

As far as the assessment of social factors and social influences are concerned, the differences between the mean responses are not statistically significant. This means that both groups are equally convinced as to the readiness of consumers to accept organic products. Winemakers are however rather skeptical in their approach when it comes to the influence of the social environment on their production decisions.

The largest differences in the perception of organic winemaking are on environmental issues – the impact of that method on the natural environment and the possibility of organic farming in the context of environmental conditions. These differences are shown in Figure 7.

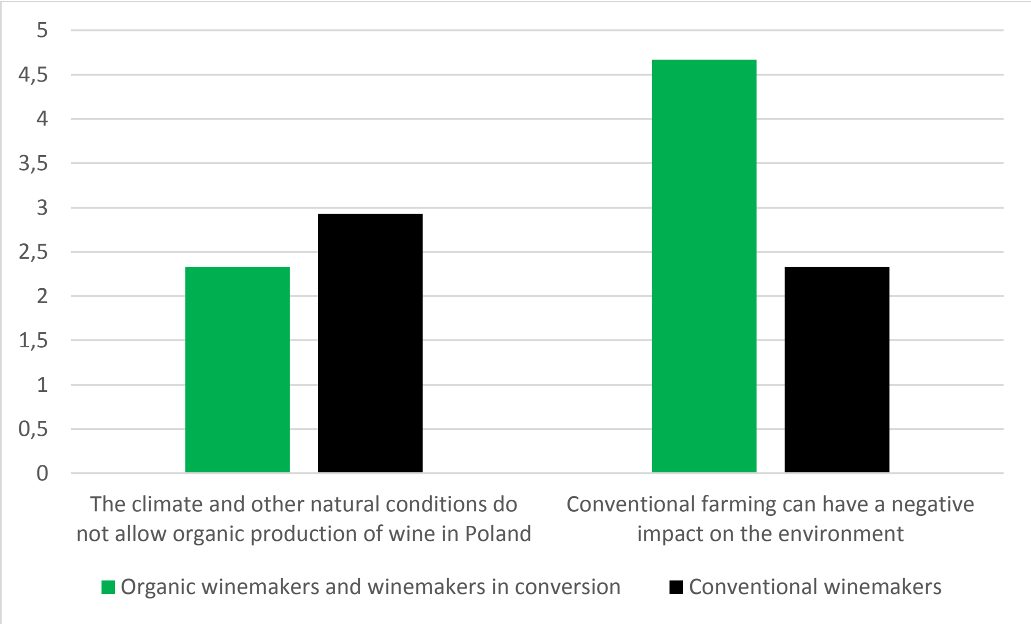

Figure 7. Perception of environmental issues in the view of organic and conventional winemakers

The largest differences in mean responses are to be seen with reference to the perception of the effect that conventional agriculture and processing can have on the environment. Organic winemakers and those in conversion clearly see the potential for conventional methods having a negative impact on the environment. Conventional winemakers disagree with this point of view, instead tending to believe to a greater extent that the climate and natural conditions are not conducive to organic production in Poland. It should however be emphasized that, on average, they do not believe such production to be impossible.

5. Discussion

The aims of the studies was to:

- Construct a decision-making model to understand making a choice process between conventional or organic production.
- Indicate the factors conditioning the decision-making process of pioneers in Polish winemaking regarding production method.
- Indicate the barriers and motivators to the implementation of principles of organic production, in the context of values and beliefs based on the example of Polish winemakers.

