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AGRICULTURE THROUGH SUSTAINABILITY PERSPECTIVES

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University of Rijeka
Faculty of Economics and Business

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Edited by:
Jana Katunar, Nenad Vretenar & Jelena Jardas Antonić

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Agriculture through sustainability perspectives

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FOREWORD

Today's agriculture is facing a number of challenges that will have a major impact on its future. Therefore, even though most of these issues are universal and apply to the agricultural sector across Europe and the world, this book is dedicated to analyzing the specific problems and opportunities in Croatian agriculture. Understanding these challenges is crucial for developing sustainable strategies that will enable farmers to successfully adapt their operations to global trends and changes.

One of the biggest challenges for Croatian agriculture is its size, which is small, and fragmentation, both of which pose an obstacle in its competitiveness in comparison to large global producers. While the sector is experiencing rapid progress worldwide, the state of Croatian agriculture is aggravated even more by technological backwardness as many farmers still rely on outdated methods and equipment. Rural communities, already burdened by economic challenges, are facing depopulation and out-migration of young people, resulting in the reduction of the agricultural labour force and threatening the survival of rural areas. This is a problem not only in Croatia, but also in other European countries, which increasingly emphasizes the need for sustainable solutions. Moreover, climate change makes the already difficult conditions in agriculture even more complex as it significantly affects crop yields and quality. The preservation of agricultural varieties is not only a question of agricultural survival, but also of preserving cultural heritage and food diversity. Adapting to the new conditions requires innovative approaches, investment in more resilient varieties and equipping farmers with the knowledge and resources needed to manage change effectively.

Despite these difficulties, Croatian agriculture has considerable potential for development. The synergy with tourism offers opportunities to combine local products with the growing agritourism sector, opportunities to promote local products, support rural development and preserve traditions. With the help of government incentives and European funding, Croatian farmers can modernize their farms, invest in innovation and improve product quality. Particular opportunities lie in the development of organic farming, the circular economy and the shortening of supply chains, which enable greater added value for both producers and consumers.

In this book, particular attention is given to products that combine market potential and cultural identity, such as wine, prosciutto and honey. These products not only have high added value, but are also a symbol of Croatian tradition and excellence on the international stage. Their development can open up and create new business opportunities and, at the same time, strengthen the identity of rural communities.

By comprehensively analyzing the challenges and opportunities, this book aims to give the reader a deeper insight into the complexity of the Croatian agricultural sector. We hope that it will help to understand the problems faced, but also to find solutions for sustainable development. With the right use of resources, innovative

strategies and the combination of science and practice, Croatian agriculture has the potential to become more competitive, to preserve rural areas and to contribute to the overall economic development of the country.

We would like to take this opportunity to thank the authors who had recognized the need to participate in writing this book and have contributed to it with their work. We would also like to thank four distinguished university professors who have reviewed the book and have recognized the value of this academic work. In addition, we would like to thank all thirty-four reviewers of the individual chapters, as each chapter underwent a double-blind anonymous review process before the entire book was reviewed. Finally, we would like to thank the management of the Faculty of Economics and Business of the University of Rijeka for their full support in preparing this book. And to conclude, the book in front of you entitled Agriculture Through Sustainability Perspectives is published as a scientific monograph of the University of Rijeka in accordance with the decision of the Senate (Class 007-01/25-03/02, Registration number: 2170-137-01-25-38, on 18th February 2025).

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Jana Katunar, Nenad Vretenar and Jelena Jardas Antonić

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PART ONE

Throughout history agriculture has been one of the fundamental economic activities in every country and is deeply rooted in economic, social and environmental processes. In today's modern world, it is confronted with numerous challenges brought about by globalization, technological progress, climate change, but also as a result of the specific conditions in individual regions. The first part of this book is dedicated to the analysis of the key economic aspects and the challenges facing agriculture, with a particular focus on international trade, profitability, rural development, innovation and current trends in ownership structures in the agricultural sector. The aim of this introduction to the economic and business challenges of agriculture is to provide a comprehensive overview of current trends and development opportunities in the agricultural sector, which is a key area for sustainable economic progress and social stability.

Chapter 1 analyses the trends in international trade in agricultural products, particularly within the European Union, focusing on the differences between the old and new member states. The analysis aims to show how technological factors and production productivity influence the export capacities and thus the economic sustainability of these countries. Chapter 2 focuses on the profitability of agricultural enterprises in Southeast Europe, including Croatia, Slovenia and Serbia. Based on empirical data, factors influencing the business performance of these companies, such as debt, labour productivity and company size, are analysed, taking into account the specific economic and political circumstances of each country. Chapter 3 provides an overview of attitudes towards the importance of agricultural and rural development in Croatia and compares these to those in other EU Member States. This analysis shows how citizens' perceptions of agriculture and its relationship to climate change can determine the direction of further development.

Chapter 4 examines the representation of agricultural topics in the economic literature and shows how the challenges of the agricultural sector, including climate change and technological innovation, are increasingly gaining prominence in academic and professional circles. Chapter 5 looks at innovation and technological progress in agriculture focusing on digitalization, smart farms and precision agriculture. It pays special attention to the barriers in implementing new technologies, especially for smaller farms, and provides recommendations for increasing competitiveness through education and adapted technologies. The last chapter of the first, Chapter 6, deals with the impact of horizontal shareholdings and co-ownership in the agri-food sector. By analysing market dynamics and the impact of ownership consolidation, the chapter explores the effects of these processes on competitiveness, prices and social equality.

DETERMINANTS OF INTERNATIONAL TRADE IN AGRICULTURAL PRODUCTS IN EUROPEAN UNION COUNTRIES

CHAPTER 1

Vinko Zaninović *

ABSTRACT

This chapter presents the trends and analyzes the determinants of bilateral international trade in agricultural products with reference to the European Union and two groups of countries within the European Union: the old (EU14) and the new (EU13) Member States. Considering the importance of the agricultural sector at national level, the importance of the Common Agricultural Policy, as one of the economic and political pillars of the European Union, and the recent global events that have led to increased academic and professional public interest in the agricultural sector, the aim of this chapter is to examine the determinants of international trade in agricultural products at global level and compare them with the situation at EU level and between the mentioned groups of countries in the period 1996-2019. We estimate the extended gravity model of international trade. The estimation results indicate a significant impact of productivity on the export of agricultural products, especially in the new member states of the European Union. Moreover, the new member states focus predominantly on exporting to less competitive markets, which affects the profitability and sustainability of production in these countries.

Keywords: *international trade in agricultural products, gravity model, old EU countries, new EU countries, productivity*

INTRODUCTION

The history of trade in agricultural products goes back to antiquity. In ancient times, natural resources and physical production possibilities, which were primarily determined by the quality of the soil and the climate, were the decisive factor for production and thus also for the pattern of trade. In the 21st century, the above factors continue to have a strong influence on the quantity and quality of agricultural production and patterns of international trade, but the development of technology and various production techniques are becoming increasingly important. Agricultural production, which is the basis of the food industry, is one of the pillars of the development of countries. Therefore, one of the most important goals of the agricultural policies of states and associations such as the European Union is to achieve self-sufficiency in agricultural production, while international trade and the intensity of international trade often depend on the degree of self-sufficiency. As early as 1963, Kuznets investigated the relationship between agricultural activity

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and overall economic activity and quantified the contribution of growth in agricultural activity to economic growth. Most subsequent research has confirmed that the agricultural sector contributes to the process of economic development (Poonyth et al., 2001; Lains and Pinilla, 2009). The EU recognized the importance of agricultural policy and the foundations of the Common Agricultural Policy (CAP) were first laid down in the 1957 Treaty of Rome; the Treaty establishing the European Economic Community (now the EU) and the CAP itself came into force in 1962.

The CAP is one of the EU's most important and oldest policies, introduced with the aim of coordinating and managing the agricultural sector in all EU Member States. Over time, the priorities of agricultural policy have changed, from the priorities of economic reconstruction in the post-war period to the priorities of sustainability and environmental protection. Nevertheless, the agricultural sector has been and remains crucial to the EU economy: although agriculture accounts for only 1.3% of the EU's GDP, it employs 4.2% of the workforce (Eurostat, 2024). The CAP supports the competitiveness of the agricultural sector on the global stage, as the agricultural sector is crucial for employment in rural areas and makes an important contribution to the food and manufacturing industries. The EU is one of the most competitive players in global agricultural trade and its agricultural exports and imports are among the largest in the world. It is the world's largest exporter of agricultural products; in 2022, EU agricultural exports were estimated at over EUR 229 billion (8.9% of total exports; European Commission, 2024), with the main export products including processed food, dairy products, meat, wine, cereals, fruit and vegetables. The country is particularly known for high-quality products such as wine, spirits, cheese, olive oil and processed foods. Due to its good reputation for quality, safety and compliance with strict production standards, there is a high demand for agricultural products worldwide. The competitiveness of agricultural trade in the EU is influenced by various factors, including the CAP, trade agreements, agricultural innovation and environmental standards. The EU also exports agricultural products to all continents, ensuring that it is not too dependent on one country or region to maintain its competitiveness. The EU's numerous free trade agreements with countries such as Canada (CETA), Japan (EPA) and various developing countries further open up markets for EU agricultural products, reduce tariffs and improve access to developing countries.

The EU is not only a major exporter, but also one of the world's largest importers of agricultural products (7.2 of total agricultural imports; European Commission 2024), including tropical products such as coffee, cocoa, fruit and animal feed (e.g. soybeans). This diversity of imports enables the EU to meet consumer demand for a wide range of products.

The EU has also positioned itself as a leader in sustainable agriculture, as the Common Agricultural Policy promotes environmentally friendly agricultural practices. Sustainable agricultural practices are in line with the growing global consumer demand for environmentally friendly and ethically produced products, which also increases the competitiveness of EU agricultural products.

Regardless of the existence of the CAP, there is an obvious difference between the EU member states that joined before 2004 and those that joined after. The differences are visible in the development of the economy, including agriculture. Nowak and Zakrzewska (2024) developed a synthetic index showing the competitiveness of EU countries in agricultural production from 2012 to 2021. None of the new member states were among the top 10 countries in terms of competitiveness in the observed period, and the main bottleneck was the low level of factor productivity. This chapter closely examines the differences in the determinants of exports (whose growth over a given period indirectly indicates an increase in competitiveness) and imports (whose growth over a given period indirectly indicates a possible decrease in competitiveness), controlling for countries' factor productivity.

The aim of this chapter is to examine the determinants of international trade in agricultural products and, in particular, to analyze the specificities of the determinants between two groups of EU countries, i.e. between old and new EU countries (which became members in 2004 and thereafter). Considering the different economic structure and the different economic and social development, it is useful to examine how the influence of selected determinants affects the export and import of agricultural products and whether there are differences between the individual groups. In view of the existence of the CAP and the fact that the new Member States had the opportunity to use EU pre-accession aid, the period from 1996 to 2019 is analyzed. The year 2019 was included in the analysis as the last year, as no observations were available for certain variables from 2020 to 2023. The theoretical basis of the work is Ricardo's theory of comparative advantage, according to which the motive for trade results primarily from the different ratio of product prices between countries, which is caused by differences in productivity, Heckscher-Ohlin's theory of comparative advantage, according to which countries export/import products that make more intensive use of factors of production in which the country is relatively rich/scarce, and the gravity model of international trade, according to which economically similar countries trade more, while the increase in trade costs of production has a negative impact on the volume of trade.

The rest of the chapter briefly reviews the literature of the research area, i.e. the development of international trade in agricultural products and the impact of EU agricultural policy on international trade in agricultural products between the old and new Member States. The third chapter presents the methodology used and describes the database. The fourth chapter presents the research results and explains the practical significance of the results. Finally, the conclusions of the study are presented in the fifth chapter.

LITERATURE REVIEW

The gravity model of international trade is the model most commonly used in the economic literature to assess the determinants of international trade. Based on the analogy of gravity to explain the volume of bilateral trade, the gravity model has become very popular in the study of international trade, i.e. bilateral trade flows (Head and Mayer, 2013). The gravity model, which has been tested in the analysis of aggregate exports and imports, but also at the sectoral and firm level, has found its

application in international trade in various agricultural products with a focus on European Union countries (Atici and Guloglu, 2006; Persson, 2008; Hatab, Romstad, and Huo, 2010; Cipollina et al., 2013; Já mbor, 2014; Braha et al., 2017). Of particular note is the work of Balogh and Leitao (2019), who apply the gravity model to investigate the effects of geographical proximity, cultural similarity and free trade agreements on bilateral agricultural trade and intra-trade between EU Member States and their trading partners (EU internal and external trade). The results of their study show that the EU exports more agricultural products to other Member States than to third countries and that export costs are lower when the EU has similar cultural similarities, the same religion or a free trade agreement. Cantore, Canavari and Pignatti (2008) evaluate the determinants of international trade in agricultural products using Italy as an example and using the variable of environmental standard as one of the regressors. Indeed, their hypothesis is that similar standards of countries in terms of organic production have positive effects on trade between them. The results of the gravity model estimation show that countries with "similar" organic standards develop more intensive bilateral trade relations compared to those of Italy. In this chapter, a similar control variable is used as a measure of the sustainability of agricultural production - the nitrogen use sustainability index.

In this chapter, the theory of Ricardo and Heckscher-Ohlin is empirically tested on the basis of the theoretical foundation first presented by Bergstrand (1989) within the gravity model of international trade.

The modularity of the gravity model, i.e. the possibility of incorporating different theories of international trade into the methodological framework and model of the gravity model, has been demonstrated in recent theoretical research by Costinot and Rodriguez-Clare (2014).

To achieve the research objective, it is necessary to determine whether there are significant differences in the influence of certain variables of the gravity model on trade (export and import) in agricultural products compared to trade in other goods. Therefore, the results of the estimations of this chapter are compared with the results of the meta-analysis of the coefficients of the gravity model variables prepared by Head and Mayer (2014: 160). In this chapter, the extended structural gravity model is evaluated, and Table 1 shows the results of the meta-analysis mentioned above.

	All gravity models				Structural gravity models			
variables	Median	Average	Standard deviation	Number of ex.	Median	Average	Standard deviation	Number of ex.
distance	-0.89	-0.93	0.4	1835	-1.14	-1.1	,41	328
k. border	0.49	0.53	0.57	1066	0.52	0.66	0.65	266
zaj. language	0.49	0.54	0.44	680	0.33	0.39	0.29	205
col. relationship	0.91	0.92	0.61	147	0.84	0.75	0.49	60
RTA	0.47	0.59	0.5	257	0.28	0.36	0.42	108

Table 1 Results of a meta-analysis by Head and Mayer
Source: creation of the author according to Head and Mayer, 2014, p. 160

In the literature aimed at testing the adequacy of Ricardo's and Heckscher-Ohlin's theories to explain trade patterns in agricultural products, the results of Gopinath and Kennedy (2000) stand out, showing that the level of available capital and labor affects the export of agricultural products from the US. Li (2012) came to the same conclusion in the case of China. Costinot and Dondaldson (2012) found that Ricardo theory accurately predicts patterns of trade in agricultural products at the global level, i.e. for the world's top 55 producers of agricultural products. The authors obtained the data on agricultural production and producer prices from FAOSTAT, while the data on productivity came from the results of the Global Agricultural-Ecological Zones project. Conceptually, this study follows the above, with the differences in the choice of variables arising from the theories of international trade mentioned above and the fact that in this study all three theories are tested with a single econometric model.

METHODOLOGY AND DATA

For the econometric evaluation of the model, this chapter uses the Poisson pseudo-maximum credibility (PPML) estimator introduced by Santos Silva and Tenreyra (2006) for the evaluation of the gravity model of international trade. The advantage of this estimator over the OLS estimator is its impartiality and consistency in the case of residual heteroscedasticity, which is the case in practice when analyzing bilateral trade data. The use of panel data also makes it possible to control for heterogeneity between trading pairs. Based on the previous literature review in the field of international trade in agricultural products, i.e. its determinants, the following econometric model was defined:

$$trgovina_{ijt} = \exp(\beta_0 + \beta_1 lgdp_{it} + \beta_2 lgdp_{jt} + \beta_3 ldistcap_{ij} + \beta_4 zgranica_{ij} + \beta_5 kol_odnos_{ij} + \beta_6 KL_{it} + \beta_7 KL_{jt} + +\beta_8 obradivapp_{it} + \beta_9 obradivapp_{jt} + \beta_{10} tfp_{it} + \beta_{11} tfp_{jt} + \beta_{12} snmi_{it} + \beta_{13} snmi_{jt} + \beta_{14} fta_{ijt} + \lambda_t + \theta_i + \mu_j + u_{ijt}) \quad [1]$$

In equation 1, trade represents trade flows from country *i* to country *j* at time *t* (two models are estimated; in one, exports are the dependent variable, and in the other, imports are the dependent variable). When the PPML estimator is used in the estimation, it means that a linear-logarithmic model is estimated (the dependent variable is in absolute values, and the continuous independent variables are logarithmic), so that the trade flows are expressed in US dollars, and the three continuous independent variables ($lgdp_{it}$, $lgdp_{jt}$ and $ldistcap_{ij}$) are respectively the gross domestic product of partner *i* , partner *j* and the distance between the main cities of trading partners (originally expressed in kilometers). The *border* variable is a binary variable with a value of 1 if the countries have a common land border, while *col_relations* is a binary variable with a value of 1 if the countries have ever been in a colonial or dependent relationship (eg in the same state). The variables KL_{it} and KL_{it} represent the ratio of capital and labor of countries, while $obradivapp_{it}$ and $obradivapp_{jt}$ represent the area of arable land (measured in hectares) per inhabitant. Variables tfp_{it} and tfp_{it} are total factor productivity (measured in relation to the USA and corrected for purchasing power parity), and $snmi_{it}$ and

$snmi_{jt}$ present indices of sustainable nitrogen management in agricultural production. The variable *fta_wto* is a binary variable with value 1 if there is a trade agreement between the partner countries in year t ,. The variable $\lambda_t$represents time effects, while the variables $\theta_i$and $\mu_j$represent binary fixed effects, or MOTs, according to the research of Anderson and van Wincoop, 2003. The last term of equation 1, u_{ijt}, represents the stochastic error of the model.

Variables	Observations	Average	Standard deviation	Minimum	Median	Maximum
Total trade	425942	3.03e+08	2.44e+09	0.000	4.24e+06	1.53e+11
Export	425942	1.51e+08	1.34e+09	0.000	6.52e+05	9.37e+10
Import	425942	1.53e+08	1.32e+09	0.000	7.38e+05	9.86e+10
GDP_i	373433	5.49e+08	1.83e+09	76553,440	6.60e+07	2.14e+10
GDP_j	367334	4.65e+08	1.68e+09	76553,440	4.63e+07	2.14e+10
Distance	358658	6928,417	4349,726	2,000	6565,000	19815,000
Joint cop. border	358658	0.026	0.160	0.000	0.000	1,000
Qty. relationship	358598	0.016	0.126	0.000	0.000	1,000
Ratio K/L_i	394167	2.24e+05	1.92e+05	2071.911	1.58e+05	1.23e+06
Ratio K/L_j	391630	2.00e+05	1.89e+05	1398.182	1.28e+05	1.35e+06
Arable land pc_i	407677	0.245	0.269	0.000	0.166	3,192
Arable land pc_j	405250	0.229	0.251	0.000	0.157	3,192
Inc. fac. productivity $_{and}$	316815	0.716	0.253	0.145	0.717	2,425
Inc. fac. productivity $_j$	290324	0.696	0.261	0.055	0.696	2,425
$SNMI_{and}$	394616	43,369	17,739	0.000	42,680	99,477
$SNMI_j$	391298	41,458	17,581	0.000	40,242	99,477
FTA	358658	0.180	0.385	0.000	0.000	1,000
EU_{and}	377978	0.221	0.415	0.000	0.000	1,000
EUj	378641	0.175	0.380	0.000	0.000	1,000

Table 2 Descriptive statistics for the entire sample
Source: Author's calculation
(Comment : SNMI is an acronym for Sustainable Nitrogen Management Index , Croatian index sustainable of use nitrogen - composite index with values between 0 and 100. A value of 100 indicates that the country optimizes yields in agriculture production and application fertilizers ; FTA is an acronym for Free Trade Agreement, Croatian . Agreement on leave trade . All continuous variables shown are in absolute values , exports , imports and GDP in US in dollars , distance in kilometers ; workable area in hectares per inhabitant)

Table 2 shows descriptive statistics for the entire sample, which includes 27,070 trading pairs over 24 years (from 1996 to 2019). The total factor productivity variable is used to test Ricard's theory of comparative advantage, according to which the motive for bilateral trade results from differences in the relative prices of products between countries, which are a consequence of countries' different technological capabilities, i.e. differences in productivity. The variables farmland and capital per worker are used to test the Heckscher-Ohlin theory of comparative advantage, according to which the motive for bilateral trade results from different ratios of factors of production between countries. Since both the Ricardo and Heckscher-Ohlin theories of international trade assume perfect competition on the supply side, the agricultural sector is ideally suited for the empirical testing of these theories, as this sector comes closest to the theoretical assumption of perfect competition, which is a rare case. By including the SNMI variable, we control for the sustainability of agricultural production through the low and efficient use of

nitrogen, which is increasingly promoted in the EU through the CAP. The other variables are the usual variables for a gravity model of international trade.

Figure 1 shows the trade balances of the new Member States of the European Union (with the exception of Malta and Cyprus) for trade in agricultural products during the observation period. The years of accession of certain subgroups of countries to the EU (2004, 2007 and 2013) are particularly marked. Only Poland recorded a significant change in the trade balance from exports and imports to a trade surplus after EU accession, while no significant change in the trade balance can be observed for the other countries.

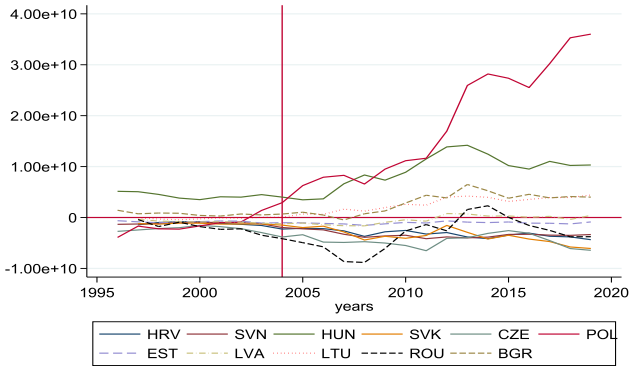

Figure 1 EU11 trade balance from 1996 to 2019
Source: Creation of the author
(Comment: Cyprus and Malta are not included)

Figure 2 shows trade balance sheets old ones countries member of the EU for trade agricultural products. Half the old ones of EU countries records positive commercial balance , and values surplus significantly are larger compared to the new one countries members .

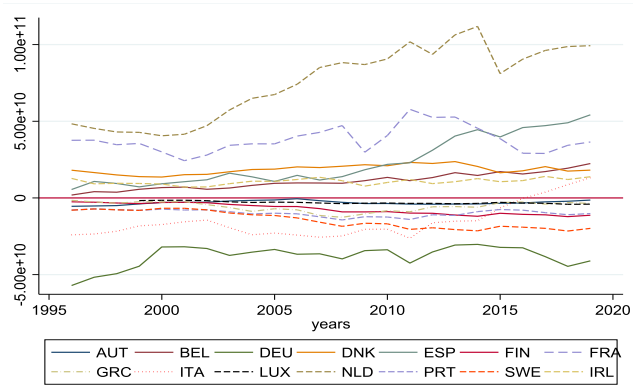

Figure 2 EU14 trade balance from 1996 to 2019
Source: Creation of the author
(Comment: Great Britain is not included)

Figure 3 shows the coverage of imports by exports for 25 EU countries in 2019. In the top 10 countries according to that statistic, there is an approximately equal number of old (6) and new countries (4), although the old countries lead in absolute values (compare with Figures 2 and 1).

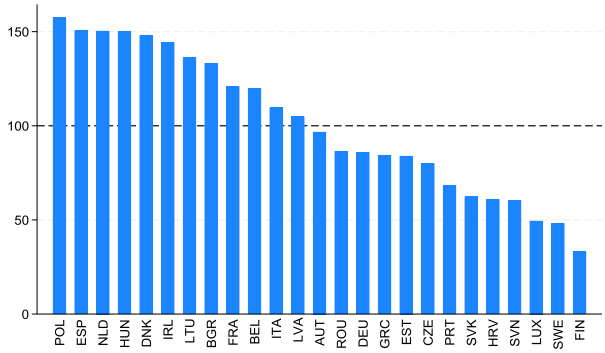

Figure 3 Coverage of imports by exports in the EU25 in 2019
Source: Creation of the author
(Comment : They are not included Cyprus , Malta and Great Britain)

The decoupling of the SNMI between old and new member states is visible in Figure 4, especially after 2010. The decoupling is taking place in the wake of the global financial crises. Although sustainable production was primarily promoted by the old member states, they recorded a decline in the SNMI indicator.

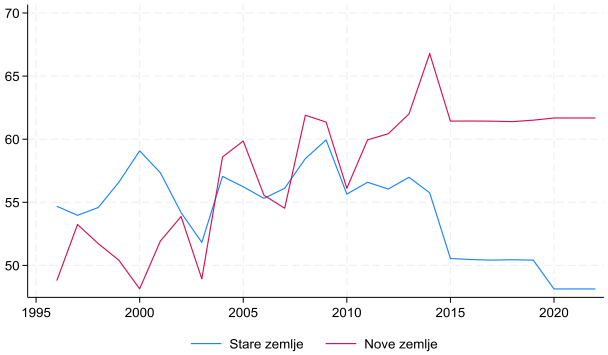

Figure 4 Comparison of indices of sustainable nitrogen management in agricultural production: old versus new EU member states from 1996 to 2021
Source: Creation of the author

RESULTS AND DISCUSSION

Table 3 contains the estimation results of Model 1 for the whole sample, i.e. for all trade pairs, and the estimation results represent reference values for Model 1 estimated (separately) for the old and the new Member States. In the first column are the results when the dependent variable is total trade (export + import), in the second and third column when the dependent variables are export or import of

model 1. The estimated coefficients can be categorised into three groups: related to the gravity model (GDP, distance, common land border, colonial relations, free trade agreements), related to Heckscher-Ohlin theory (K/L and arable land pc) and related to Ricardo's theory of comparative advantage (total factor productivity SNMI). The results show that the results of the gravity model are consistent with the results of previous studies (Head and Mayer 2016), i.e. that the methodological framework of the gravity method is applicable to trade in agricultural products. For the whole sample, the results of the empirical testing of the Heckscher-Ohlin and Ricardo models are not in line with expectations, which can be explained by the pronounced heterogeneity of the sample and trade pairs, as well as the fact that trade in agricultural products is a necessity for certain countries and groups of countries (be it for export or import).

	(1)	(2)	(3)
	Total trade	Export	Import
lGDP $_i$	0.607 ***	0.459 ***	0.728 ***
	(0.0635)	(0.0796)	(0.0868)
GDP $_j$	0.426 ***	0.762 ***	0.164 ***
	(0.0489)	(0.0687)	(0.0467)
Distance	-0.616 ***	-0.707 ***	-0.531 ***
	(0.0555)	(0.0649)	(0.0635)
Zay. cop. Gr.	1,070 ***	1,102 ***	1,067 ***
	(0.0755)	(0.0968)	(0.0884)
Qty. relationship	0.602 ***	0.549 ***	0.655 ***
	(0.0878)	(0.149)	(0.110)
K/L $_i$	-0.000000319	-8.51e-08	-0.000000556
	(0.000000307)	(0.000000344)	(0.000000392)
K/L $_j$	0.00000105 ***	6,62e-08	0.00000168 ***
	(0.000000313)	(0.000000411)	(0.000000336)
Arable land pc $_i$	0.209	-0.265	0.681
	(0.378)	(0.456)	(0.511)
Arable land pc $_j$	0.494 *	0.303	0.650
	(0.251)	(0.282)	(0.365)
Inc. fac. prod. $_{and}$	0.00324	0.231	-0.187
	(0.158)	(0.186)	(0.186)
Inc. fac. prod. $_j$	0.0167	-0.436 **	0.367
	(0.151)	(0.156)	(0.200)
SNMI $_{and}$	0.00371 ***	0.00477 ***	0.00241 *
	(0.000923)	(0.00117)	(0.00113)
SNMI $_j$	0.00477 ***	0.00170	0.00806 ***
	(0.00102)	(0.00159)	(0.00139)
FTA	0.895 **	1,041 **	0.714 **
	(0.283)	(0.321)	(0.229)
Constant	3,534 *	0.240	4,880 *
	(1,672)	(2,286)	(2,093)
Number op.	53327	53327	53327
pseudo R^2	0.937	0.930	0.922

Table 3 Results of estimation of Equation 1
Standard errors in parentheses: *** p < 0.01, ** p < 0.05, * p < 0.1
Source: Author's calculation

Table 4 shows the results of Model 1 estimated for the old EU countries (columns 1 and 3) and the new EU countries (columns 2 and 4). The coefficients of the gravity variables are largely in line with expectations, although some of them deviate from the usual values. For example, the coefficient of the binary variable colonial relations

is not significant for the new EU countries, neither for exports nor for imports, as these countries were historically not colonial powers. Comparing the results, it is clear that trade costs, measured by the variable distance between trading pairs, have a more negative effect on exports and imports of the new member states, indicating a greater competitiveness of the old countries. It is also evident that the old countries make better use of the better competitive position in third-country markets that the free trade agreements give them.

To assess the validity of the Heckscher-Ohlin theory in the results, we would expect countries with a higher K/L ratio to import more than countries with a lower K/L ratio because agricultural activity is relatively labor intensive. In addition, countries with more available arable land per capita should specialize relatively more in agricultural production and export more. The results presented partly confirm this. The new member countries export relatively more to countries with a higher K/L ratio, which is consistent with the HO theory, while the old member countries export and import more from countries with a lower K/L ratio, which are on average less developed countries. Although the latter is inconsistent with the HO theory, it is in line with empirically established patterns of trade in agricultural products. The coefficients for arable land are only significant for the new EU countries and indicate that these countries export more to countries with a smaller arable land area and import more from countries with a larger arable land area per capita, which is in line with expectations.

Finally, Ricardo's theory was partially confirmed for both groups of countries. In the new Member States, exports are a positive function of total factor productivity (coefficient value 1.351), while imports are a negative function (coefficient value -1.066). The estimated coefficients indicate that the old and new Member States import more from countries with a higher SNMI index, which is in line with the CAP and the protection of domestic sustainable production.

	(1) Old EU countries	(2) New EU countries	(3) Old EU countries	(4) New EU countries
	Export	Export	Import	Import
lGDP $_i$	0.122	0.526 *	0.765 ***	0.540 **
	(0.0983)	(0.227)	(0.140)	(0.167)
GDP $_j$	0.782 ***	0.474 ***	0.232 ***	-0.144
	(0.0749)	(0.128)	(0.0523)	(0.0809)
Distance	-0.672 ***	-1,037 ***	-0.410 ***	-0.961 ***
	(0.0788)	(0.118)	(0.0854)	(0.122)
Zay. cop. Gr.	0.918 ***	1,068 ***	1,080 ***	0.911 ***
	(0.0992)	(0.143)	(0.120)	(0.145)
Qty. relationship	0.457 **	-0.352	0.570 ***	-0.326
	(0.166)	(0.368)	(0.154)	(0.557)
K/L $_i$	-0.000000653 *	0.00000190	-0.00000131 **	-0.00000148
	(0.000000318)	(0.00000139)	(0.000000407)	(0.000000983)
K/L $_j$	0.000000745	0.00000407 ***	0.00000135 **	0.00000342 ***
	(0.000000438)	(0.00000114)	(0.000000449)	(0.000000651)
Arable land pc $_i$	-1,680	0.480	1,782	0.415
	(0.878)	(0.331)	(1,221)	(0.331)
Arable land pc $_j$	0.161	-1.001 *	0.345	1,573 **
	(0.326)	(0.428)	(0.352)	(0.529)
Inc. fac. prod. $_{and}$	-0.0898	1,351 ***	-0.368	0.0762
	(0.200)	(0.398)	(0.220)	(0.296)

Inc. fac. prod. $_j$	-0.281	-1,066 ***	0.275	0.665 *
	(0.177)	(0.292)	(0.219)	(0.319)
SNMI $_{and}$	0.000658	0.00252	0.000387	-0.000141
	(0.000958)	(0.00165)	(0.000865)	(0.00127)
SNMI $_j$	-0.000838	-0.00603	0.00889 ***	0.00348 *
	(0.00162)	(0.00312)	(0.00185)	(0.00165)
FTA	1,050 *	0.0707	0.590 **	0.186
	(0.408)	(0.129)	(0.225)	(0.0980)
Constant	7,554 *	5,658	2,821	16.76 ***
	(2,970)	(4,863)	(3,195)	(3,697)
Number op.	29352	24761	29352	24761
pseudo R^2	0.952	0.889	0.934	0.888

Table 4 Results of estimation of Equation 1
Standard errors in parentheses: *** p < 0.01, ** p < 0.05, * p < 0.1
Source: Author's calculation

CONCLUSION

This study examined and analyzed the trends and determinants of bilateral trade in agricultural products, focusing on the old and new EU Member States. The research findings point to the importance of productivity and economic structure in shaping international trade in agricultural products within the European Union, with differences found between the old and new Member States. The results confirm that the new EU Member States are oriented towards less competitive markets, which affects their profitability and long-term sustainability. On the other hand, the old member states show greater competitiveness in global markets, with greater utilization of agricultural resources and the application of innovation in production.

The gravity model proved to be suitable for analyzing bilateral trade flows in agriculture, while the theories of comparative advantage, such as those of Ricardo and Heckscher-Ohlin, were partially confirmed. While the old EU member states benefited from higher factor productivity and economic development, the new members experienced a positive development in agricultural exports thanks to the Common Agricultural Policy and the adaptation of production to European standards.

This research points to the need for further investment in increasing productivity and sustainable practices in agriculture, especially in the new EU Member States, in order to increase their competitiveness on international markets. The continuation of the research should go in the direction of analyzing the sectoral interdependence of the agricultural sector between the EU member states with the help of an input-output analysis. In this way, the channels of influence of exogenous shocks on the activity of the agricultural sector at EU level could be determined, which would be useful for policy makers in defining measures to strengthen the resilience of the agricultural sector and, consequently, to strengthen competitiveness vis-à-vis the rest of the world. Future policies should certainly focus on sustainable production, environmentally friendly practices and strengthening international cooperation to ensure the stability and growth of the agricultural sector across the EU.

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PROFITABILITY DETERMINANTS OF AGRICULTURAL FIRMS IN SELECTED SOUTH-EASTERN EUROPEAN COUNTRIES

CHAPTER 2

Ivana Tomas Žiković *

ABSTRACT

The chapter analyses the determinants of profitability of companies engaged in agricultural crop production in Croatia, Slovenia and Serbia. On the one hand, the analysis across all firms shows that more indebted companies and those with slower receivables collection achieve lower profitability due to higher debt servicing costs and lower liquidity. On the other hand, higher sales growth rates and higher labour productivity have a positive effect on profitability. Similarly, larger agricultural companies achieve higher returns, which can be explained by their stronger negotiating position, easier access to finance and economies of scale. Contrary to expectations, younger companies have higher profitability, which is probably due to their greater flexibility compared to older companies. In a cross-country analysis, indebtedness and labour productivity have a significant impact on profitability in all countries, while other determinants vary. In Croatia and Slovenia, more profitable companies pay off their debts faster and achieve higher returns. This can be partly attributed to EU membership, where agricultural support systems, better regulated markets and a more stable business environment contribute to greater security and profitability in agricultural production. Although Croatia and Slovenia are EU members and following the Common Agricultural Policy, Croatia and Serbia are rather similar in terms of the analysing determinants such as sales growth and shorter collection periods. Both countries have undergone a number of political and economic changes, including the privatisation and modernisation of farms, which should lead to higher profitability in the future. Finally, a different impact on profitability can be observed for younger companies in Croatia and Slovenia, which are more profitable than the older ones, while in Serbia, larger companies perform better than the smaller ones. These findings may be of use to sector stakeholders, including owners, managers and policy makers in improving the performance of the companies analysed in this chapter.

Keywords: *profitability determinants, agricultural activity, crop production, panel data analysis*

INTRODUCTION

Agricultural production is considered a sector of national interest, i.e. of national security, in almost all countries. The primary food production is a prerequisite for the security and stability of the nation and any government. In the 21st century, with growing interest in climate change and the sustainability of production, society is increasingly concerned about perceived resource scarcity, androgenic effects on the climate, and concerns about food and energy security.

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The European Green Deal aims to transform the entire European economy and society to ensure sustainability and minimise the impact on climate change. Agriculture is one of the most important pillars of the European Green Deal due to its importance for the European Union from an economic, social and security policy perspective. Crop production has a significant share (60%) in the production of agricultural goods in the EU and Croatia (Croatian Bureau of Statistics, 2023). It is important to note that crop production systems play an important role in agricultural land use decisions. The combination of different elements such as crop rotation, green manure and different tillage methods within a cropping system can significantly influence both environmental and economic outcomes. Understanding the performance of each element and the complex interactions between elements is fundamental to designing sustainable agricultural practises that promote long-term environmental benefits while ensuring the economic resilience of crop producers.

The demands placed on European farmers are leading to a significant increase in the complexity of the strategies and measures required of agri-food businesses, which are faced with complex technical and socio-environmental constraints in order to maintain and improve their economic vitality and efficiency. The European objectives are very ambitious and require a strong operational and financial commitment from agricultural companies to adapt to the new production requirements imposed by the European Commission. However, as the European Commission wants to achieve its environmental and social objectives, the agricultural sector must remain profitable and competitive on the international market (Uhre, Buckwell, 2014). In order to increase efficiency and withstand price pressure, agricultural companies are increasingly struggling to achieve the necessary level of profitability (Yazdanfar, 2013). Therefore, the aim of this chapter is to analyse the determinants of profitability of agricultural companies in selected countries in South-Eastern Europe (Croatia, Slovenia and Serbia) using a panel analysis that allows the profitability of enterprises to be tracked over time. Additionally, the goal is to examine whether there are differences in the determinants of profitability between these countries and how these determinants vary depending on the specific conditions in each country. Previous research has focussed exclusively on internal determinants of profitability (firm-specific variables). In this chapter, in addition to the firm-specific variables, the impact of GDP growth as an external determinant of profitability is also analysed. The extensive dataset for the period from 2017 to 2022 is collected for companies engaged in crop production within the agricultural sector. The main findings relate to differences in the determinants of profitability of agricultural companies operating in neighbouring countries in South-Eastern Europe.

The chapter is divided into five sections. After the introduction, the second section provides an overview of previous research on the determinants of profitability and a description of the variables used. The third section presents the characteristics of the sample, a description of the variables and the methodology. The fourth section presents the results of the empirical research, while the fifth section contains the concluding discussions.

THEORETICAL BACKGROUND

Agricultural production has specific characteristics, e.g. in terms of the intensity of land use and other biological requirements for primary agriculture, the demand for low-skilled seasonal labour and the emphasised seasonality of production (Charlton, Castillo, 2020; Luckstead, Nayga, Snell, 2020). For these reasons, the topic of sustainability in agriculture is becoming increasingly important both academically and in practise (Camaréna, 2020, Fridman, Koellner, Kissinger, 2021). The paradigm that focused only on the financial profitability of agricultural production now emphasises the need to achieve a balance between financial profitability and the sustainability of production itself. This trend is particularly visible in the European Union (see e.g. Stoorvogel et. al, 2004, Vastola et. al, 2017, Špička et.al, 2020).

Previous studies on the determinants of profitability have focussed on the profitability of firms within a particular industry: manufacturing firms (McDonald, 1993; Goddard, 2005; Agiomirgianakis et al, 2006; Coban, 2014; Škuflić, Goddard 2005; Mlinarić, Družić, 2016, etc.); construction firms (Škuflić, Mlinarić, Družić, 2018, etc.); hotel firms (Dimitrić, Tomas Žiković and Arbula Blecich, 2019; Škuflić, Mlinarić, 2015, etc.); agriculture firms (Kryszak, Guth and Czyżewski, 2021; Jakšić et al., 2016; Mijić, Jakšić 2017, Tekić et al., 2023, Tomašević et al., 2019, Zouaghi, Hirsch and Garcia, 2016).

Mijić and Jakšić (2017) found that the profitability determinants of agricultural enterprises in Southeast European countries differ to a certain extent depending on the country of origin. For example, only in Hungary (HU), Romania (RO) and Bosnia and Herzegovina (BiH) does debt have a significant and positive impact on firm profitability, while size has a significant and negative impact on profitability only in Hungary and Romania. The quick liquidity ratio and growth had a positive impact on the profitability of agricultural enterprises in all South Eastern European countries. The differences in agricultural policies reflect the differences in profitability between Hungary and Romania compared to the Republic of Serbia (RS) and Bosnia and Herzegovina, which are not EU members.

In order to explain the profitability of companies, various authors have used the following firm-specific determinants: debt, firm growth, investment, inventory turnover, receivables collection period, payables payment period and labour productivity. In addition, non-financial variables related to the size and age of the company were also analysed. As external factors also influence the profitability of companies, the impact of GDP growth as an indicator of economic activity was also analysed in addition to the internal determinants.

SAMPLE CHARACTERISTICS, VARIABLE DESCRIPTION AND METHODOLOGY

Sample characteristics and variable description

The final sample includes data for 1,395 companies (7,696 observations) from Croatia, Serbia and Slovenia for the period from 2017 to 2022 that are engaged in

crop production within the agricultural sector according to the US SIC classification (01 – Agricultural Production - Crops (Industry Group 011: Cash Grains)). For each country, companies without financial data were excluded from the sample. An additional condition for the selection of companies was the availability of data for at least four consecutive years. The companies' financial data is taken from the Orbis Europe Moodys database, while the GDP growth data is taken from the World Bank and OECD databases. The sample is dominated by companies from Serbia (754) and Croatia (520), while for Slovenia data was available for 121 companies according to the defined criteria. The distribution of companies across the countries observed is shown in Table 1.

Country	Number of firms
CROATIA	520
SLOVENIA	121
SERBIA	754

Table 1 Distribution of firms according to the country of origin
Source: Author

Based on previous studies, the following variables were used to explain the profitability of companies: debt ratio, firm growth, investment, inventory turnover, receivable collection period, creditor payment period, total asset turnover, labour productivity, age and size of the firm. The age and size of the company represent the non-financial firm-specific variables. GDP growth was used as an indicator of economic activity.

The description of the firm-specific variables and the macroeconomic variable as an external determinant can be found in Table 2.

Symbol and type	**Definition**		**Source**
Dependent variable			
ROA	**Return on asset using P/L before tax**	(Profit before tax / Total Assets) * 100	Orbis Europe
Explanatory variables			
Firm-specific variables (internal factors)	**Definition**		**Source**
DEBT	**Debt ratio**	(Non-current liabilities + Current liabilities) / Total assets	Orbis Europe
GROWTH	**Firm growth**	(Sales in current period – Sales in the previous period) / Sales in the previous period	Authors calculation according to Orbis Europe data

INV_TA	**Investments**	((Tangible fixed assets in current period – Tangible fixed assets in the previous period) + Depreciation)) / Total assets	Authors calculation according to Orbis Europe data
STOCKTURN	**Inventories (stock) turnover**	Operating revenues/ Inventories	Orbis Europe
COLP	**Collection period (days)**	(Debtors / Operating revenue) * 360	Orbis Europe
CREDITP	**Credit period (days)**	(Creditors / Operating revenue) * 360	Orbis Europe
OR_EMP	**Operating revenue per employee**	Operating revenue / Employees	Orbis Europe
Age	**Firm age**	Year – Incorporation date of a firm	Authors calculation according to Orbis Europe data
lnsize	**Firm size**	Natural logarithm of total assets	Authors calculation according to Orbis Europe data
Macro variable (external factor)	**Definition**		
GDPg	**GDP growth (annual%)**	Annual percentage growth rate of GDP at market prices	World Bank and OECD data

Table 2 Variable description
Source: Author

Table 3 shows descriptive statistics on the selected variables for the entire sample and by country of origin). To control for potential outliers, which are common in firm-level data, financial ratios below the 1st percentile and above the 99th percentile are replaced by their winsorised values.

ENTIRE SAMPLE (1395 firms)

Variable	Arithmetic mean	Standard deviation	Minimum	Maximum
ROA	3.683	10.596	-39.315	41.196
DEBT	.593	.354	.014	1.906
GROWTH	.202	.654	-.792	4.05
INV	.069	.119	-.19	.583
STOCKTURN	16.548	43.646	.331	333.833
COLP	87.283	100.712	0	561.944
CREDIT	89.424	112.586	0	605.34
OR EMP	178.518	231.779	6.098	1364.69
Age	17.031	9.179	0	76
lsize	6.596	1.825	.46	13.167

Variable	Arithmetic mean across countries		
	CROATIA (520 firms)	**SLOVENIA (121 firms)**	**SERBIA (754 firms)**
ROA	**4.933**	4.178	2.679

DEBT	**.63**	.517	.582
GROWTH	**.253**	.09	.197
INV	**.098**	.072	.048
STOCKTURN	**20.756**	20.144	13.232
COLP	92.872	**59.737**	88.101
CREDIT	**75.279**	82.599	100.146
OR EMP	137.108	105.461	**220.06**
Age	15.622	19.175	17.624
lsize	6.372	5.763	6.888

Table 3 Descriptive Statistics
Source: Author´s calculations according to Orbis Europe data

The average return on assets (ROA) for all countries is 3.67%. When analysed individually, Croatian and Slovenian companies have a higher ROA (4.93% and 4.18% respectively), while the average ROA in Serbia is only 2.68%. The average debt ratio of all companies is 59.3%, with Croatian companies being the most indebted (63%), while Slovenian companies have the lowest average debt ratio at 51.7%. The average revenue growth is 20.2%, with the highest growth in the period under review being recorded by Croatian companies (25.3%) and the lowest by Slovenian companies (9%). The share of investments in relation to total assets (INV) averages 6.9%, with Croatian and Slovenian companies having a higher share of investments (9.8% and 7.2% respectively) than Serbian companies (4.8%). Companies engaged in crop production in Croatia and Slovenia have a higher inventory turnover (20.8 and 20.1) than companies in Serbia (13.2). Slovenian companies have the shortest receivables collection period of two months (59.7 days), while Croatian companies wait an average of three months to collect receivables (93 days), similar to companies in Serbia (88 days). On the other hand, payments to suppliers are made the fastest by Croatian companies (75 days) and the slowest by companies in Serbia (100 days). Croatian companies could therefore have liquidity problems, as they collect their receivables on average later than they pay their suppliers. The average revenue per employee is highest for companies in Serbia (220) and lowest in Slovenia (105). High fluctuations in revenue per employee could indicate undeclared labour in Serbia. In terms of company age, the average age of Slovenian companies is 19 years, while Croatian companies are the youngest (15.6 years). In terms of company size, measured by the logarithm of total assets (lsize), the largest companies are in Serbia, followed by those in Croatia.

Methodology

For each company, data was collected over several years (panel data), resulting in multiple observations for each unit of analysis (company). Since the collected panel data makes it possible to track each observation unit over a certain period of time, panel data analysis is used in the empirical part of the chapter. In static panel analysis, there are three types of estimators: 1) the *Pooled Ordinary Least Squares* (POLS) estimator, which has the most limitations but serves as an introduction to panel analysis, 2) the *Fixed Effects* (FE) estimator and 3) the *Random Effects* (RE) estimator. The advantages of panel data analysis include the ability to control for unobserved heterogeneity, reduce variability and multicollinearity between variables, increase degrees of freedom and improve efficiency. In addition, it enables the identification of effects that cannot be observed when analysing time series or

cross-sections separately (Hsiao, 2014).

Based on the panel analysis and the previous profitability determinants presented in Table 2, the following model is defined:

$$ROA_{it} = \beta_0 + \beta_1 DEBT_{it} + \beta_2 GROWTH_{it} + \beta_3 INV_{it} + \beta_4 STOCKTURN_{it} + \beta_5 COLP_{it} + \beta_6 CREDIT_{it} + \beta_7 OR_EMP_{it} + \beta_8 Age + \beta_9 lnsize_{it} + \beta_{11} GDP_t + \mu_i + \lambda_t + \varepsilon_{it}$$

$$i = 1, \dots N,\ t = 1, \dots T$$

In addition to the variables listed in Table 2, μ_i represents the unobserved characteristics of each company (e.g. education and skills of the owner/manager of the company, motivation and skills of employees, relationships with suppliers, customer satisfaction, etc.) that are constant over time and specific to each observation unit (company). λ_t stands for temporal variables (*temporal dummies*) that change over time but are the same for all companies in the observed period, while ε_{it} s an error term.

The choice between the fixed-effects model and the random-effects model is made on the basis of the Hausman test (1978). The Hausman test tests whether there is a significant difference between the parameters estimated by the fixed-effects and random-effects models. Both estimators are consistent, and the estimates of the fixed-effects model do not differ significantly from the estimates of the random-effects model if there is no correlation between the individual characteristics of the observation units and the independent variables (regressors). Since the random effects estimator has a lower variance in this case, it is considered more efficient and its parameter estimates are preferred. On the other hand, the differences in the parameter estimates between the models obtained with these two estimators are significant if there is a correlation between the variables and the individual effects. If the random error correlates with one of the independent variables, the random effects estimator becomes inconsistent, while the fixed effects estimator remains consistent. In such situations, the parameter estimators of the fixed effects model are selected.

EMPIRICAL RESEARCH

The following section presents an analysis of the determinants of profitability using a static panel analysis. First, the correlation between pairs of independent variables was analysed, as multicollinearity can lead to inaccurate conclusions regarding the significance of individual variables (Table 4).

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) DEBT	1.000						
(2) GROWTH	0.077	1.000					
(3) INV	0.046	0.113	1.000				
(4) STOCKTURN	-0.001	0.051	0.055	1.000			

(5) COLP	0.054	-0.119	-0.080	-0.047	1.000		
(6) CREDIT	0.293	-0.097	-0.061	-0.094	0.438	1.000	
(7) OR_EMP	0.044	0.100	-0.045	0.033	-0.109	-0.110	1.000

Table 4 Correlation matrix
Source: Author´s calculations

All correlation coefficients between the observed pairs of variables are below 0.8, which allows further empirical analysis with the given set of variables.

The analysis was initially conducted for the entire sample of 1,395 companies engaged in agricultural crop production in Croatia, Slovenia and Serbia for the period from 2017 to 2022. The models presented in Table 5 aim to analyse the impact of different groups of independent variables on the dependent variable – the return on assets (ROA). The first model analyses the impact of the firm-specific (financial) variables, including debt ratio (DEBT), sales growth (GROWTH), investment-to-total assets ratio (INV), inventory turnover (STOCKTURN), receivables collection period (COLP), accounts payable days (CREDIT) and revenue per employee (OR_EMP). The second model extends the analysis by including additional firm-specific variables, such as company size, measured by the logarithm of total assets (lnsize) and company age (Age). Finally, the third model includes the GDP growth variable and makes it possible to analyse the impact of the macroeconomic environment on the profitability of companies.

VARIABLES	**(1) Financial ratios only**	**(2) Financial ratios, size and age**	**(3) Financial ratios, size, age and GDP growth**
DEBT	**-20.970*** **[-11.904]** **(1.762)**	**-21.002*** **[-11.752]** **(1.787)**	**-20.933*** **[-11.719]** **(1.786)**
GROWTH	**2.020*** **[7.886]** **(0.256)**	**1.977*** **[7.776]** **(0.254)**	**1.964*** **[7.730]** **(0.254)**
INV_TA	0.646 [0.514] (1.257)	-0.471 [-0.366] (1.287)	-0.515 [-0.401] (1.286)
STOCKTURN	0.007 [1.201] (0.006)	0.008 [1.417] (0.006)	0.009 [1.482] (0.006)
COLP_w	**-0.009*** **[-3.770]** **(0.002)**	**-0.010*** **[-4.274]** **(0.002)**	**-0.010*** **[-4.198]** **(0.002)**
CREDIT	-0.004 [-1.456] (0.003)	**-0.005*** **[-1.760]** **(0.003)**	**-0.005*** **[-1.770]** **(0.003)**
OR_EMP	**0.010*** **[6.464]** **(0.002)**	**0.009*** **[5.665]** **(0.002)**	**0.009*** **[5.674]** **(0.002)**
lsize		**2.022***	**2.009***

		[2.885]	**[2.875]**
		(0.701)	**(0.699)**
Age		**-0.334*** **	**-0.330*** **
		[-3.202]	**[-3.173]**
		(0.104)	**(0.104)**
GDPg			**0.128*** **
			[2.926]
			(0.044)
Constant	14.976***	7.339*	6.805*
	[13.607]	[1.867]	[1.730]
	(1.101)	(3.931)	(3.933)
Number of id	1,391	1,383	1,383
R-squared	0.166	0.169	0.171
Hausman test	254.01***	234.36***	246.87***
Time dummies	YES	YES	YES

Table 5 Profitability determinants of agriculture companies (dependent variables ROA) – all countries included
Note: Statistical significance (p-value): *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. t-statistics in square brackets, standard errors in round brackets. Temporal variables (annual effects) are also included in the model estimation.
Source: Author´s calculations

The table displays models with corrected (robust) standard errors for the parameters, as the White test for residual homoscedasticity confirmed the presence of heteroscedasticity in the models analysed. In addition, the table shows models estimated using the fixed effects estimator, as the Hausman test confirmed a significant difference between the estimated parameters of the fixed effects (FE) and random effects (RE) models. This indicates the existence of a correlation between the individual characteristics of the observation units and the independent variables, making the fixed-effects estimator (FE) consistent and suitable for interpretation.