Referring to the first aim of the studies conducted was to recreate a decision-making model characteristic for organic and conventional producers, to understand an optimum method of production of wine, taking into account economic, social and environmental criteria, pointing out any significant difference between the groups of producers analyzed, that is between conventional and organic winemakers. Studies conducted to date of the criteria of choice between an organic or conventional method of production focus on two areas – looking for statistical relationships between specific population and/or institutional variables and examination of the values underpinning farmers' decisions. Among the population characteristics related to the functioning of the organic system, age was one of the factors analyzed amongst other things. However, there are no clear conclusions drawn one way or the other here. In Norway and the Czech Republic, young farmers were found to be more willing to engage in organic production, while older farmers above all expected a stable, predictable income (Anderson et al., 2005; Koesling et al., 2008; Pechrová, 2014). In turn, in surveys of farmers from South Korea, age proved to be an insignificant factor (Lee et al., 2016), while in Nepal, the older the farmer, the greater the chance for organic production was shown to be, as older farmers are subject to less pressure to be productive (Singh et al., 2015). A study in the subject of a choice of an organic or conventional method of production by winemakers also did not reveal demographic criteria such as age, gender, roles or experience to be important in making this decision (Cobelli, Chiarini, Giaretta, 2021). Another of the variables frequently analyzed was the level of education. Here, the conclusions were rather similar – a higher level of education was related to a greater tendency to choose organic farming (Lee et al., 2016; Singh et al., 2015). In studies conducted among Czech and German farmers, as in the case of Chinese and organic Austrian farmers, the decision to convert to organic farming was often down to financial considerations related to subsidies (Bichler et al., 2005; Darnhofer et al., 2005; Home et al., 2019; Pechrová, 2014; Wang et al., 2018). An element frequently shown to play a role is the impact of the external social environment, from which organic farmers receive support, whether from the group, an important entity or even appropriately constructed direct sales networks (Anderson et al., 2005; Wang et al., 2018). As far as the values declared by organic and conventional farmers are concerned, studies from New Zealand based on the decision-tree method showed that organic farmers made the conversion based on a life philosophy, a fear of chemically treated food and a concern for health. For a significant group, financial incentives were also a motivating factor (Fairweather, 1999). The aforementioned studies conducted among farmers in Norway also showed there to be differences in the values presented by both groups. Organic farmers indicated 'sustainable and environmentally friendly farming' to be the number one priority of their work, followed by production of high-quality food, and then, only in third place, stability of income, which was the value which was judged to be the most important by conventional farmers, (Koesling et al., 2008) something which was confirmed by the results obtained from the research conducted for the purpose of this article. Surveys of Swiss farmers have shown that the choice of production method is, in their opinion, dependent on the belief that technical and social problems have been solved. Producers often feel social pressure to be productive, and organic production is, in their view, not oriented toward productivity. The authors note a dichotomy between 'us' and 'them', which is not conducive to conversion (Home et al., 2019). Surveys of farmers in Austria have shown that, despite noticeable correlations between population characteristics, it is the values held by farmers that play the key role. The authors identified 5 types of attitude: 1) committed conventional, 2) pragmatic conventional, 3) environmental conscious, but not organic, 4) pragmatic organic 5) committed organic, which differ in terms of their approach to economic and environmental values (Darnhofer et al., 2005).

Research on winemakers and the motives and barriers in making decisions about organic production indicate a significant advantage of non-economic motives in the behavior of organic winemakers. Among the issues affecting the decision to produce organic, it was indicated: performance and effort expectancy, social influences, self-efficiency and specific attitude towards wine production (Cobelli et al., 2021). the key role of non-economic factors is indicated by Dominici, Boncinelli, Marone (2019). In this study, a key role in the decision about organic production is played by passion, the desire for independence, and life close to nature. Conversely, decisions regarding conventional production are dictated by pecuniary motivations and profit maximalistion. These results are confirmed in our research. A detailed study of the motivators and barriers to implementing organic production in selected regions of Germany reveals the positive impact of, among others, environmental awareness (preserving the ecosystem, healthy soil), ideological attitude, and social capital. As for the identified barriers, the authors point to concerns about low yield, ideological prejudices, skepticism, fear of financial risk, bureaucracy and more work (Siepmann, Nicholas, 2018).

In this context, the present survey showed that, the organic winemakers consider environmental issues to be the values of the most importance with a priority value of 0.6911 for organic farming and 0.3089 for conventional farming. In turn, conventional farmers confirmed that they assign greater value to conventional production with a priority value for that production method of 0.5700 compared to only 0.4300 for organic production. None of the groups surveyed considered the social factor and the impact of the surrounding community to be significant (Table 6). The results obtained confirm that conscious choices are made with regard to the farming method used for the production of wine in the groups analyzed.