All determinants, with the exception of investment and inventory turnover, are statistically significantly related to firm profitability in the observed models. Companies that utilise financial leverage (debt) to a greater extent achieve a lower return on assets. Higher financing costs associated with debt increase company risk and ultimately reduce firm profitability, as confirmed by numerous studies (Aytac et al., 2020; Burja, 2020; Dakić and Mijić, 2020; Dimitropoulos, 2018; Kryszak, Guth and Czyżewski, 2021; Özkaya and Yaşar, 2023; Pervan and Mlikota, 2013; Tekić et al., 2023). Conversely, Mijić and Jakšić (2017) concluded that agricultural firms with a higher debt ratio have better profitability, which they explained with the capital structure theory, according to which debt financing has a positive influence on profitability due to tax savings. Firm growth, as measured by sales growth, has a positive impact on the profitability of agricultural firms, as also confirmed by studies (Asimakopoulos et al., 2009; Aytac et al., 2020; Mijić and Jakšić, 2017; Özkaya and Yaşar, 2023; Prša, 2020 and Zouaghi, Hirsch and Garcia, 2016). Market expansion and the resulting sales growth have a positive impact on profitability. Contrary to expectations, long-term investments and inventory turnover do not have a significant impact on firm profitability, which is consistent with the findings of Bui et al. (2020). The results indicate that companies with longer receivables collection periods and slower payment of liabilities achieve lower profitability. A negative

impact of longer receivables collection periods reduces the firm's liquidity and increases the risk of non-payment by customers (Özkaya and Yaşar, 2023). In addition, there is a significant positive effect of employee productivity on the firm's profitability. Higher labour productivity enables the production of more goods and services and a larger sales volume to meet increased demand and expand into new markets. The positive effect of labour productivity on profitability has also been confirmed in other studies (e.g. Raguž Krištić, Družić and Logarušić, 2020; Dimitrić, Tomas Žiković and Arbula Blecich, 2019). Furthermore, the results indicate that larger agricultural firms achieve higher returns on assets, which can be explained by the stronger negotiating position of larger companies, easier access to finance and economies of scale. These results are consistent with the studies by Dimitropoulos (2018) and Pervan and Mlikota (2013). Conversely, younger firms achieve higher profitability compared to older ones, which could be attributed to the greater flexibility of these firms (Aytac et al. 2020; Dakić and Mijić 2020). Finally, GDP growth as an indicator of economic activity has a positive effect on profitability, implying that firms achieve higher profitability in times of economic recovery, when demand for their products and services increases, which is consistent with the findings of Arboleda, Bermúdez-Barrezueta; Camino-Mogro (2022) and Tekić et al. (2023).

In order to analyse the differences in the profitability determinants by country of origin, the following section presents an analysis of the profitability determinants for agricultural firms separately for firms from Croatia, Slovenia and Serbia (Table 6).

	CROATIA			SLOVENIA			SERBIA		
VARIABLES	(1) Fin_ratio	(2) Fin_ratio _Size_Age	(3) Fin_ratio_Size_Age_gdp	(1) Fin_ratio	(2) Fin_ratio _Size_Age	(3) Fin_ratio_Size_Age_gdp	(1) Fin_ratio	(2) Fin_ratio _Size_Age	(3) Fin_ratio_Size_Age_gdp
DEBT	-24.487*** [-8.961] (2.733)	-24.221*** [-8.660] (2.797)	-24.221*** [-8.660] (2.797)	-10.189** [-2.535] (4.019)	-11.127*** [-2.857] (3.895)	-11.127*** [-2.857] (3.895)	-19.704*** [-7.277] (2.708)	-20.210*** [-7.594] (2.661)	-20.210*** [-7.594] (2.661)
GROWTH	1.084*** [3.739] (0.290)	1.083*** [3.767] (0.287)	1.083*** [3.767] (0.287)	4.048** [2.207] (1.834)	3.043 [1.622] (1.876)	3.043 [1.622] (1.876)	2.438*** [6.892] (0.354)	2.388*** [6.848] (0.349)	2.388*** [6.848] (0.349)
INV_TA	0.117 [0.063] (1.842)	-0.285 [-0.154] (1.853)	-0.285 [-0.154] (1.853)	3.127 [0.520] (6.010)	-0.559 [-0.087] (6.451)	-0.559 [-0.087] (6.451)	2.099 [1.295] (1.621)	0.875 [0.530] (1.649)	0.875 [0.530] (1.649)
STOCKTURN	0.007 [1.645] (0.004)	0.007 [1.591] (0.004)	0.007 [1.591] (0.004)	0.021 [0.878] (0.024)	0.009 [0.323] (0.027)	0.009 [0.323] (0.027)	0.006 [0.569] (0.011)	0.011 [0.990] (0.011)	0.011 [0.990] (0.011)
COLP	-0.014*** [-3.510] (0.004)	-0.015*** [-3.653] (0.004)	-0.015*** [-3.653] (0.004)	-0.012 [-1.380] (0.008)	-0.012 [-1.314] (0.009)	-0.012 [-1.314] (0.009)	-0.006* [-1.900] (0.003)	-0.006** [-2.246] (0.003)	-0.006** [-2.246] (0.003)
CREDIT	-0.014*** [-2.875] (0.005)	-0.014*** [-2.951] (0.005)	-0.014*** [-2.951] (0.005)	-0.017*** [-2.840] (0.006)	-0.015* [-1.798] (0.009)	-0.015* [-1.798] (0.009)	0.001 [0.365] (0.003)	0.000 [0.095] (0.003)	0.000 [0.095] (0.003)
OR_EMP	0.019*** [5.644] (0.003)	0.018*** [5.369] (0.003)	0.018*** [5.369] (0.003)	0.051*** [3.065] (0.017)	0.077*** [4.648] (0.016)	0.077*** [4.648] (0.016)	0.005*** [3.251] (0.001)	0.004** [2.566] (0.001)	0.004** [2.566] (0.001)
lsize		0.618 [0.526] (1.176)	0.618 [0.526] (1.176)		3.591 [1.542] (2.329)	3.591 [1.542] (2.329)		2.537*** [2.978] (0.852)	2.537*** [2.978] (0.852)
Age		-0.308* [-1.787] (0.172)	-0.355* [-1.859] (0.191)		-1.728*** [-4.316] (0.400)	-1.592*** [-3.984] (0.400)		-0.164 [-1.216] (0.134)	-0.097 [-0.728] (0.134)

GDPg			0.054 [1.013] (0.053)			0.272 [1.622] (0.168)			**0.133*** **[1.877]** **(0.071)**
Constant	20.021*** [11.268] (1.777)	20.392*** [3.221] (6.331)	20.912*** [3.279] (6.378)	7.545*** [2.829] (2.667)	15.780 [1.176] (13.421)	12.154 [0.951] (12.780)	12.392*** [7.844] (1.580)	-1.535 [-0.312] (4.922)	-3.207 [-0.645] (4.969)
Number of id	516	509	509	121	121	121	754	753	753
R-squared	0.257	0.224	0.224		0.176	0.176	0.144	0.152	0.152
Hausman test	165.23***	137.06***	136.74***	18.94*	23.72**	24.07**	125.59***	149.85***	149.85***
Time dummies	YES	YES	YES	YES	YES	YES	YES	YES	YES

Table 6 Profitability determinants of agriculture companies (dependent variables ROA) – analysis over countries
Note: Statistical significance (p-value): *** p < 0.01, ** p < 0.05, * p < 0.1. t-statistics in square brackets, standard errors in round brackets. Temporal variables (annual effects) are also included in the model estimation.
Source: Author´s calculations

Debt and labour productivity are significant determinants of profitability in all the countries studied. Companies with a lower debt ratio and higher labour productivity achieve a greater return on assets. Contrary to the findings of Mijić and Jakšić (2017), a significant negative correlation between debt and profitability was confirmed for companies in the Republic of Serbia. As in the analysis of the overall sample, investments and inventory turnover were not found to be significant in the separate country analyses. Sales growth and a shorter period for the collection of receivables only have a significant influence on companies from Croatia and Serbia, while these factors have no significant influence on Slovenian companies. Thus, companies in Croatia and Serbia that collect receivables faster and have higher sales growth achieve higher profitability. In Croatia and Slovenia, companies that settle their obligations to suppliers more quickly are more profitable, while this variable has no significant influence in Serbia. Firm size is a significant determinant only for companies in Serbia, where larger agricultural companies are more profitable and benefit from economies of scale. These findings differ from those of Tomašević et al. (2019), who concluded that firm size has no statistically significant impact on the profitability of agricultural companies in Serbia. Furthermore, firm age is a significant determinant only for Croatian and Slovenian companies, with younger companies showing higher profitability compared to older ones. GDP growth has a significant impact on the profitability of companies in Serbia, with companies achieving better profitability on average during periods of economic growth. Tekić et al. (2023) also found that with an increase in GDP, the profitability of micro-agricultural companies in the Republic of Serbia is likely to increase.

The results show that in all analysed countries, agricultural companies with higher leverage and lower turnover per employee achieve a lower return on assets. Agricultural companies in Croatia and Serbia with higher sales growth and faster receivables collection achieve higher profits. More profitable companies in Croatia and Slovenia settle debts faster. GDP growth is significantly and positively correlated with the profitability of companies in Serbia. Company size and age are the variables in which the countries differ the most. Thus, a distinct effect on profitability can be observed for younger agricultural companies in Croatia and Slovenia and for larger companies in Serbia, which achieve higher profitability compared to smaller agricultural companies.

CONCLUSION

Agriculture is a cornerstone of food security in every country, as it ensures a stable food supply and reduces dependence on food imports. Agriculture not only contributes directly to economic growth and creates jobs, especially in rural areas, but also supports the development of other sectors such as tourism, trade and manufacturing.

A profitable business is an important prerequisite for the long-term sustainability of agricultural enterprises. Although debt and labour productivity have a significant

impact on profitability in all countries, the results show that certain determinants of profitability differ from country to country. For instance, the more profitable companies in Croatia and Slovenia settle their obligations to suppliers in a shorter period of time, which is also reflected in the descriptive statistics. The better organised payment situation can be partly attributed to the higher legal security and regulation in these countries. In addition, companies in Croatia and Slovenia have almost double the return on assets, which is partly attributed to EU membership, where agricultural support systems, better regulated markets and a more stable business environment contribute to higher agricultural profitability. Although Croatia and Slovenia, as EU members, follow the common EU agricultural policy, which is more supportive of rural development through reforms, it seems that Croatia and Serbia share more in common, especially when analysing the impact of factors such as sales growth and shortening of receivables collection periods. Thus, sales growth and a shorter period for receivables collection in these countries have a significant impact on increasing profitability. Both countries later underwent political and economic changes, including privatisation, restructuring and modernisation of agricultural enterprises, which should ultimately lead to an increase in the profitability of agricultural production.

The results of this research provide insights into the current state and potential for further development of agricultural businesses in South East Europe and can be useful for all stakeholders in agricultural enterprises, from managers and owners to policy makers, to improve the operations of the analysed companies. A recommendation for future research is to conduct an analysis using dynamic panel models to further deepen the understanding of this topic. Furthermore, it is suggested to include a larger number of European countries in the study in order to perform a comparative analysis and explore potential differences in profitability determinants based on the specific business conditions in the different countries. Another recommendation is to extend the analysis to include new factors, such as the role of innovation and technology in agricultural production, the impact of climate change and the impact of different agricultural subsidies and trade policies.

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ASSESSMENT OF THE CURRENT STATE AND THE IMPORTANCE OF FURTHER DEVELOPMENT OF AGRICULTURE AND RURAL AREAS

CHAPTER 3

Ivan Prudky [*], Ana Marija Filipas [**], Nenad Vretenar [***]

ABSTRACT

The development of agriculture and rural areas is one of the most important interests in any country. It is even more important in Croatia due to the decades-long challenges faced by domestic agricultural production, the ever-increasing depopulation of Croatian villages and the aggravation of problems related to climate change. In this chapter, the attitudes of 1,014 respondents from Croatia participating in the Eurobarometer survey were analysed and compared with the attitudes of respondents from other European Union countries (the total sample comprises of 26,511 participants). At the same time, attitudes towards the importance of agricultural development in rural areas, the role of agricultural producers, the desired characteristics of agricultural and organic products and the relationship between agriculture and climate change were analysed. Despite the similarities and trends in the responses in most of the analysed areas, there were evident differences between the developed and less developed EU members and between the member states from the southern part of the European Union. In particular, Croatian respondents showed a positive attitude towards organic and ecologically produced agricultural products and the need to improve the quality of life in rural areas. This positive attitude can serve as a glimmer of hope and an incentive to invest additional efforts in the development of this part of the economy.

Key words: *rural development, citizens' perception, agriculture, organic agriculture*

INTRODUCTION

Rural areas make up 63% of the area of the Republic of Croatia, where 42.5% of the country's total population lives, and the main characteristic of agriculture in the Republic of Croatia is many small farms, mainly cultivating up to five hectares of land (European Commission 2023). The agriculture, forestry and fisheries sector contributes 3% to the value added of Croatian national income in 2023, putting the Republic of Croatia at the top of the list with a share of national income almost twice as high as the average of EU Member States (Figure 1). Based on the first available data from 1995, when the realised contribution was 5.7%, the predominant trend is

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the decline in the sector's share of national income in the Republic of Croatia, although the trends are unstable over the entire period. The lowest level was reached in 2019 at 2.8% of national income, and in the last three years, the sector's share of national income has been steadily declining (from 3.3% in 2021). The decline in agricultural production in 2023 compared to 2022 is a significant drop in livestock production, which is not offset by the increase in crop production compared to the previous year (Croatian Bureau of Statistics 2024). Despite the decline in the share of agriculture, forestry and fisheries in Croatia's national income, value added per worker (World Bank Group 2024) shows a growth trend from 1995 (EUR 4,434.48) to 2022 (EUR 17,069.77). Growth has also remained constant in the last three years (EUR 14,591.93 in 2020). Value added per employee is below the EU average of EUR 23,695.29 in 2022. This shows that the Republic of Croatia is no exception to the rule, as in other Member States with a high share of agriculture, forestry and fishing in national income, the sector's value added per employee is at the lower end of the scale: Romania with EUR 4,791.70, Poland with EUR 6,914.27 and Bulgaria with EUR 13,761.26 are the countries with the lowest values (World Bank Group 2024).

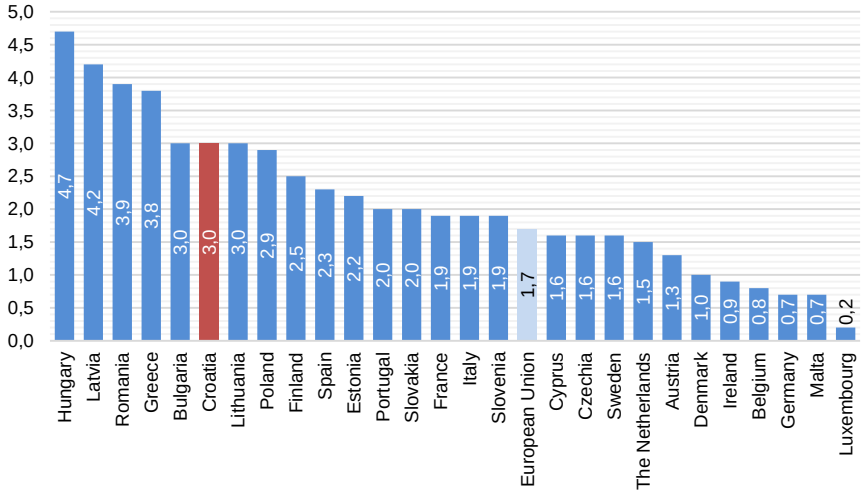

Figure 1 Agriculture, forestry and fishing as realised added value (% of GDP) of EU countries in 2023
Source: authors based on World Bank Group 2024

The Economic Accounts for Agriculture consist of a group of three indicators (Eurostat, n.d.): Index of real factor income in agriculture per annual labour unit, Index of real agricultural net entrepreneurial income per unpaid annual work unit and Net entrepreneurial income in agriculture. Agricultural production in the Republic of Croatia has grown steadily from 2020 to 2022. The growth in gross value added in agriculture is even more pronounced in the period under review. In contrast, the value of labour input stagnated in the three-year period (Croatian Bureau of Statistics, 2023). Observing the values of agricultural production from 2008 to 2023 (Figure 2) (Eurostat 2024), the Republic of Croatia recorded a 17.1% drop in the volume of agricultural production and a 26.2% drop in intermediate consumption at the end of the observation period compared to the 2008 values. The EU average for both indicators was down, with agricultural production increasing by

5.9% and intermediate consumption by 3.4% in the same period. During the period under review, Lithuania is the EU Member State with the highest growth in agricultural production at 50.6% (together with an increase in intermediate consumption of 13.6), and high growth is also recorded by Ireland (32.1%) and Latvia (32.0%), albeit with significantly higher values for intermediate consumption (Ireland – 20.8% and Latvia – 23.8%). Belgium (+20.6%), Germany (+8.0%) and Hungary (+5.4%) stand out as Member States that recorded an increase in the volume of agricultural production between 2008 and 2023, with a simultaneous decline in intermediate consumption.

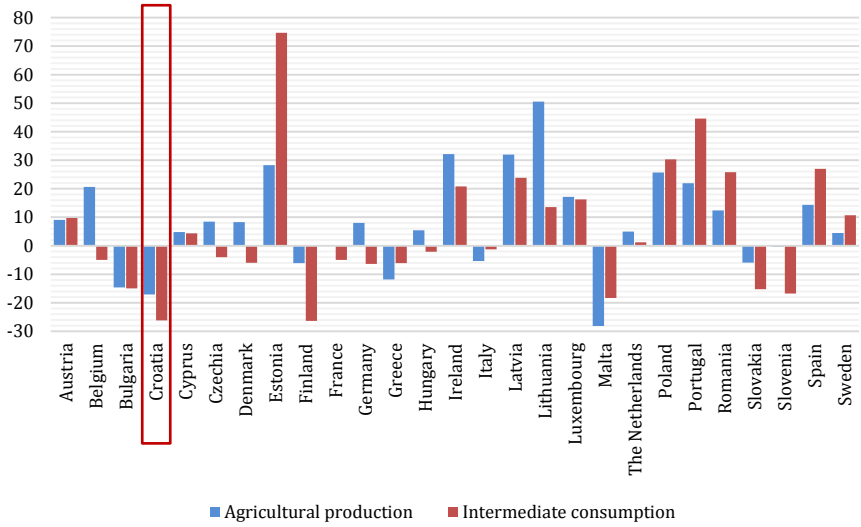

Figure 2 Economic accounts for agriculture – indicators of agricultural income (2015 = 100) of EU countries in 2023
Source: authors based on Eurostat 2024

Understandably, the statistics alone are not sufficient to show the whole picture, as the dairy industry, for example, was severely decimated during this period (Gospodarski list 2023), while the decline in the area of vineyard plantings is the result of targeted efforts to replace old plantations with new, higher quality ones (Katunar et al. 2020). Apart from the difficulties in reducing the backlog and improving certain agricultural crops, the situation is further aggravated by the worrying depopulation of villages (Večernji list 2023) and climate change. The aim is, therefore, to analyse the views of Croatian respondents on the importance of agricultural and rural development and the role of producers. In addition, they will be compared with the views of respondents in other EU countries to highlight the differences between developed and less developed countries. The focus is also on the relationship between agriculture and climate change, identifying trends and exploring the potential of positive attitudes towards organic products and improving life in rural areas as a basis for further development and investment in the sector.

CHALLENGES OF CROATIAN AGRICULTURE

Agriculture in the Republic of Croatia has a long tradition. Given the geographical diversity and a relatively large part of the territory suitable for agricultural activities, there are numerous reasons why agriculture in Croatia should not only survive but also be strengthened and developed. With this in mind, the strategic goals of the Ministry of Agriculture, Forestry and Fisheries (2022) have been set, which recommend measures to increase the productivity and competitiveness of Croatian agriculture, strengthen resilience to the challenges of climate change, promote innovation in agriculture and improve the rural economy, products and living conditions in rural areas.

The resulting challenges are numerous and difficult to solve. The first of these are inadequate strategies for the development of agriculture and agricultural production and still obvious problems with the functioning of the land registry system (Vidaček, 2019). An even more pressing problem is the worrying depopulation and emigration of the population, which particularly affects traditionally agricultural areas. In her research, Sokolić (2023) notes that, in addition to the depopulation of rural areas, the lack of interest in jobs in agriculture is also a cause for concern. In addition, the agricultural population is generally conservative towards the use of new technologies and ways of working, and in order to avoid inefficiency and the risk of running into problems of permanent non-competitiveness, agricultural enterprises should closely monitor the development and application of technologies (Katunar, 2023a). Despite the generally favourable natural conditions and investments in agriculture in the form of subsidies, Croatia has a high demand for imports of agricultural products (Tomić, 2020). The characteristic features of agriculture in the Republic of Croatia, such as a large number of fragmented agricultural areas and many small farms, combined with insufficient education and expertise of farmers, insufficient application of technologies (e.g. irrigation) and protective measures in extreme weather conditions (e.g. drainage) and existing incentive measures that do not serve the purpose of increasing production, lead to inefficient agricultural production. On the other hand, the analysis conducted by Rusielik and Szczecińska (2020) using the method of Data envelopment analysis (DEA) showed that Croatia is in the second group of developed countries in terms of technological efficiency of agriculture, alongside Germany, Hungary, Italy, Poland and Portugal. They conclude that Croatia is, therefore, eligible for the allocation of more funds, as guaranteed by the EU's Common Agricultural Policy.

Shortening supply chains should be one of the most important ways to improve agricultural operations. This process can increase the profitability of farms, especially small ones (Katunar et al., 2022) and create added value for buyers of agricultural products. Building and developing short supply chains is crucial for the sustainability of farms and the development of the local community, customers and the environment. In addition, farmers should not limit themselves to a single distribution channel but should ensure a greater number of distribution channels for their products (Katunar, 2023b). Bokan et al. (2023) state that Croatian farmers know that involvement in short supply chains requires additional knowledge and skills, but they do not see it as impossible. They are very satisfied with working in such a system and emphasise numerous advantages: they achieve better prices, gain

regular customers and see the possibility for small farms to survive on the market. Therefore, it is necessary to educate the public about organic farming, the importance of short supply chains and more robust institutional support in creating opportunities for such systems (Slavuj Borčić, 2020).

The rapid effects of climate change pose an increasingly urgent problem for the adaptation of agricultural production in the Republic of Croatia to extreme weather conditions. According to farmers' own assessment, less than half of them use basic systems for insurance/prevention of damage caused by extreme weather conditions, and only 3% of them use advanced systems (Senko et al., 2022). The specificity of agricultural production in the Adriatic part of Croatia, which is very suitable for the production of experience goods such as wine, olive oil, prosciutto and the like, is also reflected in the increase in the price of agricultural land, which in these areas limits the profitability and viability of farms on already traditionally small agricultural areas (Host, 2023). A particular form of concern about the impact of agriculture on environmental pollution is the problem of food waste, to which agricultural production and food processing contribute about 30% (Čegar & Rotim, 2022). Farmers in the Republic of Croatia are unaware of the amount and do not valorise the by-products of their agricultural production. There is a clear need and desire to educate farmers about the circular economy, the efficiency of product processing and concern for the preservation of the environment (Sudarić et al., 2022; Katunar & Katunar, 2022).

An opportunity for agriculture, which is also an answer to some of the existing weaknesses of agricultural production, is also the growing demand for organically produced products. As previous studies have already shown (Tarandek et al., 2023) and the analysis of the attitudes of European Union citizens carried out as part of this research has also confirmed, the negative impact of traditional agriculture on the environment is recognised at all levels, and the need to develop organic farming is acknowledged. Organic agricultural production represents a significant potential, as in Croatia (Romanov & Slavuj, 2021), despite constant growth since 2013, it occupies a much smaller share of the total agricultural area than, for example, in Austria, Estonia or Sweden. Specifically, from 2013 to 2020, the number of organically used agricultural areas increased by 4.5 times, while the number of processors of organic agricultural products increased by 2.1 times (Bilandžija, 2022), and the favourable conditions in Croatia give hope for further successful development of organic farming. However, with a share of 8.95% of organically farmed land, Croatia is still very far from the target announced by the European Commission that this share should reach 25% in the member states by 2030 (Tarandek et al., 2023). The same authors point to the need to establish a support system that focuses on increasing supply (production and availability of organic products) and consequently on reducing the price of organic products rather than the support system for organic producers, as has been the case so far. In addition, a system of credibility for organic products from the EU is to be created, guaranteed by a common control and certification system.

As already mentioned, the need for supply chain management is particularly important for the organic production segment. For example, Pugelnik et al. (2024) state that the distribution channel through specialised fairs significantly limits

organic agricultural production in the Republic of Croatia. Diversification of distribution channels would lead to greater recognition and, thus, higher demand for such products, and additional regulatory and administrative facilitation would further increase the competitiveness of organic farming in Croatia. Romanov and Slavuj (2021) point to young people as carriers of the development of organic agriculture in the Republic of Croatia and define the offer, place of purchase and origin of the product as important criteria in the decision to buy organic agricultural products and additionally emphasise the importance of short supply chains for organic products.

ANALYSIS OF THE PERCEPTION OF AGRICULTURE, FARMERS AND RURAL AREAS

This research aims to reveal the key characteristics of the state of agriculture and rural areas, focusing on Croatia, through a comparative analysis of data collected by a special Eurobarometer. By combining the data of the special Eurobarometer SP520 (European Data 2023) and Eurobarometer 97.1 (European Commission 2023), we get an insight into the perceptions of the state of agriculture and rural areas of all EU members (N = 26,511). There is a particular focus on the Republic of Croatia (N = 1,014) to observe the current situation, the main shortcomings, and the potential through comparison with other EU members.

The aim of this study is to highlight the main characteristics of the state of agriculture and rural areas with a focus on Croatia through a comparative analysis of data collected in a special Eurobarometer survey. By combining data from the special Eurobarometer SP520 (European Data 2023) and the Eurobarometer 97.1 (European Commission 2023), we gain insight into the perception of the state of agriculture and rural areas in all EU Member States (N = 26,511). A special focus is on the Republic of Croatia (N = 1,014) to observe the current situation, main shortcomings, and potential in comparison with other EU members.

EU Member States show a high level of affection for rural and agricultural areas (Figure 3), with residents of all Member States viewing agriculture and rural areas as a source for the future development of the EU as a whole. 95% of respondents from the Republic of Croatia also see the relative or strong importance of agriculture and rural areas for the development of the EU. The attitude of respondents from the Republic of Croatia corresponds to the average values of respondents in the EU as a whole. Looking at the views of EU residents on the importance of agriculture for the future development of the Union, two extremes can be identified: The opinion of respondents from Portugal, where 100% of respondents consider agriculture to be very or fairly important for the development of the EU. Ireland, Greece, and Slovenia followed with high scores, with respondents believing that developing agriculture and rural areas is important for the overall development of the EU. Of particular note is Slovenia, where as many as 81% of respondents rated agricultural activity and rural development as very important for the future development of the EU. In contrast, 18% of respondents from Romania and 11% of respondents from Austria did not consider agriculture to be important for the future development of the EU. In the Strategy for Agriculture until 2030 of the Ministry of Agriculture of the Republic

of Croatia (2022), it is pointed out that the plan for developing agriculture and rural areas aims to achieve broader development goals. The survey results show the recognition of the development policy and the agreement of the opinion of the population of the Republic of Croatia with the institutions.

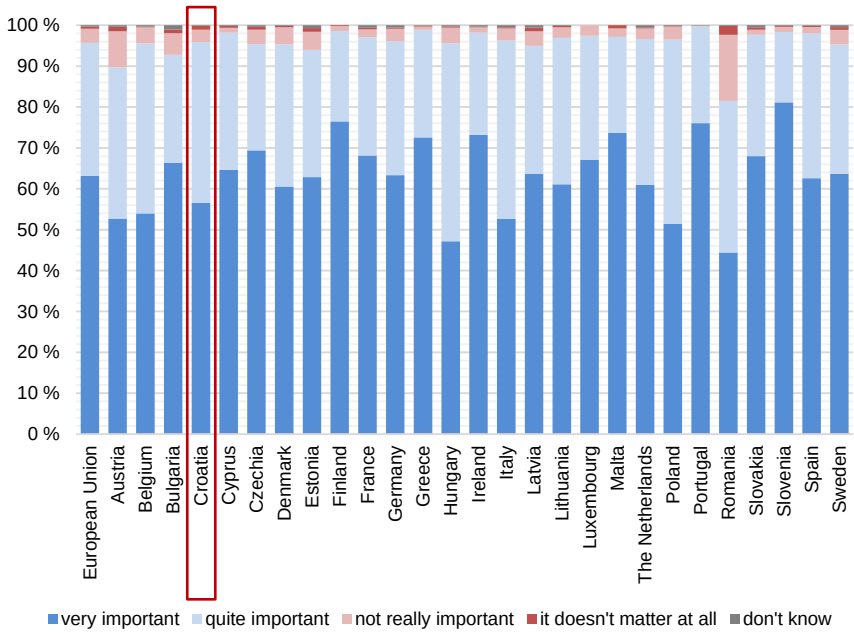

Figure 3 Assessment of the importance of agriculture and rural areas for the future development of the EU
Source: authors based on European Commission 2023

The development of a country's agriculture and rural areas depends not only on natural resources and institutional conditions but also, to a large extent, on the work of farmers. Respondents in individual EU countries have different perceptions of the responsibilities and tasks of farmers, and it is possible to identify the specificities of particular countries (in the questionnaire, respondents had the opportunity to select a maximum of two areas that they considered particularly important). In the Republic of Croatia, respondents distributed the importance of farmers' responsibility for certain tasks relatively evenly. They consider providing safe and healthy food of high quality (42%), securing and improving life in the countryside (34%) and securing growth and job creation in rural areas (30%) to be the most important. Respondents in the Republic of Croatia consider the role of farmers in protecting the environment and combating climate change (17%), ensuring the welfare of farm animals (17%) and securing food supplies within the EU (19%) to be the least important (Figure 4).

The assessment of the importance of farmers' activities differs significantly when looking at respondents' responses from other EU countries. However, the task of farmers to provide safe and healthy food of high quality is considered most important at the level of the whole sample (50% of all respondents). However, at the level of the overall sample of EU countries, the tasks of ensuring the welfare of farm

animals (29%), food supply within the EU (26%), environmental protection and combating climate change (24%) and the task of ensuring various quality products (22%) follow with a significant difference in rating. Creating growth and jobs in rural areas (19%) and securing and improving life in the countryside were rated as the least important aspects of farmers' work.

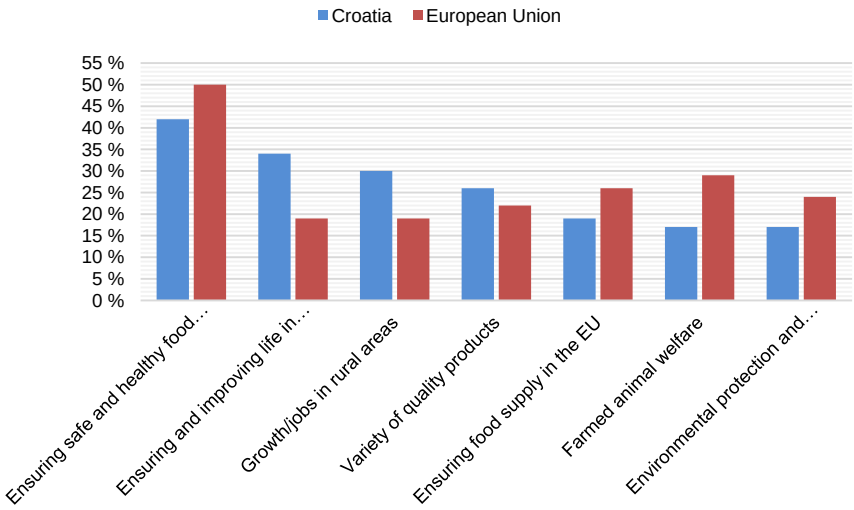

Figure 4 Assessment of the inhabitants of the Republic of Croatia on the importance of aspects of the work of farmers
Source: authors based on European Commission 2023

In highly developed countries such as the Netherlands, Sweden, Finland and Denmark, activities to create growth and jobs in rural areas and to secure and improve life in rural areas are not seen as an important part of farmers' work (the proportion of respondents who consider these activities important is < 10%). The opposite opinion is found in Bulgaria, Croatia and the Baltic countries (> 32%), while most respondents see these activities as important tasks for farmers. Respondents from Estonia, Slovakia and Finland (< 12%) are the least convinced of the possibility of the impact of farmers' work on environmental protection and the fight against climate change. In comparison, respondents from Denmark (44%) convincingly support this idea the most, followed by those from France, Malta and Belgium (> 32%). Respondents in highly developed countries such as Sweden, France, the Netherlands and Denmark (>40%) also believe that ensuring the welfare of farm animals is a very important aspect of farmers' work. In contrast, respondents from Bulgaria, Latvia, Romania and Hungary (< 14%) do not see these tasks as a priority in the work of farmers. Respondents from Cyprus, Bulgaria and Italy prioritise the food supply to the entire EU as the least important (< 16%). In comparison, respondents from Finland and Germany place these tasks very high on the list of priority tasks for farmers (> 40%).

The assessment of living conditions in rural areas is based on several criteria (Figure 5). The lowest rated criterion is the possibility of employment in rural areas, which is rated as good by only 31% of respondents from Croatia. Croatia is below the EU average (37%) on this criterion. Furthermore, Croatia is at the very bottom of the

scale for this criterion, and only respondents from Bulgaria, Latvia and Portugal see employment opportunities in rural areas as worse than those in Croatia. On the other side of the scale are respondents from Luxembourg, Denmark and Belgium, who rate employment opportunities in rural areas as fairly or very good (> 59%).

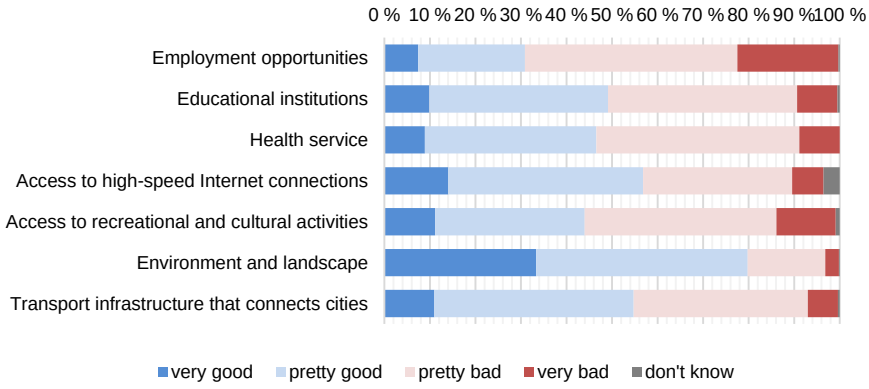

Figure 5 Assessment of the inhabitants of the Republic of Croatia on living conditions in rural areas
Source: authors based on European Commission 2023

The availability of educational facilities in rural areas in Croatia is rated as good or fairly good by 51% of respondents. This share is also below the EU level for this criterion (55%). Nevertheless, it is significantly more favourable than in the countries at the lower end of the scale, such as Bulgaria (27%), Lithuania and Greece (< 38%). At the top of the ranking, i.e. among the countries with the highest estimates of the availability of educational institutions in rural areas, are again Luxembourg, Belgium and Malta (> 79%). Similarly, 48% of respondents from the Republic of Croatia rated the availability of healthcare services in rural areas as good, which is also (slightly) below the average for EU countries (50%). The lowest assessment of the availability of healthcare services was evidenced in Bulgaria, Lithuania and Greece (< 29%), while Malta, Luxembourg and Belgium are at the top (> 80%).

The first criterion for assessing the quality of life in rural areas, where the Republic of Croatia is rated better than the EU average, is access to high-speed internet connections (57% compared to 51% for the EU average). In this criterion, Germany (27%) and Portugal (32%) are at the lower end of the EU countries, while Luxembourg, Belgium and Hungary are rated best with more than 79%. Croatia is also above the EU average in assessing the transport infrastructure quality connecting rural areas with cities, with 50% positive responses. Respondents from Bulgaria and Latvia rate the transport infrastructure between rural areas and cities as the least good (< 31%), while respondents from Luxembourg, Poland and Cyprus (> 66%) are the most satisfied with it.

Access to leisure and cultural activities in rural areas in Croatia was rated as good by only 43% of respondents, putting Croatia near the bottom of the EU countries, with only Lithuania, Bulgaria and Portugal scoring worse (< 41%). Although the EU

average rating of access to recreational and cultural activities in rural areas is 54%, Luxembourg stands out as a positive example at the top of the ranking, where 80% of respondents believe that the opportunities to enjoy recreation and culture in rural areas are fairly or very good in the country, and Denmark with 76% of such respondents. The state of the environment and landscape of rural areas is rated by 79% of respondents from the Republic of Croatia as fairly or very good, which is also below the EU average (85%). Respondents from Malta are the most critical of the state of the environment and landscape of rural areas in the country, as only 58% of respondents see them as good. Respondents from Bulgaria have a slightly better opinion (64%). In Finland, the perception of a fairly or very good state of the environment and landscape is the highest, and 97% of respondents share this opinion. Several other countries, such as Latvia, Slovenia, and Sweden (93% of respondents each), share the opinion of a fairly good state of the environment and landscape.

Climate change is widely recognised as a factor that undoubtedly affects the state of agriculture. Still, awareness of the impact of agricultural production on climate change is often not sufficiently developed. 44% of respondents from the Republic of Croatia agree with the thesis that agriculture is one of the causes of climate change (Figure 6), and they are thus more aware than the EU average (38%). The smallest share of respondents who think that agriculture significantly affects climate change was recorded in France and Greece (26% each), while more than half of the respondents from Hungary, Poland and Cyprus think so. Respondents from Hungary, Poland and Cyprus (> 80%) also agree that EU farmers need to change the way they work to tackle climate change, even if this leads to a reduction in the competitiveness of EU agricultural products. Respondents from the Republic of Croatia also largely agree (74%), which is above the EU average (67%), and the only Member State whose respondents disagree with the statement is Greece, where only 44% of respondents support such a principle for farmers' work.

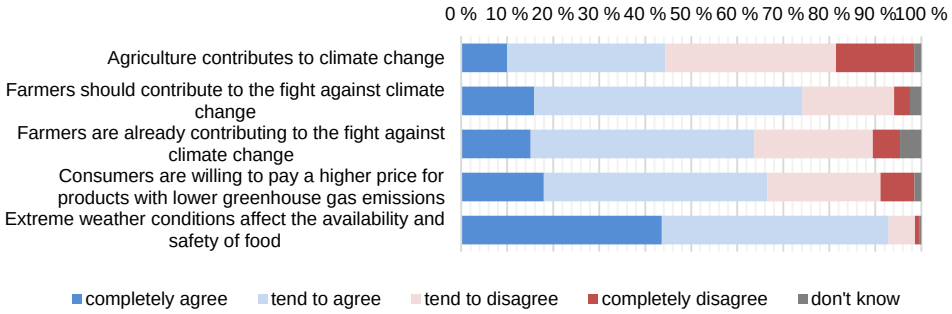

Figure 6 Assessment of the inhabitants of the Republic of Croatia on the impact of agriculture on climate change
Source: authors based on European Commission 2023

As many as 58% of respondents in the EU agree with the thesis that agriculture is already making a major contribution to the fight against climate change, which is lower than the 64% of respondents from Croatia who agree with this statement. Looking at the countries, respondents from Poland, Italy and Hungary are most

convinced that agriculture has already contributed significantly to the fight against climate change (> 71%). In contrast, respondents from France, Czechia, and Germany (< 44%) agree the least. To prevent the negative impact of agriculture on climate change, the most significant share of respondents from Germany, followed by the Netherlands and Sweden (> 72%), are willing to pay a 10% higher price for agricultural products that are produced in such a way that they leave a smaller carbon footprint than competing products. At the EU level, 60% of respondents claim they would be willing to do the same, while the proportion in Croatia is slightly higher at 65%. Respondents from Portugal, Slovakia, Greece and Bulgaria (< 40%) are the least willing to spend an additional 10% when buying agricultural products.

92% of respondents across the EU and 93% of respondents from the Republic of Croatia think extreme weather events such as extreme floods and droughts significantly impact the food supply system and food safety in the EU market. Understandably, respondents from Mediterranean countries such as Cyprus, Malta, Greece, and Portugal (> 96%) agree with the impact of extreme weather conditions on the supply and safety of food on the EU market. Respondents from Romania are the least convinced (79%).

The views of Croatian respondents on most topics are close to the European average. At the same time, they rated the availability of broadband internet and transport infrastructure in rural areas better than the EU average. In contrast, Croatia lags far behind the average in terms of the availability of cultural and entertainment content in rural areas. Interestingly, in terms of their views on climate change, Croatian respondents are again above the EU average regarding awareness that agricultural activities contribute to climate change, and they are willing to buy more expensive agricultural products if they emit less greenhouse gases.

CONSUMER PREFERENCES FOR AGRICULTURAL PRODUCTS

The respondents' preferences for various product characteristics are presented in the further course of this research. From a theoretical perspective, preferences are important because of their necessity for the construction of a utility function, and preferences are always considered a choice within a pair of alternatives. However, studies on preferences in a broader sense are important, as the observed differences in consumer habits related to factors such as gender, age, education level, etc., allow this knowledge to be used in the business environment (Vretenar, 2023; Filipas et al., 2023).

According to the Eurobarometer survey, it is important for 85% of respondents from Croatia whether an agricultural product comes from a geographical area they know (Figure 7), which is higher than the EU average (80%). Respondents from Italy, Greece and Cyprus attach the greatest importance to the geographical origin of agricultural products (> 91%), while it is least important for respondents from Denmark (62%) and the Netherlands (50%). Respect for local traditions and know-how systems when selecting and purchasing agricultural products is again the least important for respondents from Denmark and the Netherlands (< 58%) and the most important for respondents from Cyprus, Italy, Greece and Slovenia (> 92%).

The Republic of Croatia is also at the top because this criterion is very important to respondents (87%). At the EU level, 81% of respondents confirmed that local tradition and know-how are important criteria for them when buying agricultural products.

Respondents from Cyprus, Italy, Malta and Ireland (> 91%) attach great importance to special quality labels for agricultural products. In contrast, respondents from Austria, Czechia, Latvia, and Lithuania (< 69%) consider quality labels to be the least important. Among respondents from Croatia, the opinion on quality labels for agricultural products is in line with the EU average, i.e. 79% of respondents state that such labels are important to them. The desire for agricultural products that come from a short supply chain, i.e. the possibility of buying directly from food producers or the existence of a small number of intermediaries between producers and consumers, proved to be much more important. Across the EU, 85% of respondents rate this criterion as important when buying agricultural products; in Croatia, the figure is as high as 87%. Although still very important, this criterion is relatively least important for respondents from Czechia, Romania and Denmark (< 78%), and a short supply chain for agricultural products is most valued by respondents from Cyprus, Italy, Malta and Slovenia (> 91%).

Figure 7 Assessment of the inhabitants of the Republic of Croatia on organic agriculture
Source: authors based on European Commission 2023

Organic agricultural products (often referred to as organic or eco-products in Croatia) are a market niche of agricultural products in which consumers can recognise the added value (the possible added values examined are shown in Figure 8). In Croatia, 80% of respondents believe that organic food is better quality than others, which is higher than the EU average (74%). Respondents from Portugal, Cyprus, and Italy (> 85%) believe that organic food is of higher quality than other types of food. This contrasts with respondents from France, Finland and the Netherlands (< 61%) agreeing the least with this view. A slightly smaller number of respondents in EU countries believe that organic products are tastier than others (65%), and the same is noticeable among respondents from the Republic of Croatia, where 72% of them agree that the products are tastier. Respondents from Portugal mostly advocate the thesis of tastier organic products (83%), while respondents from France are the least convinced of the accuracy (47%).

The common opinion that organic products are produced in more environmentally friendly processes than other food products is shared by 81% of respondents from the EU. According to the opinion of the respondents, the Republic of Croatia is positioned almost at the top because 85% of the respondents agree that the production of organic products results from more environmentally friendly processes, and respondents from Italy, the Netherlands, Malta and Poland have the most confidence in the ecologically adapted production process of organic agricultural products (> 88%). Respondents from Lithuania and Czechia are the least convinced of such production methods (< 68%). A related opinion is that specific rules on using pesticides, fertilisers, and antibiotics should produce organic agricultural products. On average, 83% of respondents across the EU consider the thesis of compliance with the rules on the use of regulated funds to be correct, and a slightly higher proportion of respondents from the Republic of Croatia (85%) share the same opinion. Respondents from Denmark, Italy, and Sweden are most confident in maintaining such a practice (> 93%), while only 63% of respondents from Lithuania have the same opinion. 80% of respondents from the EU are convinced of animal welfare and compliance with the prescribed standards to ensure animal welfare in organic farming. Also, above the EU average, 84% of respondents from the Republic of Croatia believe that higher standards of animal welfare are ensured in organic farming. Respondents from Italy, Malta and the Netherlands (> 87%) are the most convinced of this thesis, while respondents from Lithuania, France and Belgium (< 70%) are the least convinced.

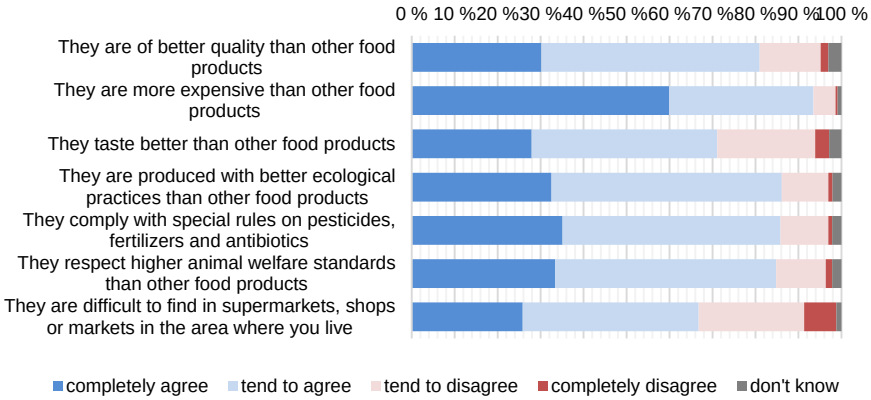

Figure 8 Assessment of the inhabitants of the Republic of Croatia on the impact of agriculture on climate change
Source: authors based on European Commission 2023

Their price is a possible obstacle to the purchase of organic agricultural products. A high proportion of respondents in all EU countries (92%) believe that organic agricultural products are more expensive than others. In the Republic of Croatia, 93% of respondents believe that organic agricultural products are more expensive than others, and more than 97% of respondents in Sweden, Cyprus, Greece and Estonia are of the same opinion. Although the percentage is still very high, the least respondents from Romania (78%) and Austria (85%) believe that organic agricultural products are more expensive than others. In addition to prices, the

availability or the possibility of finding organic agricultural products also proved to be an obstacle to buying organic agricultural products. 41% of respondents from the EU agree with the statement that it is difficult to find organic products in supermarkets or other stores in their area. Respondents from Finland, France and Denmark were the least likely to agree with this statement (<19%). They believe that it is very easy to find organic products in the stores in their area. In the Republic of Croatia, 67% of respondents agree with the statement that it is difficult to find organic products in stores in their area. In addition to the Republic of Croatia, most respondents from Hungary (79%) and Cyprus (75%) also claim this.

CONCLUSION

Due to its wealth of natural resources, Croatia is very well suited to agriculture. Almost 60% of the territory is agricultural areas, and in 2023, agricultural production contributed 3% to GDP, placing the country in the top third of the European Union. However, other statistics show that Croatian agriculture is not doing so well. This is particularly evident in the fact that between 2008 and 2023, there was a significant decline in production volume of 17 and an even more significant decline in intermediate consumption of 26%. However, the statistics do not provide a complete picture of the Croatian agricultural sector. During the reporting period, the dairy industry was decimated, while vineyards were reduced in order to replace older plantations with higher-quality ones. In addition to these challenges, the situation of Croatian agriculture is further exacerbated by rural depopulation and climate change. Furthermore, unsettled land records, excessive fragmentation of agricultural land, technological backwardness and the high proportion of small farms, which individually cultivate areas of up to five hectares, are often cited as obstacles to improving agricultural production.

The analysis of the attitudes of the population in Croatia and the rest of Europe shows that citizens are primarily aware of the importance of agriculture and the development of rural areas. Croatian respondents are more aware than average of the importance of agricultural development for improving the quality of life in the countryside and creating jobs. When assessing the current quality of life in the countryside, Croatian respondents rated the quality of the environment and natural beauty very highly, and they are also satisfied with the transportation and communication infrastructure. As expected, the worst aspects of life in the countryside were employment opportunities, followed by the availability of leisure and entertainment facilities.

Regarding the desirable characteristics of agricultural products, respondents were positive about preserving traditional products. They appreciate it when the products have recognisable quality characteristics and a known geographical area. They also recognise the importance and benefits of short supply chains. Respondents expressed concern about potential food shortages due to climate change and extreme weather conditions. They indicated they would be willing to pay a higher price for products whose production contributes less to greenhouse gas emissions. Most believe that organic products are treated less with pesticides and are produced using processes that contribute less to pollution than products from conventional

agriculture. They express some scepticism about the availability of organic products in the usual shopping channels in their area.

Among the trends where Croatian respondents score significantly lower than the average of EU countries is the insufficient proportion of those who believe that one of the main tasks of farmers is to fight climate change. In addition, a minority of Croatian respondents believe that the agricultural sector is one of the causes of climate change, although a slightly larger proportion believe this to be true. Encouragingly, most respondents still believe that the agricultural sector should also fight against climate change. Another area where Croatian respondents gave low and significantly worse ratings than the EU average concerns the role of farmers in improving the living conditions of farm animals. Based on the questionnaire, it is not possible to determine the reasons for such an attitude. In addition to the lack of concern for the living conditions of farm animals, the low ratings could also be due to the belief that farm animals live in better conditions in Croatia than in other countries or that the current regulations for farm animal husbandry are appropriate and sufficient.

Although the high share of agriculture in GDP in Croatia and other countries that are poorer than the EU average indicates weaknesses in industrial production rather than the strength of agriculture, this research undoubtedly points to the desire and willingness of the Croatian population to accelerate the development of agriculture and thus stop the negative trend of depopulation of rural areas. In addition, the respondents' answers clearly show that the revitalisation of agriculture is a prerequisite for better employability, which, in addition to enriching rural areas with cultural and recreational facilities, can also contribute to solving the problem of depopulation. These conclusions could encourage the legislative and executive authorities to make even greater efforts to improve the competitiveness of agricultural production. Respondents' awareness of the problems arising from the abandonment of agriculture and out-migration from rural areas suggests that potential government action to curb these negative trends could meet with strong public support.

Another implication for the state and agricultural producers is the positive attitude of the population of the Republic of Croatia towards organic products and products that contribute less to greenhouse gas emissions. The respondents' concern that climate change could lead to food shortages underlines the need for faster action, e.g., through developing and cultivating resistant varieties. Differentiation through organic production and an emphasis on offering local products are clear recommendations for farmers who want to survive and grow in the market. Significant efforts must be made to shorten the supply chains for agricultural products and to make the products of small and organic agricultural producers more accessible to customers.

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REPRESENTATION OF TOPICS IN AGRICULTURE IN ECONOMIC LITERATURE

CHAPTER 4

Ema Kelin [*], Antonija Srok [**]

ABSTRACT

The agricultural sector has a major influence on economic growth and development. At the same time, it is under the influence of major global changes. Climate change, new technologies and global shocks such as the COVID-19 pandemic and wars are forcing the agricultural sector to constantly evolve. This chapter provides an overview of the development of agricultural topics in economic literature over the last ten years. The results show that agricultural topics are increasingly present in economic literature, and that the most frequently covered topics relate to the challenges faced by agriculture. Although agricultural topics have been covered in economic literature by authors from all over the world, the largest number of publications come from the USA, while on average, the most cited papers are those published in European countries.