Table 7.
Local priority values for analyzed alternatives

CRITERION	Local priorities (aggregated)	Local priorities (conventional)	Local priorities (organic)
ORGANIC FARMING	0.4981	0.4300	0.6911
CONVENTIONAL FARMING	0.5019	0.5700	0.3089

The results obtained also indicate there to be significant differences resulting from the judgment of sub-criteria according to their importance for achievement of their goal between conventional and organic winemakers, especially when it comes to economic and environmental criteria (Fig. 8). For organic winemakers, it is above all quality of raw material and the environmental safety of farming method which count, and not the cost of production or farming efficiency. These producers assign a lower value to the subsidy system, which may indicate that the choice of that method of production is made based on an individual value system, and not due to economic considerations. The analyzed criteria were judged differently by conventional winemakers, for whom profits on sales and the related farming efficiency are of most importance. This confirms it to be a commonly-held belief that, from an economic point of view, the yield of organic farming is lower.

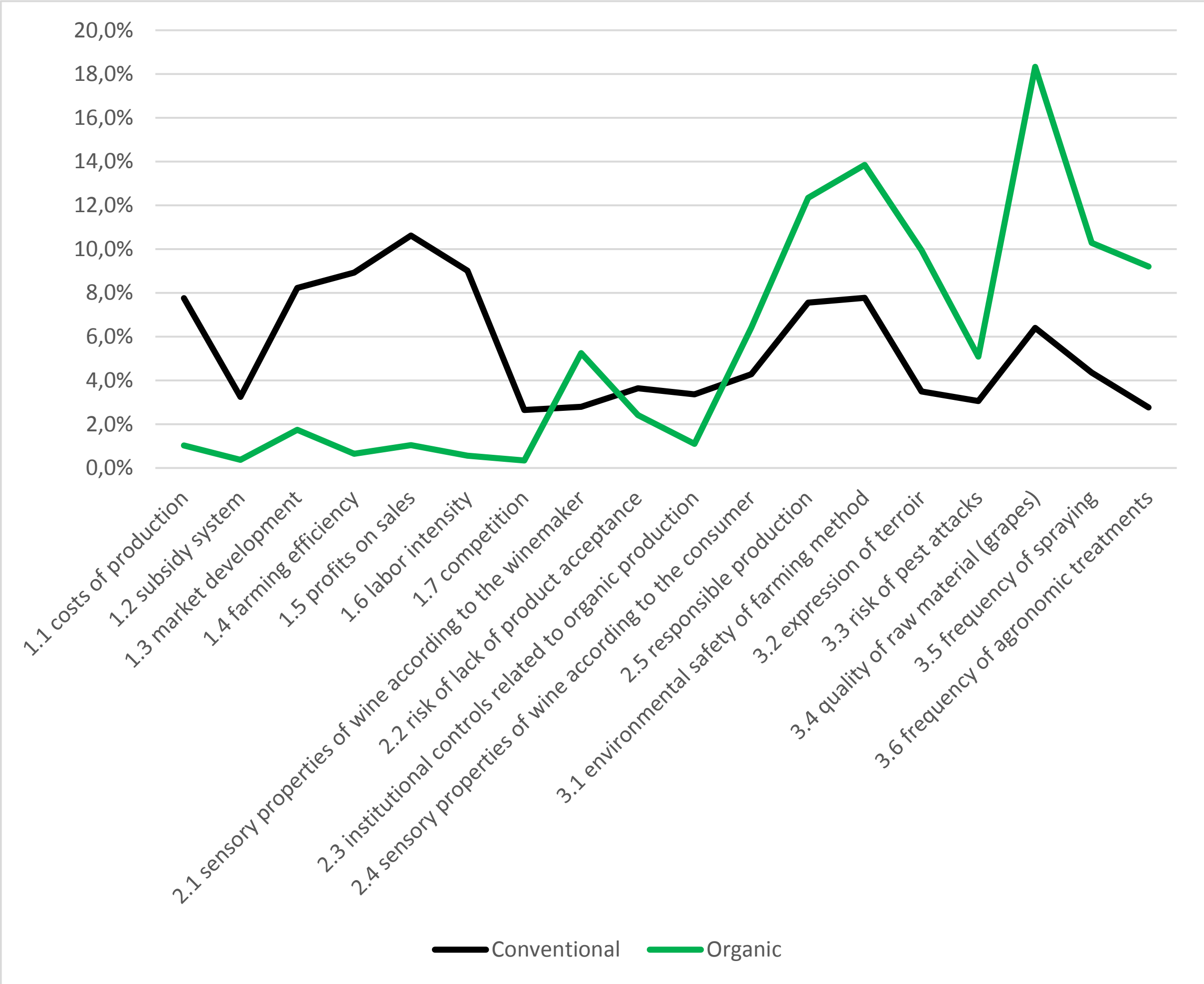

Figure 8. Sub-criteria according to their importance for achievement of goal

Surveys conducted using the AHP method diverge from the results obtained from the behavioral survey, which also showed differences in the perception of organic and conventional production. It revealed there to be statistically significant differences of opinion with reference to the effect of environmental issues and institutional and economic factors. No statistically significant differences were found with reference to the social area. Organic producers on average show a slightly higher level of trust in certification, and see it as having slightly more benefits, and they perceive the process of obtaining certification itself as being less difficult (Fig. 9).