Keywords: *agriculture, economy, business, bibliometric analysis*

INTRODUCTION

Agriculture accounts for around 4% of global gross domestic product (GDP), while in the most underdeveloped economies this share can rise to over 25% of GDP. (World Bank, 2024a). In underdeveloped economies, improving agricultural activity is one of the foundations of economic growth, as investment in agricultural activity has been shown to be very important in stimulating growth in other activities as well. (Johnston and Mellor, 1961; Schultz, 1964; Christiaensen, Demery and Kuhl, 2011).

Economic growth alone is not enough for the development of underdeveloped countries. Therefore, over time, economic research has shifted the focus from the role of agriculture in economic growth to its role in combating extreme poverty. The fight against extreme poverty is characterised by increasing the income of the poorest. Therefore, the increase of income caused by agricultural activities has become the subject of numerous economic studies. Some of these studies have shown that the growth of agricultural activities is much more important than the growth of non-agricultural activities (Christiaensen, Demery and Kuhl, 2011; Ligon and Sadoulet, 2018). Although agricultural activity plays a key role in increasing the income of the poorest, it has less impact on the income of individuals whose income

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Kelin, E., Srok, A. (2025). Representation of Topics in Agriculture in Economic Literature, in book Katunar, J., Vrenetar, N., Jardas Antonić, J. (eds), Agriculture Through Sustainability Perspectives, University of Rijeka, Faculty of Economics and Business, Croatia.

is above the extreme poverty line (Cervantes-Godoy and Dewbre, 2010). Consequently, those economies benefit less from the growth of agricultural activity in the fight against poverty.

Although agriculture is one of the most important drivers of economic growth and one of the most important instruments in the fight against poverty, most of the farmers are smallholders. They in turn often face various challenges, such as problems with infrastructure in the broadest sense of the word, access to financial resources and services, and the commercialisation of their products (Aker, Ghosh and Burrell 2016). However, many of these challenges can be mitigated with the help of technology. For example, the global development of information and communication technologies (ICT) can substantially contribute to increasing the acceptance of new technologies and reducing these challenges through the dissemination of information (Nakasone, Torero and Minten, 2014).

The continuous adoption and introduction of new technologies in agriculture is the key to increasing agricultural productivity and ensuring adequate food supplies in poor countries. Economic policies related to the education and training of farmers are central to this process. The use of new technologies must be adapted to farmers depending on the quantity they produce in order to increase agricultural productivity (Takahashi, Muraoka and Otsuka, 2020).

Education, training and the acceptance of new technologies are also crucial for adapting to climate change. Although farmers are familiar with the problem of climate change and can see it in their crops, they find it difficult to adapt to it in the long term, most likely due to a lack of options or the cost of adaptation (Schlenker, Hanemann and Fisher, 2006; Burke and Emerick, 2016). However, adaptation of agriculture to climate change is a complex issue that depends not only on the agricultural crop, but also on various climate variables, primarily temperature, but also humidity, the occurrence of strong winds and storms, and other factors (Zhang, Zhang and Chen, 2017).

In addition to climate change, agriculture is facing other global shocks such as the COVID-19 pandemic and wars, which have a major impact on food supply chains and agriculture in general (Gray, 2020; Kerr, 2020; World Bank, 2024a). For example, the COVID-19 pandemic had a particular impact on the transport and modalities of food delivery. Instead of buying from the shops themselves, end customers increasingly purchased food via various forms of delivery, which certainly had an impact on the final price of the products purchased (Gray, 2020; Hobbs, 2020). Pandemics and conflicts are global shocks that have shown the vulnerability of today's food supply chains and drawn attention to the importance of local agriculture in securing access to food (O'Hara and Toussaint, 2021).

The importance of local agriculture for the economy was also analysed in Croatia in the context of a similar question as at the global level. In particular, the role of agricultural sustainability in rural and regional development (Turkalj, Ham and Fosić, 2013; Franić, Jurišić and Gelo, 2014; Zec Vojinović et al., 2024), the economic challenges in agriculture due to climate change and natural disasters (Čop and Njavro, 2023; Posarić and Palić, 2024) and challenges in supply chains were

analysed (J. Katunar, 2023). Research on ecological and organic production is also represented (Krešić and Sučić, 2010; Petljak, 2011), while more recent research focuses on the impact of ICT and new technologies on agricultural activity in Croatia (Lamešić et al., 2019; Čop et al., 2020; H. Katunar, 2023).

All these global changes and local particularities show how turbulent the environment is in which agricultural and related activities such as the food industry or transport operate. Consequently, global changes have a major impact on the economic performance of countries. Therefore, recent research on agricultural issues has been mainly related to the bibliometric analysis of specific concepts or areas of economics. For example, Malanski, Schiavi and Dedieu (2019) use a bibliometric analysis to show the characteristics of jobs in agriculture in different scientific communities in the period from 2008 to 2018. Mühl and de Oliveira (2022) use a bibliometric and thematic analysis to show the evolution of research related to the changes in agriculture caused by Industry 4.0. Kryszak, Świerczyńska and Staniszewski (2023) deal with the topic of total factor productivity in agriculture, while Chen, Geng and Zhu (2018) conduct a bibliometric analysis of the agricultural economics, which is, however, limited exclusively to China.

This chapter is the first to show the representation of agricultural topics in the entire economic literature. In doing so, we provide answers to three central research questions. First, we analyse how the topic of agriculture has developed in economic and business research over the last ten years. As part of this question, we look at the growth of the research field by analysing the number of papers published and the journals in which the papers are published. Second, we analyse the main topics of agricultural research in economics and business through the main topics of the journals in which the papers are published and the most common keywords in the papers. Third, we analyse the countries and institutions whose authors mainly deal with agricultural topics in economics and business studies.

The chapter is organised as follows: The introduction is followed by a chapter in which the bibliometric method used for the analysis and the type of data collection are explained. This is followed by a chapter in which the data is presented and the results arising from the three research questions are discussed. The final chapter contains the conclusions drawn from this study.

METHODOLOGY AND DATA

In order to find answers to the research questions, a bibliometric analysis was carried out. Bibliometric analysis is a quantitative tool for measuring and visualising a large number of publications and their relationships. The subject of bibliometric analysis can be published scientific papers, authors, countries, institutions where the authors come from, scientific journals and more. Focusing on each of the listed potential topics of bibliometric research provides a comprehensive overview of the research field. It is through a comprehensive overview that bibliometric analysis provides an objective insight into how a particular scientific field has developed over the years, who the main authors, institutions and countries in that field are, and which topics are most prominent in a particular time period or location (Župič and

Cater, 2015; Öztürk, Kocaman and Kanbach, 2024).

Bibliometric analysis begins with the collection of data on published scientific publications from the selected scientific field via one or more scientific citation databases such as Scopus or Web of Science. After filtering the collected data on scientific publications according to the selected criteria, the actual bibliometric analysis is performed using one or both methods of analysis: (1) performance analysis and (2) science mapping (Donthu et al., 2021).

The performance analysis is mainly based on analysing the number of publications and the number of citations related to a specific country, author, scientific institution or scientific journal (Donthu et al., 2021; Öztürk, Kocaman and Kanbach, 2024). This analysis enables a quantitative overview of the scope of scientific publications and the identification of key players in a specific scientific field. On the other hand, science mapping provides a visual insight into collaboration and relationships between authors, keywords and the like in the selected scientific field (Block and Fisch, 2020).

For the purposes of this study, bibliographic data was obtained by means of an extensive literature search in the scientific citation database Web of Science Core Collection using the method described above. The data collection is limited to the Core Collection part of the Web of Science citation database, as only papers with the greatest worldwide impact on selected scientific field can be found there.

Since the aim of this chapter is to show the representation of agricultural topics in the economic literature, the field of business and economics was chosen as the scientific search area. The search included all publications published between January 2015 and April 2024 in order to analyse how the field has developed over the last ten years. Under these conditions, 8,052 publications on topic of agriculture from the research field of economics and business were analysed. During the period analysed, these publications were cited a total of 100,921 times, i.e. 91,629 times if self-citations are not counted.

After filtering the publications as described above, we applied both methods of bibliometric analysis. Using the performance analysis, we first presented the development of agricultural topics in the economic literature based on the number of publications published by year in the period analysed. We used the same method to analyse the number of publications and the number of citations by country in order to gain an insight into the geographical locations where agricultural topics are most strongly represented in economic literature.

Using another method of bibliometric analysis, science mapping, we carried out several analyses. First, we mapped the association of journals according to the average year of publication with the topics of agriculture in economics. Then we focused on the association of the journals according to the represented topics of the scientific publications and the association of the keywords used in the scientific publications. The last analysis shows the network of co-authors according to the countries they come from and the association of institutions, i.e. their collaboration on scientific papers.

RESULTS

The scientific field development

To analyse the development of the presentation of agricultural topics in the economic literature over the last ten years, the graph in Figure 1 shows how the number of scientific publications has developed by year.

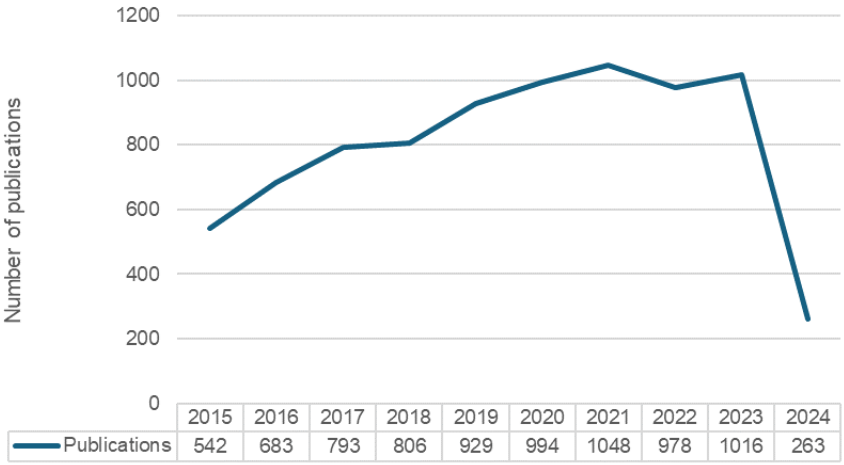

Figure 1 Number of publications by year 1/2025 – 4/2024
Source: author's own work

The graph in Figure 1 shows that the annual number of publications on agricultural topics in economic literature almost doubled in the period from the first (2015) to the last fully analysed year (2023). The last year, 2024, is not included in this part of the analysis, as it only shows the number of publications published up to April of that year. The strongest increase in publications was achieved in the first half of the observed period (2015 - 2019) when it increased by more than one hundred publications per year, with the exception of 2018. Although 2021 was the year with the highest single number of publications published in the Web of Science Core Collection citation database (1,048), the graph shows that the number of publications published from 2020 to 2023 stagnated at around one thousand publications per year.

In addition to the presentation of the annual publication figures, the development of agricultural economics topics can also be analysed on the basis of the scientific journals in which the articles were published. In Figure 2, the journals are organised according to the average year of publication on the topic of agriculture in economics. In other words, Figure 2 shows the most popular journals for the publication of the topics mentioned according to the year of publication, which provides an insight into the popularity of the topics covered over the last five years.

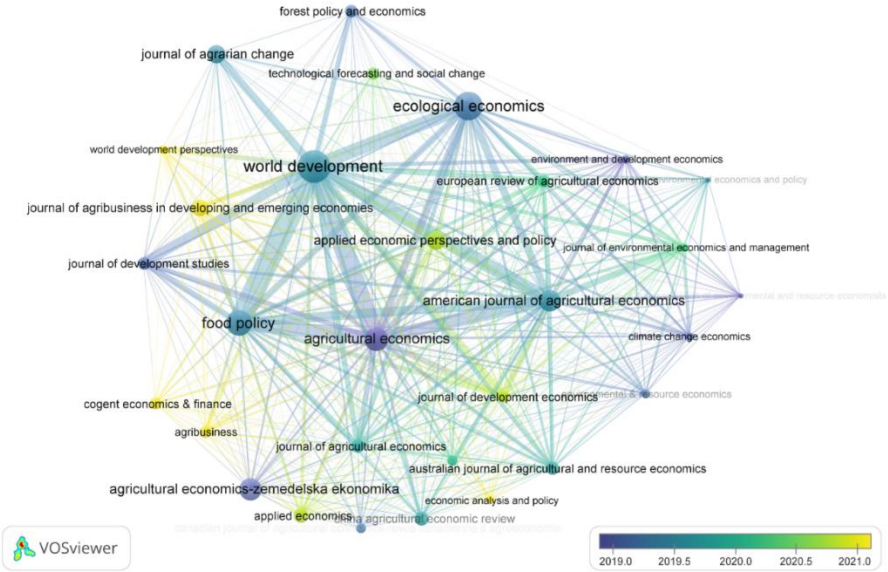

Figure 2 Journals according to the average year of publication of publications with the topics of agriculture in economics
Source: author's own work

It is interesting to note that at the beginning of the observed period, agricultural topics in economics were primarily published in journals (marked purple and blue-green) that deal with areas closely related to agriculture, such as development (journals "World development" and "Journal of Development Studies"), ecology ("Ecological Economics"), climate change ("Climate Change Economics"), food policy ("Food Policy"), but also directly agricultural economics ("Agricultural Economics", "American Journal of Agricultural Economics").

The journals marked yellow are those that published agricultural topics in economics most frequently at the end of the observed period. Figure 2 shows that after 2020, agricultural topics in economics are increasingly being published in journals specialising in general and applied economics ("Applied Economics", "Cogent Economics & Finance", "Economic Analysis and Policy", "Journal of Development Economics", "Applied Economic Perspectives and Policy") or business in agriculture ("Agribusiness", "Journal of Agribusiness in Developing and Emerging Economies").

Analysis of the published topics

To analyse the broader topics of the papers published in scientific journals, Figure 3 shows the clusters of scientific journals grouped according to the main topics of the journals.

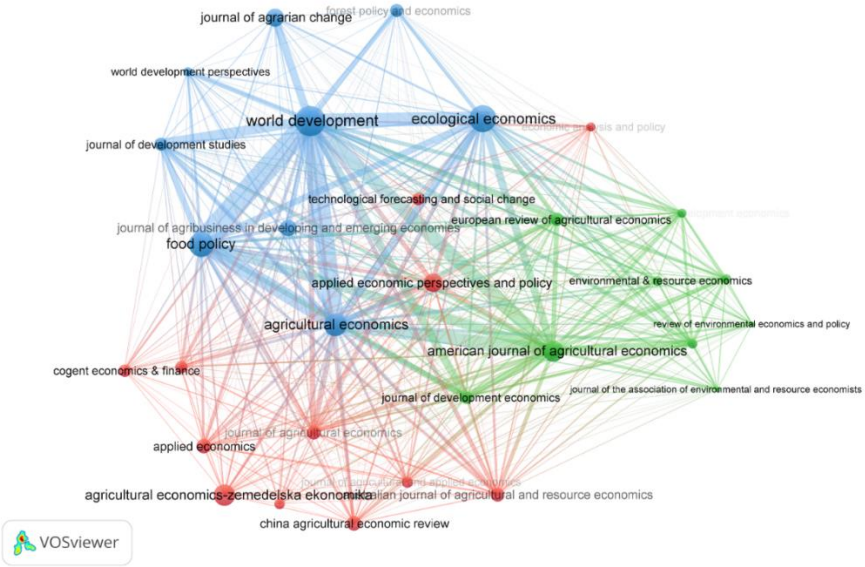

Figure 3 Connection of journals in which it is published - clusters made according to topics
Source: author's own work

Figure 3 shows that scientific journals that publish papers on agricultural topics in economics are mainly focused on three main topics: Development (marked blue), Environment (red), and General and Agricultural Economics (green). However, to get a more detailed insight into the most common topics of the publications themselves, it is necessary to analyse their keywords, as shown in Figure 4.

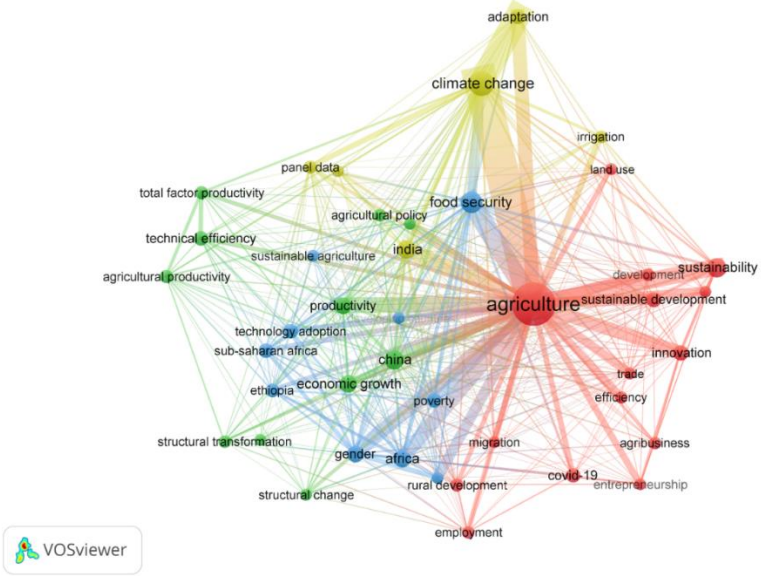

Figure 4 Connection of key words in published scientific publications
Source: author's own work

The most popular keyword is certainly "agriculture", but Figure 4 also shows that most papers mention the combination of "agriculture" and "climate change" as keywords. Climate change is certainly one of the most important global challenges for agriculture. The cluster of keywords used in relation to climate change is shown in yellow, with the words "adaptation" and "irrigation" also highlighted.

Other keyword clusters also provide an insight into the groups of the most frequently discussed topics, with each group shown in a different colour. The keywords marked in red cover the topic of development in a broader sense. This group also contains key terms related to development, such as "sustainability", "innovation", but also the COVID-19 pandemic, which has been a major test for the sustainability of food supply chains. The blue section deals with topics that mainly related to African agriculture and the associated challenges. These keywords therefore include "food security", "poverty", "technology adoption" and others. The green cluster, on the other hand, shows the topics related to efficiency and productivity, such as "agricultural productivity" or "technical efficiency".

Analysis of author's countries and institutions

Analysing the number of publications and the number of citations according to the countries from which the authors of papers on agriculture in economics originate helps to identify the leading countries in this field. Table 1 shows that the USA has been the absolute leader in the last ten years with the largest number of publications and citations. With 2,030 publications, the USA has published almost 2.5 times as many papers as India, which is in second place with 845 papers. Although India ranks second in the number of papers published, China is still the country that ranks second in the number of citations. However, the USA surpasses China in terms of citations, with three times as many citations.

Given the large differences in size between countries studied in terms of population, and therefore the number of scientists working on a particular topic, it is also necessary to analyse the individual impact that the work of scientists from a particular country achieves after publication. This influence is measured here by the average number of citations per publication and is shown in the last column of Table 1. Although the top of the table in terms of total number of publications is held by the largest countries (USA, India, China), the number of citations per publication is still led by European countries, namely Switzerland with an average of 21.04, Belgium with 19.93, the Netherlands with 19.68 and Sweden with 18.87 citations per publication. Although scientists from Kenya have only published 105 papers in the last ten years, they are in fifth place in terms of the number of citations per publication. With an average of 18.76 citations per publication, papers from Kenya are therefore cited very frequently.

No.	Country	No. of publications	No. of citations	Citations per publication
1	USA	2,030	37,304	18.38
2	India	845	6,097	7.22
3	China	703	12,201	17.36
4	England	547	10,100	18.46
5	Germany	513	9,602	18.72
6	Italy	443	6,881	15.53
7	Australia	430	6,464	15.03
8	France	359	5,403	15.05
9	Canada	307	5,184	16.89
10	Netherlands	228	4,486	19.68
11	Spain	207	3,577	17.28
12	Brazil	183	1,683	9.20
13	Poland	165	788	4.78
14	RSA	161	1,823	11.32
15	Switzerland	155	3,261	21.04
16	Sweden	148	2,780	18.78
17	Russia	141	781	5.54
18	Indonesia	135	1,299	9.62
19	Belgium	132	2,631	19.93
20	Vietnam	123	1,277	10.38
21	Ghana	111	1,192	10.74
22	Pakistan	108	1,456	13.48
23	Kenya	105	1,970	18.76
24	Malaysia	105	902	8.59
25	Ethiopia	98	1,637	16.70
26	Denmark	96	1,548	16.13
27	New Zealand	93	1,438	15.46
28	Norway	78	1,155	14.81
29	Mexico	74	892	12.05
30	Scotland	68	1,054	15.50

Table 1 Thirty leading countries by number of publications and citations 1/2015 – 4/2024
Source: author's own work

The USA, India and China have the highest total number of published papers, while the USA and China also have the highest total number of citations. European countries are ahead in terms of the average number of citations per publication. However, Table 1 shows that countries from all continents are among the thirty countries with the most publications. Although agriculture as an activity is often associated with the beginnings of a country's economic development, this shows that agricultural topics in economics and business are not a location-bound subject of research, but are researched worldwide, regardless of the level of development of a particular country.

In order to understand the development of the field, it is necessary to analyse not only the number of publications and their citations, but also the cooperation in work between different countries (Figure 5). Authors from the USA, the country with the largest number of publications, mostly publish in collaboration with scientists from all over the world, but especially with scientists from China, India, Australia, England, Germany, Italy and Canada.

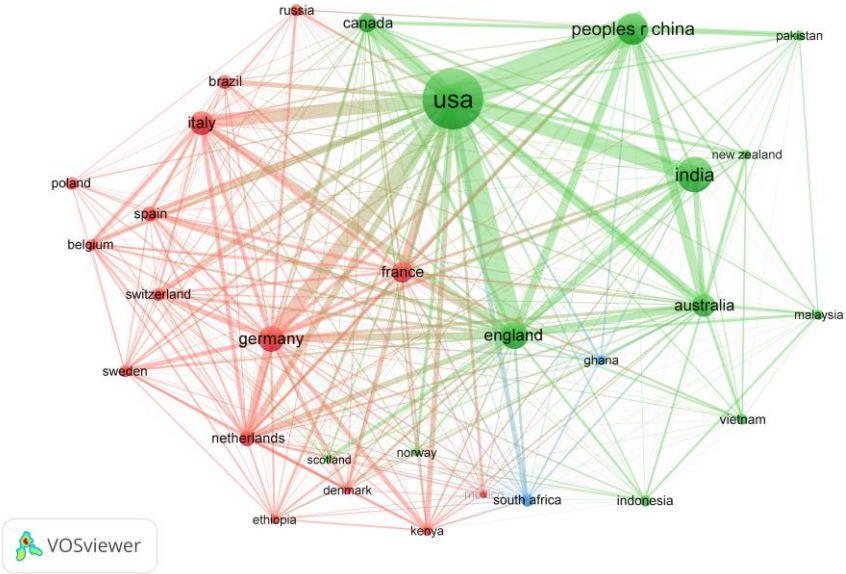

Figure 5 Connection of co-authors according to the countries they come from
Source: author's own work

In Europe, England, Germany and Italy have the most publications, while the strongest co-authorship within Europe is between authors from Germany and the Netherlands. Although authors from most of the European countries analysed also publish with authors from the USA, Figure 5 shows that the densest network of co-authorships, marked in red, is to be found in Europe. This indicates frequent international co-operation in publications between European co-authors.

By showing the co-authorships via the institutions from which the authors originate, Figure 6 provides a more detailed insight into the institutions and organisations that deal with topics relating to agriculture in economics. Globally, most publications come from the International Food Policy Research Institute and the World Bank.

Both organisations focus on the economic development of less developed countries. The International Food Policy Research Institute mainly conducts research in the field of agriculture, with the aim of reducing the problem of poverty and malnutrition and promoting economic development with environmental sustainability(*The International Food Policy Research Institute* 2024). Similar goals with a focus on reducing extreme poverty by promoting sustainable economic development are also being pursued by the World Bank (*World Bank,* 2024b). These are precisely the topics that are most strongly represented in research on topics

from agriculture in the economics, as the analysis of the keywords of the published papers in Figure 4 shows.

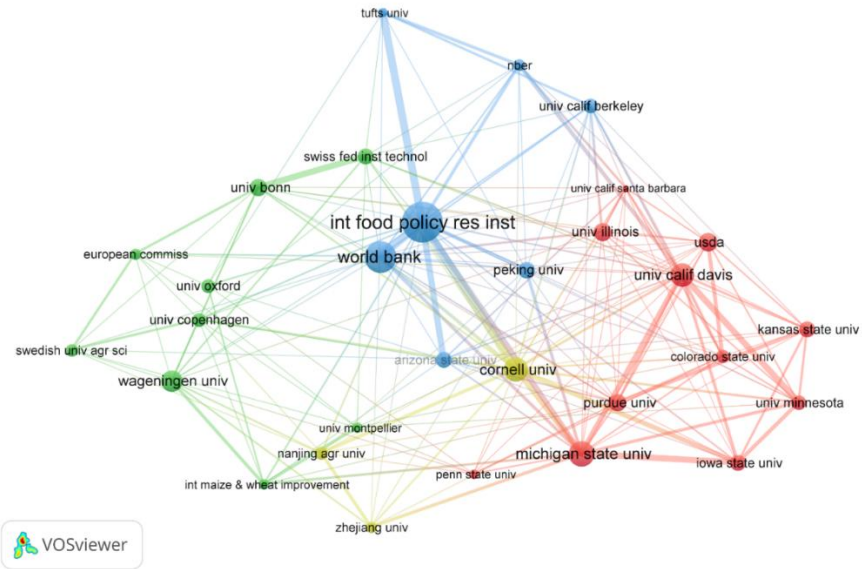

Figure 6 Institutions from which the leading authors in the field come
Source: author's own work

In addition to the two global organisations mentioned above, several universities around the world are also working on these issues. American and European universities stand out in particular, as can be seen from the number of papers published, and especially from the number of citations in Table 1. Of the American universities, Cornell University, Michigan State University, Purdue University, the University of California Davis and Iowa State University and University of Illinois stand out with the largest number of publications. Scientists from these universities often contribute to publications as co-authors.

In Europe, most of the publications come from authors at Wageningen University in the Netherlands, the University of Bonn in Germany, Oxford University in England, the University of Copenhagen in Denmark and the Swiss Federal Institute of Technology in Switzerland. Some of the authors in Europe come from the European Commission itself, which co-operates with numerous European universities.

CONCLUSION

This chapter analyses the representation of agricultural topics in economic literature. The analysis was carried out using two bibliometric methods, performance analysis and scientific mapping. 8,052 publications contained in the scientific citation database Web of Science Core Collection were analysed. The representation of agricultural topics in the economic literature was analysed from three perspectives: (1) analysis of the development of the research field, (2) analysis of the topics of the published papers and (3) analysis of the countries and

institutions that make the greatest contribution to this research field.

Over the last ten years, there has been a substantial increase in research on agricultural topics in economic literature. This is particularly evident in the increase in the number of publications from 2015 to 2019. From 2020, the number of publications from the field of agriculture in economics and business in the scientific citation database Web of Science Core Collection stagnated at around one thousand publications per year. In addition to the number of publications, the research field is also developing via scientific journals. While until 2020, agricultural topics in economics were mainly found in journals specialising narrowly in agriculture and agriculture-related topics, after 2020 more and more such topics have been published in journals specialising primarily in economic topics.

The analysis of the topics covered in scientific journals shows that the most frequently covered topics are the connection between agriculture and development, environment and economy. The analysis of the keywords gives a more detailed insight into the topic of the published papers and shows that the four most important groups of keywords from 2015 are African specificities, productivity, adaptation to climate change and innovation in agriculture.

Although topics related to agriculture in economic literature are represented in papers around the world, the USA tops the list with almost 2.5 times more publications and three times more citations than the second-placed countries. Authors from the USA publish by far the most, but authors from Europe, led by authors from Switzerland, top the list with the highest average number of citations per published paper. Authors from Europe also frequently collaborate on scientific papers, while the co-authorship of authors from the USA is spread across countries around the world.

In addition to numerous American and European universities that publish scientific papers agriculture in economics, the International Research Institute for Food Policy and the World Bank stand out as leading institutions in this field. Both institutions analyse the role of agriculture in economic development and poverty reduction and contribute to economic policy. This sufficiently emphasises the role that agriculture continues to play as a driving force for economic development.

This chapter has shown how the topic of "agriculture" is represented in economic literature, leaving several research directions open. One of these directions is to investigate the stagnation in the number of published papers on this topic after 2020. There are many reasons why the number of publications could stagnate: from the focus on research into specific agricultural crops to the increase in the number of publications in the interdisciplinary and not exclusively economic field. Research in this direction would provide an even more detailed insight into the direction of development of this field of research.

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TECHNOLOGY AND INNOVATIONS IN AGRICULTURE

CHAPTER 5

Nenad Vretenar *

ABSTRACT

Decisions about investments into technology and technology sources made by manufacturing companies are often decisions which have long-term consequences for the business. In recent years, there has been a rapid and strong development of technological possibilities in agricultural production, especially those based on digital technologies enabling improved efficiency and productivity. Concepts such as precision agriculture, smart farms and the integration of technologies including satellite guidance and sensor systems play a particularly important role in modern agriculture. However, research shows that there are still major barriers to the adoption of new technologies, particularly for smaller farms. This chapter provides an overview of the most important emerging technologies and analyses the possibilities of their implementation in the context of Croatian agriculture, with special emphasis on challenges for instance, low average of cultivated area and labour shortage. In order to prevent further technological backwardness and a drop in the competitiveness of small and medium-sized producers, it is necessary to improve the possibilities of education for the workforce and to promote technologies that are also suitable for smaller producers in terms of investment, application and maintenance. Further development and wider application of new technologies supported by public policies is the key to facilitating technological transformation of Croatian agriculture in the future.

Keywords: *technology, innovation, precision agriculture, smart farms, operational management*

INTRODUCTION

Agricultural production in the Republic of Croatia has long faced numerous challenges. The early 1990s and the country's independence were marked by intense wartime events that significantly affected some of the most important agricultural regions such as central and eastern Croatia and Lika. The war left lasting consequences on agricultural land and other agricultural capacities and labour. This was followed by years of relative technological lag and increasing competition from agricultural products from other European countries as well as from East Asia. After joining the European Union, the problem of labour migration intensified, disproportionately affecting Croatian villages. Croatia's issues with labour shortages and lack of interest in agricultural work are not alleviated by the import of temporary, unskilled labour, as such jobs do not guarantee long-term employability

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for those hired. In addition, investments in the education of unskilled workers by small and medium-sized enterprises paradoxically make these trained workers more attractive to larger companies, exacerbating the problems for those who have invested in their training (Sokolić, 2023). This situation poses a major challenge for most economic activities in agriculture, as reported in the State of Agriculture Report 2022 (Majdak 2023, p. 23), where 69.4% of farms in Croatia use less than 5 hectares of agricultural land. In addition, 97.6% of farmers operate through family farms (OPGs), specialised family farms (SOPGs) or crafts. These characteristics often indicate smaller farm sizes.

The state of Croatian agriculture becomes even more worrying when looking at the statistics on the growth of agricultural production volume and intermediate consumption. From 2008 to 2023, both indicators recorded a significant decline of 17% and 23% respectively (Eurostat, 2024), despite the fact that rural areas make up the majority of Croatia's territory and employ a significant part of the population. At the same time, an analysis of public attitudes in Croatia and across Europe based on the Special Eurobarometer (European Data, 2023) revealed that Croatian citizens are well aware of the importance of agriculture and rural development. Croatian survey participants demonstrated an above-average level of awareness regarding the need for agricultural development to improve the quality of life in rural areas and to create jobs.

Considering the fact that the issues related to the depopulation of Croatian villages cannot be solved quickly (if at all, given the trends of urbanization and that the influx of labour from third countries mostly ends in cities), the most promising way to develop and improve the competitiveness of agricultural production lies in its technological advancement. Since Croatia's challenges regarding technological lag and labour shortage in agriculture are not unique and similar issues are not uncommon in relation to relatively small farms worldwide, this research provides an overview of technological opportunities and advancements in agricultural production. Spanning the last two decades or even less, this period represents a time of significant technological change, including the advent of satellite-guided machinery, sensor systems that facilitate field condition monitoring and decision making, variable rate crop enrichment tools, weed control technology, and more. Concepts such as precision agriculture, smart farming, autonomous machinery, and the Internet of Things represent a significant and growing current in agricultural technology discussions today. Existing and upcoming innovations will undoubtedly transform operational management and bring new opportunities as well as new challenges. Therefore, the primary aim of this research is to explore and present the latest technological trends in agricultural production and to present results of recent scientific studies that have investigated various aspects of the new technologies.

THEORETICAL FRAMEWORK FOR ANALYSING TECHNOLOGIES AND INNOVATIONS IN PRODUCTION

Technology decisions are among the most long-term decisions in operations management (Briš Alić et al., 2022). The time periods are usually categorised as follows: less than one year is considered short-term, three to five years as medium-

term and more than five years as long-term. A less pragmatic but more meaningful interpretation of these time frames is provided by microeconomics, which defines the long-run as a period in which all production factors are flexible, the short-run as a period in which at least one factor is fixed, and the very short-run (curent) as a period in which all factors are fixed. The reasons why technology decisions fall into the long-run category according to both conventional interpretations lie in their financial requirements and, more importantly, in the sunk costs that technological investments often entail. The financial requirement usually requires the financing of long-term investments, for which there must be a reasonable degree of certainty that these technological investments will generate an adequate return. At the heart of the profitability analyses for this challenge is the estimation of future demand, i.e. whether the demand for a company's products will allow sufficient utilisation of technological capacity in the long-run. For example, if a family farm is considering moving into hydroponic vegetable production, it will first consider whether the significant investment required for this type of production is justified based on the long-term demand for vegetables produced in this way and the expected price that such production will realise. The issue of potential sunk costs associated with investments is always present, but not always equally pronounced. Thus, if a family farm considers purchasing an additional tractor to expand its operation and later realises that the expansion was not successful or decides to withdraw from the investment, the tractor may be sold. Although it is expected that the tractor will have to be sold for less than the purchase price, this loss will be significantly less for standard equipment with an active secondary market than for specialised equipment that has limited use or was built specifically for a particular investment. In this example, the sale of the tractor would therefore cause relatively lower sunk costs than an unsuccessful investment in hydroponic production. Oliver Williamson (1985, 2002) explains this problem through his interpretation of asset specificity, which refers both to the specificity of physical assets and to spatial specificity.

For small producers, who make up the majority in Croatian agriculture, technology decisions are even more significant as they face greater challenges compared to large producers: limited resources, limited access to information and vulnerability to weather conditions. Resource constraints relate to lower available financial resources and limited access to external financing, as well as basic resources such as smaller amounts of arable land and water availability. The limitation of available information arises from the difficulties in obtaining timely and quality information that is important for decision making, which is not only related to the remoteness of rural areas, but is primarily due to a lack of management and administrative capacity. Simon (1955) explained the limitations of rationality in decision making by the lack of time and other resources necessary for complete information gathering and processing before decisions are made.

The introduction of new technology represents an innovation for any organisation, although it does not necessarily equate to market innovation. It is therefore interesting to outline what Joseph Schumpeter wrote on the subject of innovation because his works still serve as a starting point for the study of the relationship between business and innovation. Schumpeter saw competition as a destructive process in which effort, assets and wealth are continually destroyed by innovation. The endless process of eliminating old technologies while establishing new ones has

led to economic growth at a significantly faster rate than that of stable, conservative alternatives (Hovenkamp, 2008).

Joseph Schumpeter's key questions about innovation are still important and only partially answered: Are larger firms better innovators than smaller ones? Which market structures best support and enable rapid technological advancement? Is there a feedback loop between technological rivalry and market structures? Schumpeter understood innovation in the broadest sense as "doing things differently" This included innovations such as the introduction of new goods or new methods of producing existing goods, the development of new markets for products or the development of new sources for the procurement of materials. He even considered the restructuring of industries in a way that leads to monopolies (Martin, 2010, p. 452).

Schumpeter's view of the relationship between market structure and innovation has evolved over time. In the early stages of his academic career, he argued that entrepreneurs - especially new firms (which did not emerge from older firms but were founded alongside them) - were the main drivers of innovation. Later, under the influence of the concentrated structures of the 20th century, he revised his thesis and argued that innovation comes from existing firms, especially large conglomerates. He attributed this shift to a state of technological development in which "most of the cheap and easy inventions have already been made", suggesting that further advances tend to be more sophisticated and costly, so that few can afford to make development mistakes. Both views can easily be applied to agricultural production. The former view, where entrepreneurs or small firms are seen as innovators, is illustrated by the recent success of Croatian winemakers, where numerous small winemakers are driving technological innovation (Grudić Kvasić, 2023) and innovation in distribution channels (Katunar et al., 2020). The argument that firm size primarily affects the ability to innovate in agriculture is obvious and is interpreted in this chapter with regard to the ability of farmers to innovate technologically.

According to Martin's (2010, p. 456) categorisation in the theoretical literature, four main reasons frequently emerge as to why large firms have an innovation advantage:

- Large firms can spread fixed development costs over a larger volume of products.
- Large firms have better access to financial markets.
- Large firms can better utilise economies of scale and scope in research.
- A large, diversified firm is more likely to benefit from unexpected discoveries (the so-called serendipity effect).

Given the relationship between firm size and market concentration, the expected relationship between market structure and innovation is also significant. For these reasons, and in line with Schumpeter's later views, it can be assumed that larger firms have both the motivation and the ability to innovate more than smaller firms. Consequently, as firms grow and market concentration increases, their innovation activities should also increase. However, it is also known that monopolists tend to favour a "quiet life"," partly due to the fact that there is less pressure to innovate in

such firms. It is therefore generally assumed that innovation activity is most pronounced in market structures that lie between very low and very high concentration (see Figure 1).

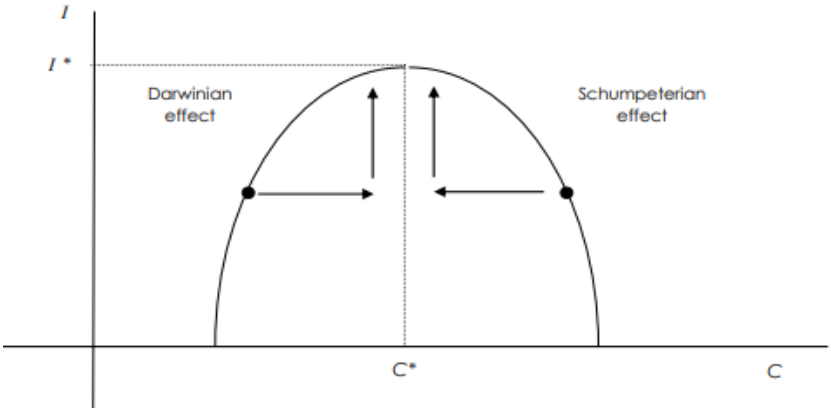

Figure 1 Innovations and Market Concentration
Source: Friesenbichler 2007 according to Aghion et al. 2005

Although Croatia is categorised as an emerging market in terms of innovation, its innovation activity— measured in terms of investment in research and development —is unfortunately still not keeping pace with GDP growth. The lack of optimism is reflected in the fact that a significant part of this investment comes from the public sector (including higher education), while investment in the real sector is less well represented (Kaštelan Mrak & Vretenar 2024).

TECHNOLOGICAL INNOVATIONS IN AGRICULTURE

While most people probably still intuitively associate farming with a traditional way of life in harmony with nature and far removed from the ubiquitous digital technology, it is precisely the solutions based on digital technologies that currently represent the greatest change in agricultural practise. Furthermore, the emergence of new technologies and methods in agriculture represents a technological disruption sometimes compared to the advent of the first tractors. The current dominant technological trends in agriculture include

- Precision agriculture
- Drones (for monitoring and mapping fields, multispectral imaging)
- Mobile technologies
- Digital markets for agricultural products

Precision agriculture can be defined as a management strategy that collects, processes and analyses temporal, spatial and individual data on crops and livestock and combines it with other information to support management decisions. The aim of precision agriculture is to improve the resource efficiency, productivity, quality, profitability and sustainability of agricultural production (International Society for Precision Agriculture 2024). According to Singh et al. (2020), precision agriculture is

the science of improving crop yields and supporting management decisions through high-tech sensors and analytical tools.

From these definitions, it is evident that precision agriculture is essentially a form of digitalisation of agriculture. Significant investments have already been made in agriculture in certain agricultural segments and parts of the world, particularly in agricultural start-ups that aim to facilitate the transformation of farms from traditional industries to the next big data industry (Burwood-Taylor, Leclerc & Tilney, 2016). In other words, precision agriculture means using technology to collect data, analyse the collected data and then make targeted interventions in agricultural crops. Pham and Stack (2018) note that a new generation of agricultural equipment enables the use of sensors and cameras to collect data from agricultural fields, such as soil moisture, leaf greening, temperature, fertiliser and pesticide use, expected crop yields, as well as fuel consumption and equipment efficiency.

The transition from conventional to precision agriculture brings with it not only potential leaps in production efficiency, but also potential changes in markets related to agriculture. As the foundation of precision agriculture is the digitalisation of farms and the focus on data collection from agricultural fields, tractor manufacturers and seed producers could be among the competitors in data collection. This focus on capturing and analysing big data from agricultural fields is attractive for traditionally complementary industries within the value chain. Increasing market competition between tractor manufacturers and seed producers is therefore to be expected within data collection systems in agriculture.

The potential benefits of utilising the opportunities offered by precision agriculture relate to increased efficiency:

- **In production planning** (by using knowledge of what is needed on agricultural land, the consumption of fertilisers, pesticides and other inputs is reduced)
- **During the season** (by avoiding errors associated with late crop protection)
- **When selling products** (accurate data on where a particular commodity was grown, how it was treated and its nutritional value).

Precision agriculture already enables numerous savings in production and advantages in sales. For example, a hypothetical pig farmer could market prosciutto or kulen (flavored sausage traditionally produced in Slavonia) if he can prove where his pigs were raised and what they ate, and if he can prove that their feed was not treated with pesticides. Fruit or grain growers could make decisions about necessary treatments based on precise information gathered from their fields, treating different parts of a field or plantation according to different needs. In order to achieve these benefits of precision agriculture, certain technological requirements must be met. In addition to the aforementioned possibilities of big data analysis and artificial intelligence, the digitalisation of agriculture also includes the Internet of Things (IoT), the creation of satellite images of areas, the use of GPS-equipped tractors and the use of livestock management tools that display information on movement, feeding, watering and milking. GPS-equipped tractors guided by satellite navigation are used to avoid areas that have not been treated or have been treated

multiple times (Barnes et al., 2019). To develop autonomous machinery capable of operating independently of the time of day or weather conditions, satellite navigation is expected to be combined with depth cameras or laser radars to achieve precision, safety and obstacle avoidance (Yao et al., 2023). Besides autonomous tractors, this group of current and future technological innovations expected to transform farms includes robotic harvesters (which can be programmed to recognise certain types of crops or fruits) and drones equipped with sensors (Sahu & Jena, 2023A).

The Internet of Things in agriculture refers to the use of sensors that are able to detect changes in the environment and collect important data such as moisture content, temperature, water quality, presence of chemicals or smoke, movement control, etc. This technology is particularly important for the application of variable rate nitrogen fertilisation techniques. In addition to cost savings, these technologies also aim to reduce the negative environmental impact of agricultural production.

In general, the technological solutions of precision agriculture can be divided into technologies that integrate existing technological knowledge into physical assets (machines) and those that focus on information. The visualisation of these two groups of technologies can be seen in Figure 2. It can be seen that the first group focuses primarily on technologically advanced agricultural vehicles, while the second group focuses on IoT sensors for data collection and processing to enable precise action, again largely using technology from the first group. Controlled Traffic Farming, for example, is a management tool that minimises crop damage (excessive fuel consumption, field damage, drainage damage) caused by frequent machine passes. The use of this management technology is directly related to variable weed control practises, machine guidance systems and driver assistance, and crop sensors, coupled with variable irrigation and crop enrichment. Despite the stated complementarity between these two groups of technologies, their application is not proportional. Research shows that satellite navigation technology has experienced rapid growth over the past decade in the US and other developed regions; however, technologies that enable variable rate crop interventions are significantly less utilised, while digital mapping of agricultural land is even less common (Lowenberg-DeBoer & Erikson, 2019). It can be assumed that agricultural producers are reluctant to use technologies whose effectiveness they are not yet convinced of. Although the use of satellite data is mostly free, converting this data into useful processing applications requires considerable technological expertise (Sishodia et al., 2020).

According to other authors (Briner et al., 2021), technologies utilising GPS systems, sensor networks and variable rate devices may be acceptable for smaller farms, but systems for autonomous machinery analysis in the cloud remain financially and technologically out of reach. In some cases - e.g. the use of satellites for digital mapping - there may also be concerns that such images could be misused by large seed producers. This assumption should be empirically tested in future research.

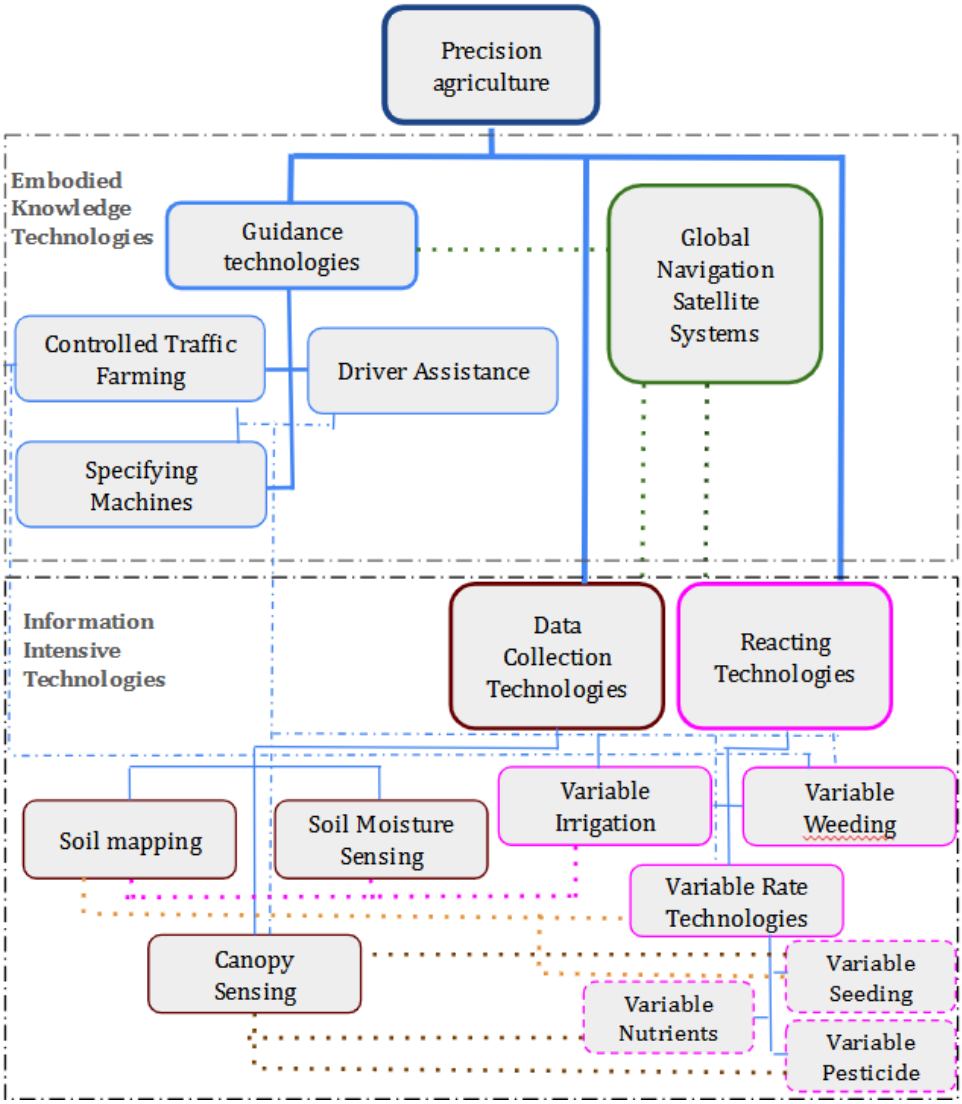

Figure 2 Systematization of Precision Agriculture Technologies
Source: Author's creation based on Barnes et al. (2019)

OVERVIEW OF RESEARCH INTO THE USE AND BENEFITS OF PRECISION AGRICULTURE TECHNOLOGIES

In their overview of the main trends and opportunities for the development of sustainable agriculture under its three main aspects (environmental, economic and social), Dossa and Miassi (2024) emphasise that precision agriculture focuses on optimising spatial management to increase yields while avoiding the unnecessary use of pesticides and fertilisers. In contrast, smart agriculture relies on the use of

artificial intelligence and the Internet of Things to manage farms with the help of cybernetics.

Research on the adoption of precision agriculture technologies in Brazil (Carrer et al., 2022) has shown that the adoption of these technologies correlates positively with farm size, the level of education of farm managers and the amount of technical support available. Interestingly, the same study emphasises that the likelihood of adopting smart farming technologies decreases with increasing farming experience. Similar conclusions were reached by Pivoto et al. (2019), who identified high initial investment costs, a lack of skilled labour and digital literacy as barriers to the adoption of smart farming technologies. Barnes et al. (2019) also point to maintenance costs as a barrier. In addition to these commonly cited barriers, other studies (Sharma, 2023) identify challenges such as managing large amounts of data, crucial compatibility issues between different technological solutions (Kunu et al., 2024) and concerns regarding data privacy.

The perception of precision agriculture adoption is low because it is associated with variable rate technology (VRT), which emerged among the first technologies but still rarely covers more than 20% of agricultural land. However, this technology is only one of many technologies for precision agriculture, while other technologies show significantly higher growth. An exception in development or a further technological lag can be observed in small farms in developing countries that do not use motorised machinery (Lowenberg-DeBoer and Erikson, 2019). The challenge of measuring technology adoption in agriculture is recognised in the scientific community. To enable systematic and comparable analyses of information technology adoption on farms, Rajeshwari and Dolli (2020) developed a scale with 48 indicators and surveyed 250 scientists and agricultural experts to create the questionnaire.

Wolfert et al. (2017) analysed leading smart farm management applications that include capabilities such as big data analytics, cloud storage and the Internet of Things. According to their findings, the capabilities of smart farm applications go beyond primary production and are already impacting the entire food value chain. These applications help with forecasting, assist in managing operational decisions and help change/adapt business models. The impact of digitalisation on innovative processes in agriculture was examined in the work of Sozaeve et al. (2021). In their research, they suggest that agricultural regions should strive for interaction between the public and private sectors in order to build innovation capacities even among smaller producers. Otherwise, the upcoming digitalisation and the associated efficiency gains could only be accessible to large firms.

In their study on the effectiveness of agricultural meteorology based on information and communication technologies (ICT), Baruah et al. (2023) found that three quarters of the farmers involved in their research (n = 100) were satisfied with the timeliness of the information provided; however, respondents' satisfaction with the quality and comprehensibility of the data was significantly lower. They concluded that the available tools for agrometeorology are more suitable for farmers with

greater experience and higher levels of education, especially those with more experience in using information technologies. Wolfert et al. (2021) also call for greater collaboration between the private and public sectors and emphasise that the integration of digital technologies in food production is shifting from small individual applications to complex ICT solutions involving multiple stakeholders.

A study conducted in Pakistan (Chhachhar et al., 2014) to analyse the use of information and communication technologies on farms found that more than 95% of interviewed participants (n = 150) had never used a mobile phone (the most accessible form of technology) to obtain information about the prices of their products or to contact agricultural officials to resolve any issues or obtain necessary information. A more recent study (Pyay Thar et al., 2020) on the use of mobile phones and their applications conducted in Myanmar warns that mobile applications developed to support agricultural decision-making should target younger populations and be tailored to specific problems in order to be successful, highlighting that mobile phones are increasingly used for discussions and consultations in specialised Facebook groups. This use of mobile phones as information and counselling tools falls under the so-called simple digital tools, which are characterised by ease of use and low barriers to entry. More advanced and sophisticated uses of mobile phones become possible when they are used for manual or automatic data entry (in conjunction with sensor systems). Such use proves to be much more productive, as mobile phones offer not only simplicity and low financial requirements but also a much higher quality of information. However, this technology is still associated with requirements for timely data input or investment in sensor detection systems and automatic input (Daum et al., 2022).

As one of the key aspects of precision agriculture that farmers are most concerned about, we highlight weeding using tractors, given that weeds are the biggest cause of yield loss in fields, surpassing insects and plant diseases (Sahu and Jena, 2023A). In this regard, precision agriculture refers to both mechanical and chemical weed control. Despite the appeal of these technologies, particularly due to the labour-intensive nature of traditional weeding and the pervasive labour shortage, these technologies are not considered financially affordable for smaller producers.

Recent research by Ković et al. (2024) found that company size does not appear to be a predictor of the likelihood of using artificial intelligence in business, and even companies that can be categorised as high-tech do not use artificial intelligence significantly more often than others. Although this research was conducted in the field of industrial production and not agriculture, it is possible that artificial intelligence in agricultural production will become a technology that can be used by both small and medium-sized enterprises.