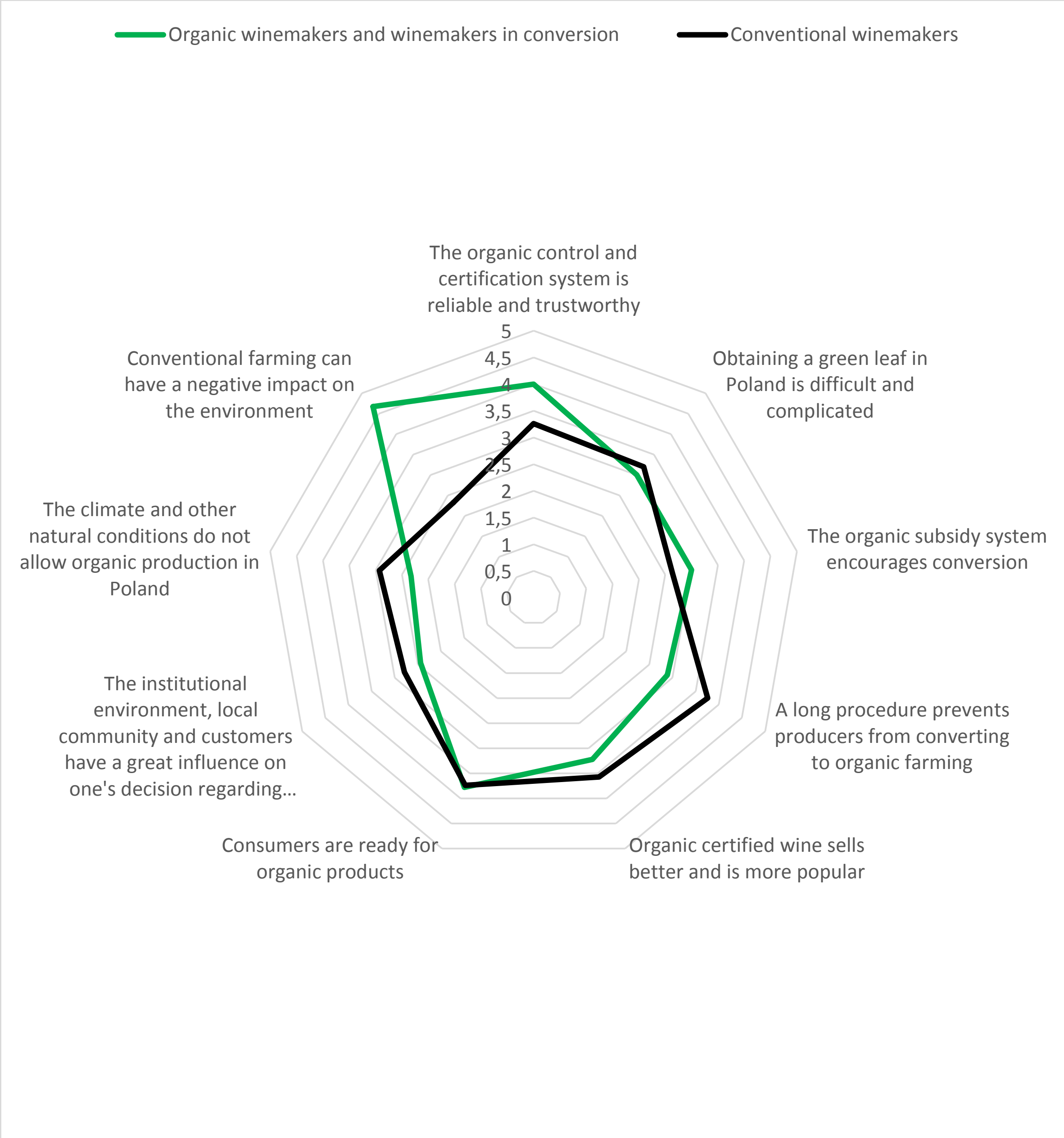

Figure 9. Values among conventional winemakers and organic winemakers and those in conversion

Conclusions

In the context of the formulated research issues:

- Why is organic wine production not very popular, despite growing popularity of organic wine?
- On what values is the winemakers decision-making process based?
- What are barriers and motivators of conversion into organic wine production?
- What actions can be taken to support the conversion towards organic production?

the following conclusions can be made:

The choice of method of production (organic or conventional) depends on the hierarchy of values declared by the winemaker, and the key values taken into account by conventional winemakers are values from the economic area in contrast to organic winemakers, for whom it is values of an environmental nature which are key. Only the social area was a common point of importance to both conventional and organic winemakers. It can therefore be concluded that the low interest in organic production proves the priorities of winemakers, who identify more strongly with pecuniary values.

The course of the decision-making process proves that conventional winemakers more often prioritize economic issues, and organic ones - environmental ones. This is confirmed by a behavioral survey, in which conventional winemakers reveal skepticism towards the method and organic certification.

In the context of the studies conducted, it is also possible to diagnose some barriers to conversion to organic farming. It seems that the main barrier is a lack of environmental sensitivity and awareness, as well as an insufficient level of knowledge and information concerning the benefits of organic farming, above all those of an economic nature. Attention is also drawn to concerns related to the institutional dimension of conversion to organic production. Wine producers are a clearly polarized group and it is possible to conclude that the area which divides them is above all their attitude to the natural environment. In the surveyed group, organic farming still seems to be understood more as a kind of personal mission, or even extravagance, rather than an efficient and profitable alternative method of production.

Attention should however be drawn to certain limitations in the studies conducted. They result from the relatively small population of organic farmers, despite the fact that 90% of winemakers identified in an entire population as organic or in conversion took part in the surveys. In the future, it is planned to conduct surveys on a wider sample, carrying out comparative studies between countries.

The conducted studies may prove to be useful material in making a choice of wine production method not only for producers entering the market, but also for winemakers who are planning a change in production method, but above all, serve as a basis do for the formulation of policy-making recommendations, especially in agricultural and environmental policy. There is also a visible need for education about the possible environmental effects of conventional farming in a monoculture. Support is also needed in improving farmers' knowledge in the area of organic farming – regarding not only procedures and requirements, but also its economic benefits. Identifying organic production with ideology, lack of financial efficiency and greater risk is a dangerous barrier to sustainable development. The research indicates the needs of: changing the attitude of agricultural advisory institutions and administration bodies responsible for agriculture strategies and disseminating knowledge about organic production and its advantages.

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