Optimistic conclusions regarding the present and especially the future of precision agriculture can be drawn from the research of Kumar et al. (2020). The authors emphasise that precision agriculture will lead to the emergence of resilient, adaptable and interconnected technologies in food production, accompanied by

increases in yield and performance. However, they also point to the associated technological complexity and the challenges of financing the necessary investments. Nevertheless, scientific studies that independently analyse and confirm the changes in agricultural production efficiency due to the introduction of specific precision agriculture technologies are relatively rare. According to a study by the Indian Ministry of Agriculture, the use of technologically advanced precision agriculture leads to savings of 15% to 20% in the use of seeds and fertilisers and to savings of 20% to 30% in working hours. In addition, yield increases of 13% to 23% and a reduction in labour requirements of 20% to 40% are expected (Gaadhe, 2024). Bhojwani et al. (2020) show concrete results from empirical research on the impact of using available sensor technology and state that sensors such as those used in their study are affordable for farmers and can increase efficiency on any farm.

The growing number of studies providing concrete and credible data on potential savings would be a good start to steer more farmers towards precision agriculture. Sangeetha et al. (2024), in their review of the progress and development of technologies, emphasise that precision agriculture has already become an integral part of modern food production. However, for it to spread globally, it is necessary not only to overcome technological barriers and increase accessibility — especially for smaller farms — but also to continue developing its predictive power and adaptability in use. In addition, flexibility in application and the ability to integrate with existing technologies are of crucial importance.

Based on the analysis presented, as well as the principles commonly used in the field of operations management, decisions about technologies must be made not only with financial viability in mind, but also with an understanding of the needs and capabilities of the end user. Even the most effective tools cannot fulfil their potential if their use is far more complex than the operator can manage. This principle not only emphasises the need for employee training in agriculture, but also has practical implications for the question of which technologies should be offered to farmers: For example, great hopes are pinned on the increased use of sensor technology through increasingly affordable agricultural drones that can be programmed to fly specific routes to gather useful and accurate information. However, in addition to drones and specialised cameras, existing solutions require software to navigate, map and process the collected data in a format that is truly useful to end users. All of this presents a challenge and a barrier for typical farming operations, so it is likely that services such as terrain mapping and data processing will need to be outsourced to specialised providers. The need for additional external services reduces the appeal of these useful technologies compared to less accurate but simpler and cheaper solutions for users. For example, some Croatian winemakers are already using mobile weather stations. In the most widespread version in our region, a weather station is available for around 4,000 euros and can cover an area of 4 hectares in hilly terrain up to 50 hectares in flat areas and provide users with easy-to-understand information via a mobile application. Figure 3 shows an overview of the available technologies, illustrating both the cost requirements and the needs of the users.

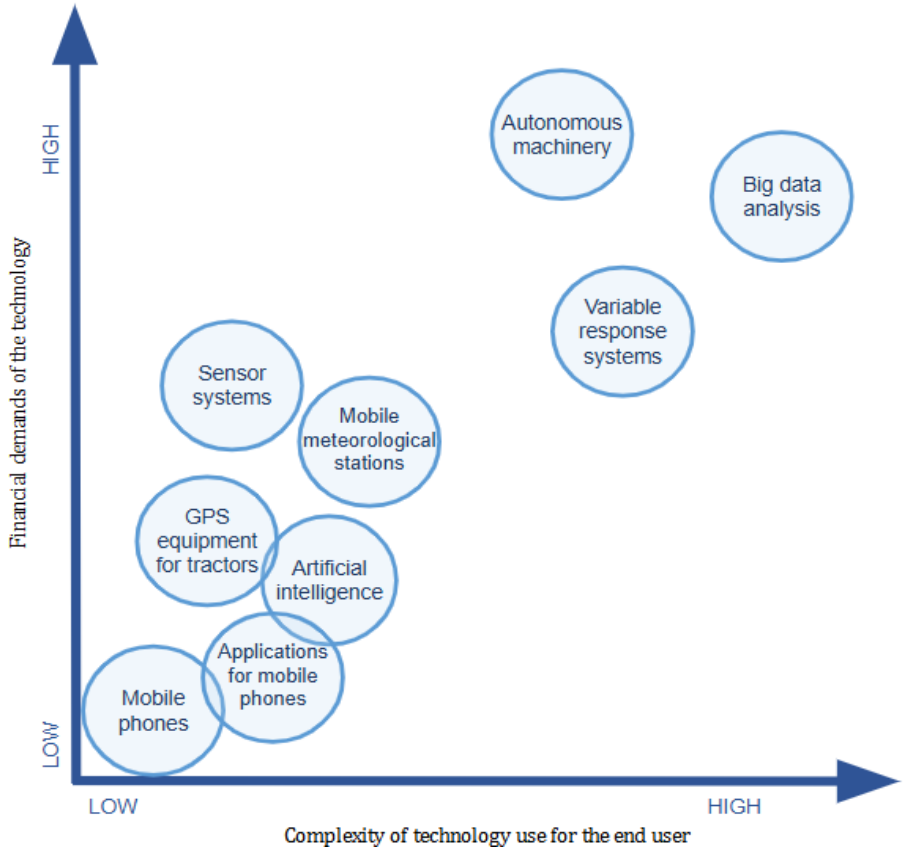

Figure 3 Available precision agriculture technologies in terms of financial requirements and complexity of use
Source: Author's creation

DISCUSSION AND CONCLUSION

After analysing previous research, it can be concluded that regarding the interpretation of innovations in agricultural production, later Schumpeterian learning is more applicable. Specifically, technological innovations are more frequently expected in large agricultural enterprises. Part of the reason for this can certainly be attributed to economies of scale and scope, which generally allow the use of more expensive but more efficient technological solutions. In any production sector, including agriculture, it is sometimes simply not economical to invest in specialised equipment that can lead to a significant leap in efficiency when the scale of operations is smaller. Due to the high purchase and maintenance costs, such equipment requires high utilisation, so it is only suitable for firms with large production volumes. For example, a small farm with around two hectares of land could significantly increase its weeding efficiency by purchasing variable-rate

weeding tools using tractors which also need to be equipped with guidance systems. This would not only speed up weeding, but also make the labour-intensive part of the work easier. However, the number of working hours that would be required to make this technology viable far exceeds the number of hours the technology could be used on this farm. Moreover, in addition to the challenges associated with the profitability of technological investments, there is always the issue of financing such investments in smaller businesses, as emphasised in many studies.

Barriers to the adoption of technological innovations that affect small rather than large farms include the availability of training and skilled labour, as well as concerns about equipment maintenance. The problem of slower adoption of new technologies is thought to be more pronounced in agriculture than in other business domains because the population working in agriculture tends to be more inclined towards traditional views than the general population (which is easily observed in Croatia and across Europe during election cycles, when the rural population typically (though not always) chooses more conservative options). Similar conclusions regarding path dependency were drawn in a research by Carrer et al. (2022), which found a negative correlation between farm management experience and willingness to adopt new technologies. A larger number of empirical studies that independently validate the effectiveness of new technologies could significantly strengthen confidence in their application.

Due to the small size of most farms in Croatia (69.4% operate on less than five hectares), there are also only a limited number of farms that can profitably invest in the many opportunities that precision agriculture currently offers. As with all technological innovations, it is to be expected that further development will lead to a significant fall in prices and thus increase the accessibility of these technologies. This particularly applies to technologies that are currently only affordable and practical for the largest farmers. However, there are also technologies that are already accessible to everyone, such as applications for mobile devices. In their simplest form, these are limited to communication and advice, but can potentially also be used to control sensor systems or other precision agriculture technologies. The latter would still be more appealing to farmers than alternative solutions due to the widespread use and simplicity of smartphones. Artificial intelligence also offers considerable potential for this purpose, as its use according to recent research shows no significant differences related to size.

It is important to emphasise that although this research focused on production, effective technological innovations in agriculture is not necessarily limited solely to production. In addition, digital technologies offer significant opportunities in marketing, particularly of organic and experiece goods, and in creating new and shortening existing supply chains. For some farmers, these activities represent a shift into new parts of the value chain, which in turn may pose challenges in terms of the availability of knowledge and other resources. Nevertheless, such activities are possible with modest investment and are less dependent on the size of the agricultural enterprise.

The public sector plays a crucial role in promoting the technological modernisation of agriculture at all levels. In addition to intensifying efforts to consolidate farms, the positive role of public authorities should also be to facilitate access to advanced technological solutions by informing farmers about the availability of technologies and the impact of their application, providing targeted training on the use of the most effective tools, etc. In addition, public authorities can strengthen the innovative capacity of farmers by expanding the range of digital public services and encouraging stronger research collaboration between the public and private sectors. The state influences the potential for innovation through targeted promotion of research in desired areas and can continue to do so; therefore, promoting and directing research on innovations in agriculture seems not only reasonable but also very necessary in the Croatian context. In addition to the aforementioned advantages that precision agriculture technology offers or will offer in the near future, the technology can somewhat mitigate the pressing problem of labour shortages. Therefore, while the question of whether farmers can afford technological innovations is very important, it is not the only question. The question of whether farmers can afford to forgo technological innovations is becoming increasingly relevant for both farmers and the state as a whole.

A limitation of this research, which also serves as a stimulus for future studies, relates to the lack of primary data on the current technological capabilities and capacities of Croatian farmers, particularly in relation to precision agriculture, as well as their perceptions of the current availability of such technologies and the barriers to their adoption.

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COMMON OWNERSHIP AND HORIZONTAL SHAREHOLDING THROUGH THE LENSES OF THE AGRI-FOOD VALUE CHAIN

CHAPTER 6

Danijela Sokolić *

ABSTRACT

The modern agricultural and food industry is characterized by a high degree of consolidation and concentration of ownership. In addition to vertical integrations with predecessors or successors in the value chain in order to secure inputs, markets or important resources, horizontal integrations are also common, whether directly through company mergers or integrations aimed at consolidation within large multinational corporations (MNCs). An increasingly common form of horizontal ownership concentration is investment by a third, independent, party, an institutional investor, in several companies within the same industry. Third-party investments in companies competing in the same industry are referred to as horizontal shareholding, a particular form of common ownership that is largely determined by the investment activities of large asset management companies and global investment funds. The research question focuses on the motives and effects of such ownership structures on the strategic behavior of companies. Trends and market dynamics, sustainability and the impact of common ownership and, in particular, horizontal shareholdings on the economy and society were examined. The effects of horizontal shareholdings and common ownership were examined for various sectors along the value chain in the agricultural and food industry. The research results show that there are economic interests of large investment funds in the agri-food sector. The interest of institutional investors could lead to far-reaching consolidation and market power in the hands of a few large companies, with a variety of negative consequences for the economy and society, from rising prices and increasing inequality to anti-competitive practices.

Keywords: *horizontal shareholding, common ownership, investment funds, agricultural and food industry, corporate governance*

INTRODUCTION

The theoretical concept of the modern corporation presupposes the continuity of corporate activity regardless of a change of ownership. This chapter does not assume continuity of corporate objectives, as different types of owners have different interests. In addition, the development of the modern company has led to a distinction between ownership and management and between management and control (Berle and Means 1932). This separation facilitates the use of professional

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management, which is often better able to steer industry developments and understand economic and business trends. Conversely, the owners (shareholders) themselves can determine the extent to which they are involved in the company's activities and the extent to which they receive information about asset management. Discrepancies between the interests of owners and managers often lead to conflicts of interest regarding the strategic direction of the company (Jensen and Meckling, 1976). The interests of the owners influence the extent and intensity of their involvement in the company's activities, which in turn is reflected in the strategic orientation of the company.

The categories of shareholders in companies range from individuals to legal entities, from private to public capital and from individual to institutional investors, and the interests of these categories differ. The strength of certain categories of ownership, as judged by their influence on the capital markets, is subject to constant fluctuation based on available cash flows.

Given the sources of capital and the different needs of each category of investor, the capital markets are in a constant state of flux. The globalization and concentration of ownership seen in recent decades has been accompanied by vigorous efforts to regulate the markets and maintain competition. The increasing involvement of institutional investors in capital markets has given rise to new practical scenarios and areas of inquiry that deserve the attention of the academic community and regulators. Corporate governance has evolved primarily in response to the demands of large institutional investors who require transparent corporate governance to protect their interests and those of their clients, promote market competition and reduce investment risks. As these investors channel funds into competing companies, their economic considerations change regarding the importance of market competition within these companies. The aim of this chapter is to analyze trends in ownership dynamics and capital flows in the agri-food industry and to initiate a discourse on the motivations of institutional investors investing in competing companies and the potential impact of such investment behavior on industry trends and relationships.

The article is divided into three main sections. The following section explains the concepts of common ownership and horizontal shareholding, and examines the overlap between these concepts, assuming that such common ownership between competing firms can influence the behavior of shareholders and managers as well as the strategic actions of these firms in the market. It then assesses trends in the agri-food industry from the perspective of ownership and the relationship structures resulting from ownership dynamics. The final section examines the implications of ownership in the agri-food sector, particularly in terms of economic theory and practice, and highlights the need for regulatory intervention in market regulation and consumer protection.

THEORETICAL DETERMINANTS OF COMMON OWNERSHIP AND HORIZONTAL SHAREHOLDING

Common ownership can be defined in different contexts. Specifically, common ownership refers to the joint ownership of several legal or natural persons in an organization (or, more broadly, in certain goods), where the ownership interests are determinable but generally indivisible (often referred to as ideational). In a broader context, the term also encompasses the ownership of property (by individuals, organizations or communities) in indivisible form and not on behalf of individual members or groups. In economic theory, co-ownership refers to a scenario in which multiple businesses or organizations are generally owned by a single entity or individual.

Modern portfolio theory — an approach that focuses on minimizing investment risk while maximizing returns through asset diversification— - conceives of common ownership as an investment strategy that advocates portfolio diversification by investing in the equity of different companies, including those competing in the same industry (Dallas, 2018).

Horizontal shareholding occurs when the significant shareholders of multiple companies in the same industry overlap. In other words, when commonly owned companies are also competitors in the same product market (representing a horizontal position within the value chain), this type of common ownership is referred to as horizontal shareholding.

Common ownership and horizontal shareholdings can have different modalities. When the common ownership is managed by both competing firms, such horizontal ownership is referred to as a traditional merger (Vretenar et al., 2017). The motivations and effects of such an investment differ from those of a cross-ownership, where one company invests directly in one or more firms with which it collaborates or shares related interests or business objectives. In cases where a company owns two firms that compete in the same market, this is referred to as a horizontal equity investment. In contrast to cross-shareholdings and mergers, where the owners involved exercise significant influence over the management and strategic direction of the companies in which they hold shares, a horizontal equity investment — particularly in the context of portfolio diversification— - may involve a degree of influence that does not equate to absolute control. Accordingly, the specific effects of a joint holding vary depending on the interests and degree of influence that the joint shareholders exercise over the companies.

The sub-area of common ownership includes the concepts of cross-industry and intra-industry common ownership. Intra-industry ownership correlates with horizontal ownership, i.e. the ownership of horizontally positioned firms within an industry. Cross-industry ownership may overlap with other concepts of common ownership, such as cross-ownership, depending on the motivations of the owner and the impact on the owning company.

Owners can positively influence company performance. Owners can contribute by actively participating in decision-making processes, providing enhanced advice

and/or specialized industry knowledge, expanding professional networks, guiding the firm towards innovative management techniques, and facilitating access to additional resources (Hirschman, 1980; Hansen and Hill, 1991; McCahery et al., 2016; Vretenar et al., 2024).

Common (horizontal) ownership is experiencing rapid growth in parallel with the emergence of institutional investors (Dallas, 2018). The investment behavior of institutional owners differs from that of corporate or private investors in two key dimensions: time horizon and investment style.

The investment time horizon of shareholders can significantly influence strategic decisions within the company, including those related to development and innovation. Long-term oriented owners are more likely to support investments in innovative activities and projects that require human capital and whose benefits take time to materialize. In general, institutional owners are characterized by a higher portfolio turnover compared to corporate owners; therefore, the increasing importance of institutional investors with shorter investment horizons may lead to less focus on long-term outcomes (Mace, 2023).

The increasing reliance on passive investment strategies, which entail less management involvement, can be detrimental to a company's productivity. Essentially, passive investing can correlate with lower levels of monitoring, potentially increasing agency costs (Bebchuk et al., 2017). The passive investment style often stems from institutional investors' preference for diversified portfolios. A relatively small holding in numerous firms may reduce investors' ability and willingness to participate in governance decisions and/or increase their reliance on proxy voting (McNulty and Nordberg, 2016). However, holding stakes in multiple firms can mitigate the limitations of influence resulting from relatively small market shares. In particular, large and diversified investors can exert significant influence and play a central role in corporate decision-making due to their networking capabilities, pyramidal relationships and market relevance (Bebchuk and Hirst, 2022).

Economic theory addresses the challenges arising from joint equity ownership, in particular horizontal equity ownership. In this strategy, a third company from another sector, often institutional investors, invests in several firms in the same sector, which can change the unilateral competitive incentives between these firms and/or promote information sharing that exacerbates or facilitates oligopolistic coordination (Elhauge et al., 2021).

Notwithstanding the influence of shareholders on firm behavior, ownership of multiple firms requires simultaneous consideration of the interests of all jointly owned firms. Consequently, individual firms are likely to adjust their strategic behavior in relation to other jointly owned firms more than would be the case in a context of fully separate ownership. This scenario departs from the traditional economic model in which the primary goal of each company is to maximize profits. In the context of common ownership, profit maximization for an individual firm may be hindered by the influence of common shareholders who have an interest in the profitability of other firms within the same portfolio (Elhauge, 2017). When jointly

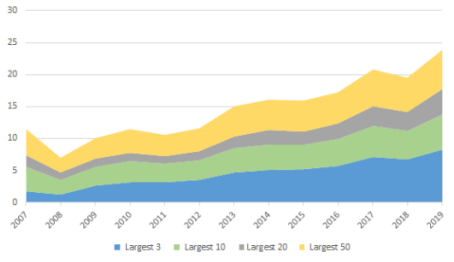
owned firms act as horizontal competitors in the same product market, an increased interest in the profitability of competitors tends to reduce investors' incentives to exert pressure on management structures, thus providing management with the opportunity to maintain favorable positions and reduce competitive pressure (Azar et al., 2018; Bebchuk et al., Hirst 2019).

Institutional investors — including investment funds, insurance companies, pension funds and asset management firms — believe that investing in competing companies facilitates the diversification of investment positions and mitigates company-specific unsystematic risks. However, such practices can be detrimental to market dynamics and competition.

THE EFFECTS OF CAPITAL MARKET TRENDS ON THE STRUCTURE OF THE GLOBAL AGRICULTURAL AND FOOD VALUE CHAIN

The financial markets have changed dramatically in recent decades. The importance of institutional investors has steadily increased over time, both in terms of the value of the assets they manage and the share of stock market capitalization they hold. According to a recent OECD analysis (Medina et al., 2022), global assets under management by the 50 largest institutional investors reached USD 24 trillion in 2019, a doubling compared to 2007 (Figure 1A, left), and the market capitalization of these investors increased by around 70% over the same period (Figure 1B, right).

A) Assets under management by institutional investors (USD trillions in 2020)



B) Share of institutional investors in market capitalization

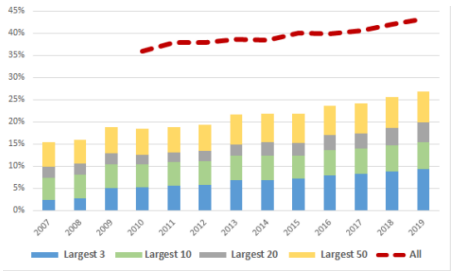


Figure 1 Assets under management by institutional investors
Source: Medina, A.; De La Cruz, A. and Tang, Y. (2022). „Corporate ownership and concentration". OECD Corporate Governance Working Papers. Link: https://www.oecd.org/en/publications/corporate-ownership-and-concentration_bc3adca3-en.htmlf (seen on July 15, 2024)

In 2019, institutional ownership accounted for around 43% of global market capitalization (Figure 1B, dashed line), a significant percentage compared to 11% owned by corporations, 10% owned by the public sector, 9% owned by strategic individuals and 27% owned by other entities in 2020 (e.g. direct retail investors and institutional holdings below the disclosure thresholds) (Bas et al., 2023).

The predominance of institutional investors on the capital markets is leading to a change in the strategic behavior of companies. Institutional investors, especially index funds, apply passive portfolio management strategies by investing on the basis of market indices such as the S&P 500 or the MSCI Global Index, thus achieving minimal investment costs while avoiding specific company risks by investing in several sector firms at the same time (the industry investment strategy). This approach contributes to the increasing prevalence of horizontal holdings between competing firms. Bass et al. (2023) identify three main factors driving the transition to passive management. First, the substantial growth of fixed income assets in the markets has increased the demand for diversified, long-term portfolios that require minimal active management. Second, the introduction of index funds and exchange-traded funds (ETFs) has provided investors with practical, low-cost options to reduce company-specific risks. Third, academic discourse has questioned the ability of active fund management to outperform benchmarks associated with passive investing (Fama and French, 2010; Jurek and Stafford, 2011). As a result, investing has become increasingly attractive to institutional investors. According to the Investment Company Institute report (2021), assets managed through passive index funds and ETFs accounted for around 48% of total equity investments through funds in 2020.

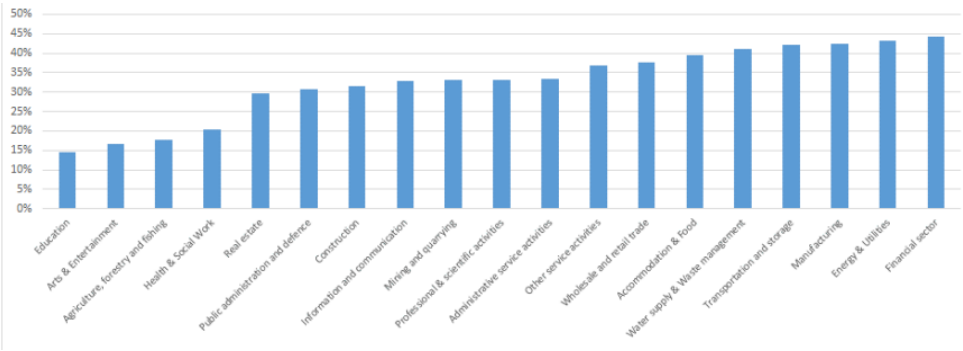


Figure 2 Ownership shares of institutional investors (market capitalization by sector - average 2010-2019)
Source: Bas, M.; Demmou, L.; Franco, G. and Garcia-Bernardo, J. (2023). Institutional Shareholding, Common Ownership and Productivity: A Cross-Country Analysis. Economics Department Working Papers No. 1769. ECO/WKP (2023)23. OECD. According to OECD calculations based on Orbis® data
https://one.oecd.org/document/ECO/WKP(2023)23/en/pdf, seen on September 20, 2024

The increase in passive (or more generally: indexed) investing is accompanied by an increase in the level of common ownership, i.e. the tendency of institutional investors to hold significant stakes in many different companies, either within the same industry (intra-industry common ownership) or across industries (cross-industry common ownership). High values of average common shares of the largest institutional investors at company level are the first indicator of this trend. Figure 2 shows the presence of institutional investors in the individual sectors. A high

proportion of company ownership by institutional investors can be found in a large part of the value chain in the food industry. Although the figure shows the ownership shares by sector, with the share of company ownership in the accommodation and food sector being particularly high at around 39% in terms of total market capitalization (average from 2010 to 2019), investment fund ownership of companies is also significant in other sectors of the agri-food value chain: energy and utilities 43%, transport and storage 42%, water and waste 41%, wholesale and retail 37%, through to agriculture, forestry and fishing 17%.

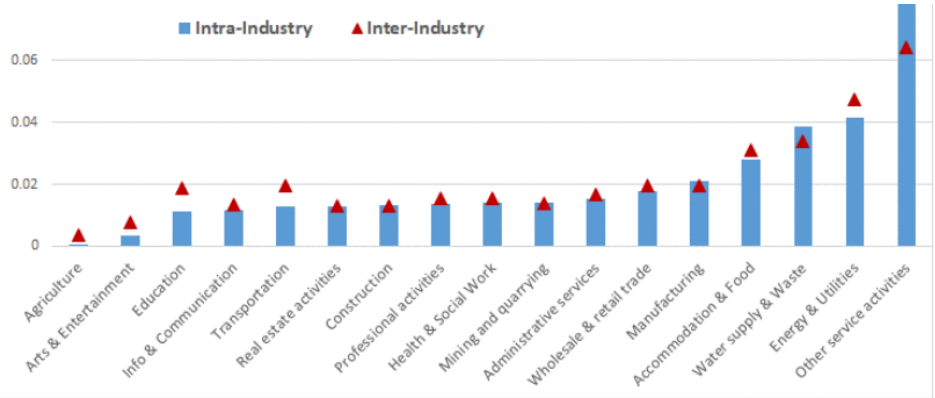


Figure 3 Average share of common ownership of the three largest investment funds by industry (average is calculated based on 2010 – 2019) (BlackRock, Vanguard and State Street)
Source: Bas, M.; Demmou, L.; Franco, G. and Garcia-Bernardo, J. (2023). Institutional Shareholding, Common Ownership and Productivity: A Cross-Country Analysis. Economics Department Working Papers No. 1769. ECO/WKP (2023)23. OECD. According to OECD calculations based on Orbis® data. Link:
https://one.oecd.org/document/ECO/WKP(2023)23/en/pdf, seen on September 20, 2024

The concentration of capital in the hands of investors varies from region to region. Economies with developed capital markets, such as the United States and the United Kingdom, lead the way. The largest institutional investors are the American investment funds BlackRock Inc, Vanguard Group and State Street Global Advisors, which manage on average 25% of the voting rights in the US capital market (Bebchuk and Hirst, 2019) or around 23% of the listed capital of each company in major markets such as the United States and the United Kingdom (Medina et al., 2022). They are represented in 88% of S&P 500 companies and their combined share of capital is the largest in the S&P 500 (Fichtner et al., 2017). On average, these three funds controlled 9% of ownership within each industry between 2010 and 2019 (Bas et al., 2023), achieving an ownership concentration of around 3% in competing companies in the accommodation and food sector (intra-industry ownership) and a further 3.5% in industries related to this sector (cross-industry ownership). In terms of intra-industry common ownership, these three funds (the "Big 3") also achieved high stakes in the other services sector (8%), the energy and services sector (over 4%), the water and waste sector (around 4%) and the wholesale and retail sector (almost 2%) (Bas et al., 2023), all of which are involved in the value chain of companies in the agriculture and/or food sector.

The trend of a growing global population, generally increasing economic prosperity and, in addition, rising affluence in developing markets means that demand for food will increase in the coming years, providing a solid basis for both active positioning within the agri-food chain through investment in expanding production, product development and service provision, as well as passive investment by institutional investors in growing industries in the area of basic human needs.

The global agricultural sector was estimated to be worth around USD 5 trillion in 2018 (Van Nieuwkoop, 2019). The estimated value-added component in agriculture is around USD 3.2 trillion (World Bank, 2019), and it is estimated that the value added in the food sector (production and services) multiplies agricultural production by a factor of two to five, depending on the development of the economy.[1] In the absence of data, the global food system was estimated to be worth around USD 8 trillion in 2018 (Van Nieuwkoop, 2019), equivalent to around 10% of the global economy worth around USD 80 trillion. The value of companies within the global food system is estimated at around USD 14 trillion, equivalent to 16-20% of global GDP (Planet Tracker, 2023). It is important to note that around 400,000 companies are directly linked to food production, although there is little accurate data on smallholder farmers and fishermen (Planet Tracker, 2023).

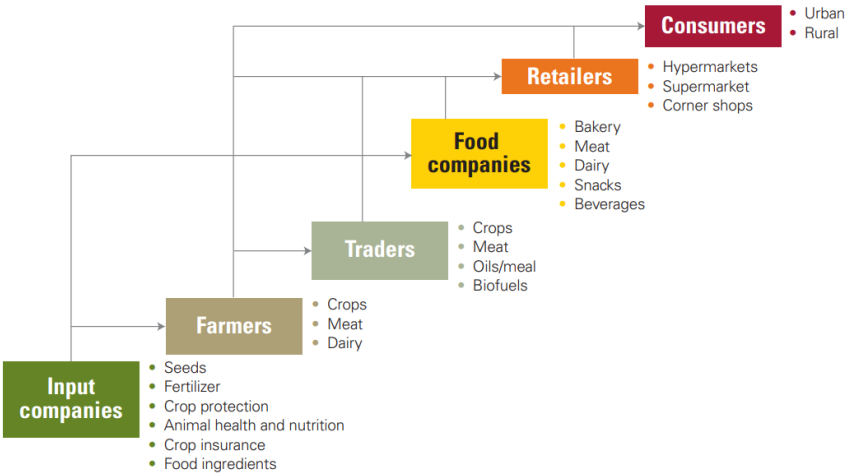


Figure 4 Agricultural and food value chain
Source: KPMG International. Link: https://assets.kpmg.com/content/dam/kpmg/pdf/2013/06/agricultural-and-food-value-chain-v2.pdf seen on June 12, 2024

[1] The relationship between the value of primary agricultural production and the final product depends on the development of the economy. For every dollar an American consumer spends on food, only 11 cents goes to farm economic activity, while the rest is divided among numerous activities related to the processing, delivery, or preparation of food. Similarly, in the UK, agriculture accounts for only ten percent of the value of the agri-food system. In developing countries, this ratio between post-farm value added and agri-food value added is much lower still.

The input market is highly concentrated. The global market concentration in agrochemicals and seeds is above 65% and 53% respectively. The agrochemicals market is strongly dominated by a few large companies.

Company	Sales, 2018 (US mil)	% market share	Headquarters
ChemChina (including Syngenta and Adama)	14,030	24.3	China
Bayer Crop Science (including Monsanto)	10,617	18.4	Germany
BASF	6,916	12.0	Germany
Corteva Agriscience (ex DowDuPont)	6,445	11.1	USA
Top 4	**38,008**	**65.8%**	
FMC	4,285	7.4	USA
UPL	2,741	4.8	India
Top 6	**45,034**	**78%**	
Total World	**57,561**		

Table 1 Input market – agrochemicals (2018)
Source: Shand H. and Wetter, K.J. (2019). Plate-Tech-tonics: Mapping Corporate Power in Big Food - Corporate concentration by sector and industry rankings by 2018 revenue. ECT Group. Link: https://www.etcgroup.org/files/files/etc_platetechtonics_a4_nov2019_web.pdf, seen on August 22, 2024

Table 1 shows the largest market players in the agrochemical market and their global market shares. ChemChina (which includes Syngenta and Adama) controlled 24.3% of the market in 2018. It is followed by Bayer Crop Science (18.4%), BASF (12.0%), and Corteva Agriscience (11.1%). Together, these four largest companies accounted for 65.8% of the market.

Company	Sales, 2018 (US mil)	% market share
Bayer Crop Science (including Monsanto)	9,338	22.4
Corteva Agriscience (ex Dow and DuPont)	8,008	19.2
ChemChina /Syngenta	3,004	7.2
Top 3		**48.8%**
Vilmorin & Cie /Limagrain21	1,834	4.4
Top 4	**22,185**	**53.2%**
BASF	354	0.8
Total World	**41,670**	

Table 2 Input market – seed production (2018)
Source: Shand H. and Wetter, K.J. (2019). Plate-Tech-tonics: Mapping Corporate Power in Big Food - Corporate concentration by sector and industry rankings by 2018 revenue. ECT Group. Link: https://www.etcgroup.org/files/files/etc_platetechtonics_a4_nov2019_web.pdf, seen on August 22, 2024

In the seed industry, representing the input industry, Bayer Crop Science, including Monsanto, held a market share of 22.4% in 2018, while Corteva Agriscience and

ChemChina/Syngenta held 19.2% and 7.2% respectively. The three largest companies together controlled almost half (48.8%) of the global seed market, and with the fourth largest player, Vilmorin & Cie from France, they accounted for a total share of 53% of the global market. To illustrate, Corteva and Bayer held 71.6% of total corn seed sales in the US and 65.9% of total soybean seed sales in the US in the 2018–2020 estimates. In cotton, the retail value of seed increased from $611 million annually from 2000 to 2003 to $966 million annually from 2018 to 2020 (USDA Details Market Shares of Biggest Seed Industry Players 2023).

Institutional investor	**Assets under management (AUM) (US trillions 2019)**	**Headquarters**
BlackRock	6.0	USA
Vanguard Group	5.3	USA
State Street Corp	2.5	USA
Fidelity (bivši FMR)	2.4	USA
Capital Group	1.9	USA
Total assets	**18.1**	

Table 3 Institutional Investors' Ownership Stakes in Seed Cultivation and Production (2018)
Source: Shand H. and Wetter, K.J. (2019). Plate-Tech-tonics: Mapping Corporate Power in Big Food - Corporate concentration by sector and industry rankings by 2018 revenue. ECT Group. Link: https://www.etcgroup.org/files/files/etc_platetechtonics_a4_nov2019_web.pdf, seen on August 22, 2024

Moreover, the ownership structure of the dominant players in seed production is characterised by the same institutional investors (so-called universal owners or index investment funds, notably BlackRock, Vanguard and State Street). At the end of 2016, before the next round of mega-mergers, the five largest global institutional investors owned shares in all five of the world's largest seed companies — Syngenta, DuPont, Dowa, Bayer and Monsanto. The collective ownership of the five largest management firms ranged from 12.4% (Syngenta) to 32.7% (DuPont) (Torshizi and Clapp, 2019).

Industry	**ChemChina**	**Bayer**	**Corteva**	**BASF SE**
Agrochemicals and agriculture	x	x	x	x
Processing of chemicals	x			x
Petrochemicals	x		/	x
Rubber and rubber products	x			
Pharmacology	x	x		
Health Care	x	x	x	x
Engineering & Construction	x			x
Energy and Natural Resources	x	x		x
Environmental protection and clean technologies	x	x		x
Biotechnology		x	x	

Materials Science		x		x
Digital agriculture	x	x	x	x
Automotive industry				x
Packaging				x
Electronics				x

Table 4 The largest corporations in the input market – related and unrelated diversification into other markets
Source: Internet pages of the analyzed companies, revised in June-July 2024

The degree of vertical concentration is also high. The largest companies in the field of input production are conglomerates that are represented in many related industries (Table 3). The diversification of the product portfolio enables technological spillover effects and cross-industry coordination of activities as well as the avoidance of duplication and the acceleration of innovation cycles. In addition, trends indicate that the so-called Global South (especially China) is rapidly becoming a driving force of global hyper-consolidation (e.g. ChemChina, SinoChem, JBS, WH Group, COFCO, Mahindra, Wilmar). In addition, globalization has increased ownership consolidation in all sectors, including the agri-food chain (Table 4). Ownership consolidations are occurring in breeding and seed production, agrochemicals, synthetic fertilizers, Big Ag machinery, veterinary pharmaceuticals, animal genetics, wholesale, food processing, meat industry, mixed commodity retail and AgTech.

This degree of ownership concentration, exacerbated by the horizontal holdings of institutional investors, is accompanied by a significant increase in prices. It is estimated that ownership by management firms over competitors was responsible for about 28% of the price increase for soybean, corn and cotton seed in the US between 1997 and 2017 (Torshizi and Clapp, 2021).

Common ownership contributes to the concentration of information in large conglomerates and potentially increases information asymmetry, leading to unequal economic development. Companies are increasingly turning to big data (especially IoT) to create new revenue streams and increase profits (across the food chain) The global market for artificial intelligence specifically for agriculture was valued at USD 1.5446 billion in 2022 and is expected to reach USD 7.8876 billion by 2030, representing a compound annual growth rate (CAGR) of 22.7% between 2023 and 2030 (Zion Market Research, 2018). Cross-industry technological and economic disruptions include expansive big data platforms, genome editing (e.g. CRISPR Cas-9), the adoption of blockchain technology and the significant influence of institutional investors.

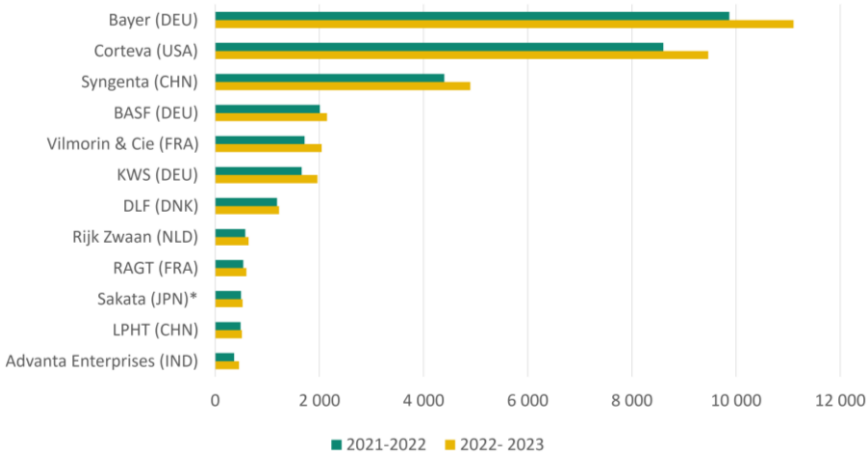


Figure 5 Largest Seed Companies (in US Millions)
Source: Uncovering the Top Seed Companies (2024). Link: https://www.doriane.com/blog/top-seed-companies, seen on May 5, 2024

The situation in other input production sectors is similar to that in the seed industry. In the fertilizer production sector, the world's top ten companies generated sales of USD 53.134 billion in 2018 and thus held over 50% of the market share (the total market value was estimated at USD 104.9 billion). In the agricultural machinery sector, the six largest companies generated sales of USD 65.218 billion in 2018, holding around 52% of the market share (with an estimated total market value of USD 126 billion), while in the animal health products manufacturing sector, the four largest companies generated sales of USD 19.554 billion in 2018, holding over 58% of the market share (with an estimated total market value of USD 33.5 billion). The potential for further development is recognized in the area of digital technologies. Table 5 shows acquisitions of successful start-ups that develop software solutions for agriculture, particularly in the area of input production. The trend and content of these takeovers indicate the future direction of industry development.

Target	Target country	Acquirer	Description	Year	Amount (US millions)
Antelliq	France	**Merck**	Digital Animal Management	2018	2,400
The Climate Corporation	USA	**Monsanto**	Farm Management SW	2013	930
Agraquest	USA	**Bayer**	Biopesticide	2012	425
Blue River Technologies	USA	**Deere and Company**	Robotics & Computer Vision	2017	305
Granular	USA	**DuPont**	Farm Management SW	2017	300
Oxitec Ltd.	UK	**Intrexon**	Biopesticide	2015	160
Gavita Holland	Netherlands	**Scott's Miracle Gro**	Indoor Growing	2016	136
Pasteuria Biosciences	USA	**Syngenta**	Biological Nematicides	2012	113

Wolf Trax	USA	**Compass Minerals**	Fertilizer Micronutrients	2014	85
Agrible. Inc.	USA	**Nutrien Ltd.**	Predictive Analytics & Decision SW	2018	63
640 Labs	USA	**Climate Corporation**	Data Analysis and Optimization	2014	N/A
Farmeron	Croatia	**Virtue Nutrition**	Performance Analytics SW - Livestock	2016	N/A
proPlant	Germany	**Bayer**	Farm Management SW	2016	N/A
Adapt-N	USA	**Yara International**	Nitrogen Management SW	2017	N/A
AgSolver	USA	**EFC Systems**	Agronomic Planning & Sustainability	2017	N/A
VitalFields	Estonia	**Climate Corporation**	Full-Service Farm Mgmt	2017	N/A
Geosys (Land O'Lakes)	USA	**UrtheCast Corp**	Satellite Imagery	2018	N/A
Mavrx	USA	**Taranis**	Satelite Imagery Analaytics	2018	N/A
Strider	Argentina	**Syngenta**	Field Monitoring SW	2018	N/A

Table 5 Input market – large acquisitions of multinational agricultural input producers related to the development of digital technology in the period from 2012 to 2018
Source: AgFunder (2019), https://research.agfunder.com/2018/AgFunder-Agrifood-Tech-Investing-Report-2018.pdf , seen on September 28, 2024

Some segments of the food sector are particularly difficult to analyze due to a lack of data and intertwined relationships between the individual sectors. Tables 5 and 6 are therefore intended to provide an insight into the concentration of ownership in the following two links of the food value chain, particularly in the areas of production and sales. The largest company in the agricultural products trade is the American Cargill, the world's largest buyer, processor and distributor of grain, oilseeds and other agricultural products, with 155,000 employees in 70 countries, followed by the Chinese state-owned company COFCO. The market leader in the meat industry, the Brazilian company JBS, ranks fourth among the largest companies in the food sector (2018), with activities in related and unrelated industries (leather, medical products, metal packaging, biodiesel, transportation, etc.).

Agricultural Commodity Traders	Food & Beverage Processors	Meat Processors
1. Cargill (USA) ($114,700 mil) 2. COFCO Group China National Cereals, Oils and Foodstuffs (China) 3. ADM / Archer Daniels Midland (USA) 4. Bunge (USA) 5. Wilmar International (Singapore) 6. Louis Dreyfus Company (The Netherlands)	1. Nestlé (17,8%) (Switzerland) 2. PepsiCo (14,3%) (USA) 3. Anheuser-Busch InBev (Belgium) 4. JBS (Brasil) 5. Tyson Foods (USA) 6. ADM (USA) 7. Mars (USA) 8. Cargill (7,2%) (USA) 9. Coca-Cola (USA) 10. Kraft Heinz Company (USA)	1. JBS S. A. (Brasil) 2. Tyson Foods (USA) 3. Cargill (USA) 4. Smithfield Foods / WH Group (China) 5. NH Foods (Japan) 6. Danish Crown (Denmark) 7. Hormel Foods Group (USA) 8. BRF (bivši Brasil Foods) (Brasil) 9. Marfrig (Brasil) 10. Vion (The Netherlands)
376,900	**450,832**	**190,929**

Table 6 Food and beverage production, processing, and sales (total revenues of the largest corporations; if available: individual revenues, market share, and headquarters; 2018 in U.S. dollars)
Source: author`s calculations according to Shand H. and Wetter, K.J. (2019). Plate-Tech-tonics: Mapping Corporate Power in Big Food - Corporate concentration by sector and industry rankings by 2018 revenue. ECT Group. Link: https://www.etcgroup.org/files/files/etc_platetechtonics_a4_nov2019_web.pdf, seen on August 22, 2024

There is also a concentration of capital in the food and beverage trade. The ten largest global companies in food and beverage retail hold around 11% of the total market share (Table 7), but also offer non-food products in their range. With a market share of 27, Walmart is by far the largest retail chain in the world in terms of total sales.

	Sales, 2018. (mil US)	Market share (%)	Headquarters
Walmart	234,031	27.3	USA
Schwarz Group	96,147	11.1	Germany
Kroger	91,808	10.6	USA
Aldi	88,957	10.2	Germany
Carrefour	70,656	8.1	France
Costco	62,336	7.2	USA
Ahold Delhaize	59,864	6.9	The Netherlands
Tesco	57,563	6.6	Great Britain
Seven & and Holdings	54,322	6.3	Japan
Edeka	52,577	6.1	Germany
Top 10	**868,261**	**10.9**	
World – total (Food and Beverage)	**7,932,000**		

Table 7 Food and beverage retail sector
Source: Shand H. and Wetter, K.J. (2019). Plate-Tech-tonics: Mapping Corporate Power in Big Food - Corporate concentration by sector and industry rankings by 2018 revenue. ECT Group. Link: https://www.etcgroup.org/files/files/etc_platetechtonics_a4_nov2019_web.pdf, seen August 22, 2024

Information and unbiased analysis about the giants of the agri-food sector (Big Food companies) is not easily accessible and is sometimes deliberately obscured by complex relationships and ownership structures. At first glance, the market structure shows the consolidation of capital and concentration of corporate power in all major sectors of the industrial food chain. Although it is difficult to assess value across the value chain, estimates from Planet Tracker (2023) suggest that around 70% of revenue along the chain comes from 0.06% of all companies. The boundaries of the individual sectors are fluid, as the interests of companies along the chain overlap. Cross-sector strategies facilitate the diffusion of innovations and technologies along the chain (vertical diversification) and across the chain (horizontal mergers, from strategic alliances to mergers and acquisitions — M&A) (especially in the field of big data and genomics technology). Horizontal ownership by large institutional investors creates intertwined oligopolies operating along the entire agri-food supply chain, with potentially anti-competitive effects in certain markets (such as the seed industry, retail, etc.) (Clapp, 2018).

When analyzing value creation and distribution in the agri-food value chain, the ownership shares of assets management companies within some industries and at the same time between vertically connected industries cannot be ignored. The fact that the five largest investment funds together own between 12.4% and 32.7% of the shares in leading companies in seed production, agrochemicals, pharmaceuticals, agtech products, etc. (Bayer, Monsanto, DuPont, Syngenta and Dowa) has far-reaching consequences for the relationships in the individual and related industries in terms of information sharing and coordination of corporate behavior. This can translate into financial and operational synergies, savings and economic benefits for society, but can also be used to achieve secret synergies. Relationships in complex ownership structures can, as illustrated, significantly influence the strategic behavior of companies and decision-making. Based on basic economic logic, it can be assumed that the positioning of these leading companies in their markets, which are also highly concentrated, could come close to a situation of interconnected oligopolies with significant anti-competitive effects along the entire agri-food value chain. Additional pressure is created by the almost complete control of inputs in the value chain, which is currently still in the hands of a relatively small number of companies.

IMPLICATIONS OF COMMON OWNERSHIP AND HORIZONTAL SHAREHOLDERS

An academic discussion of the concept of common ownership, particularly in relation to horizontal shareholding defined by the presence of investors with stakes in multiple competing companies, points to several potential risks and challenges for the market and regulators.

Investment strategies that result in a diversified portfolio of company holdings may involve holding positions in several companies in the same sector. One reason for such strategic behavior by investors is to try to reduce the unsystematic risk of individual companies by investing in the industry as a whole, which is often defined by benchmark market indices. In such cases, the selection of individual company

shares is based on the industry index and not on active portfolio construction by institutional investors. The implications of this passive investment approach can be viewed through both microeconomic theory and the regulatory perspective.

The microeconomic argument is that companies with the same owner have less incentive to compete with each other, as it is in the owner's (investor's) interest that all his companies are successful and not just one (even though some will inevitably perform better than others). This microeconomic theory states that investors explicitly or implicitly encourage anti-competitive practices that benefit the companies involved to the detriment of consumers and the common good in general (Elhauge et al., 2021). Indeed, it may be in their interest to restrict competition, in particular to reduce competition in pricing. Ultimately, higher prices can lead to higher revenues, even if the volumes that the market can absorb are not maximized. This puts companies with relatively large stakes held by the same funds in a monopoly-like position, at least in terms of price pressure, even if market competition regulation does not necessarily recognize this as such. If a fund holds relatively large stakes in companies A, B, C up to n that are market leaders in a particular industry (and thus determine market conditions, including innovation, which determines the dynamics of technological progress and prices) and operate under monopolistic competitive conditions, market concentration may or may not be high, but the effect of such investments may ultimately have a negative impact on market competition. In particular, investment fund owners may benefit from following sub-optimal management decisions that do not exert pressure on expansion, price competition or investment in development. They can support their economic interests by not taking action in capacity of representatives on company boards. However, legal regulations to mitigate the negative effects of common ownership are difficult to define, as the negative consequences of common ownership have no clear basis in economic theory, nor is there indisputable anti-competitive evidence in market practice (Dennis et al., 2021). On the other hand, investing in competing companies provides institutional investors with an excellent overview of the industry and the opportunity to influence regulators and policies.

Torshizi and Clapp (2021), in their study on the anti-competitive effects of common ownership based on empirical research of data from the US seed industry, conclude that the increasing concentration of common ownership has contributed significantly to the increase in soybean, corn and cotton seed prices between 1997 and 2017.

One possible consequence of increased presence in the industry is a bargaining position that is disproportionate to market share. A higher level of presence and a better insight into the processes and positions in the industry can lead to better availability of information and greater proximity to the regulatory channels. Regulatory capture occurs when a regulator created to promote the public interest, e.g. to promote fair competition, consumer protection or the protection of minority shareholders or weaker market participants, prioritizes the interests of the groups or industries it regulates. Therefore, authors such as Elhauge et al. (2021) recommend that market regulation should focus on market structure and not on measures of company behavior.

The presence of institutional investors with parallel holdings in multiple competing firms may sub-optimize managerial decision making and contribute to lower incentives for independent competition, as managerial compensation is more closely tied to industry performance than firm performance (Anton et al., 2016), leading managers to pursue less competitive strategies (Azar, 2016). Managers' behavior depends on the degree of control exercised by owners (Jensen and Meckling, 1976) and, in the case of institutional investors, on their investment style. The increase in the value of investments by passive investors exercising their ownership rights could again marginalize investors and undermine their basic ownership rights at a time when regulators around the world are pushing to encourage investors to meet their governance obligations. Moreover, such ownership behavior will not only disrupt competition in the market by reducing rivalry, but will also reduce investment incentives, increase executive salaries, and lead to higher inequality; hence, there are perspectives suggesting that common ownership may conflict with antitrust law (Elhauge, 2019; Schmalz, 2017).

Institutional investors interested in the financial performance of their portfolios can be expected to prioritize portfolio interests over the interests of individual companies. Through networking, information sharing or collusion, in the case of horizontal shareholder ownership, companies linked by ownership have better access to information and thus a greater ability to coordinate actions due to lower information asymmetry. A higher degree of common ownership between a firm and its competitors makes raising product prices a feasible strategy, a strategy that would be beneficial to investors as potential losses due to market contraction (number of customers) can be compensated by the detour of sales and/or by the associated profits of other firms in common ownership. This strategic behavior of companies can lead to higher prices and limited supply (Azar et al., 2018; Backus et al., 2020; Torshizi and Clapp, 2021).

According to Bas et al. (2023), the effects of common ownership depend crucially on whether share ownership occurs simultaneously within an industry or between different industries. Cross-industry joint ownership is associated with higher productivity at the firm level, possibly due to technological spillover effects along the value chain, the reduction of information asymmetries, strategic collaboration on innovation and stronger business relationships between vertically integrated firms (Azar and Vives, 2022; Bas et al., 2023).

On the other hand, the negative consequences of common ownership within an industry, i.e. horizontal shareholder ownership in terms of investment strategy in competing firms, arise from reduced competitive incentives. Companies operating in the same industry and belonging to the same investor's portfolio may compete less intensively on product markets in the interest of their common shareholders (e.g. through collusion), which has a negative impact on productivity. As a result, the analysis conducted by Bas et al. (2023) provides insights into two potential risks and related policy areas: i) the short-termism of investors and thus the role of policy in promoting long-term investment; ii) possible negative effects of common ownership within the industry on market competition and thus the hypothesized role of antitrust policy.

Another challenge arising from the increasing concentration of corporate ownership in the hands of institutional investors is the investment managers of these institutional investors. This is because there are a number of agency problems that investment managers have with their own investors. In their research, Bebchuk et al. (2017) find that investment managers of mutual funds (i.e. index funds and actively managed funds) have incentives to under-spend on management and over-align with the management of companies. These incentives are particularly pronounced for index fund managers, so that the rise of such funds has negative consequences for the entire corporate governance system, while activist hedge funds have significantly better incentives for their managers, but their activities do not provide a complete solution to the agency problems of institutional investors.

Finally, empirical research dealing with the effects of common ownership and horizontal shareholder ownership is ambiguous. While one group of authors argues that the benefits accrue to investors and managers and that consumers and workers — and thus society as a whole —are typically disadvantaged (Tzanaki, 2022), another group of researchers argues that common ownership across the economy means lower margins for consumers. Their argument is that in general equilibrium, as the industry expands, positive externalities are created for firms in other industries (especially vertically related industries), so that an increase in cross-industry common ownership leads to greater incentives for firms to expand and lower prices in their industry relative to the price level (Azar and Vives, 2021). Azar and Vives (2021) also argue that the effect of externalities is stronger than the intra-industry effect created by common ownership of firms in the same industry, so that the overall effect of common ownership is actually a reduction in market margins for products. Bas et al. (2023) discuss that common ownership within an industry could have a positive effect on innovation and productivity if coordination between firms is explicit (e.g. through joint ventures or strategic alliances) and firms collaborate in their efforts through knowledge sharing, research and development. He and Huang (2017) support this proposition with their findings that firms exhibit with common owners greater future growth in market share due to a higher number of patents per dollar spent on R&D and higher profit margins.

The lack of evidence on the impact of common ownership on the market and market relationships underscores the need for further empirical research as well as the willingness of regulators to update antitrust regulations regarding common ownership, especially in industries where product market concentration is high, as is the case in many links of the agricultural and food value chain.

CONCLUSION

The development of capital markets has led to a concentration of horizontal ownership among competing companies. The benefits of such investment strategies are questionable for consumers and society, as empirical evidence suggests that common ownership of competing firms can promote anti-competitive behavior and suboptimal economic performance, especially in highly concentrated industries, including many sectors within the agricultural and food value chain.

The results of trend analyzes on investments in the agri-food industry show a consistent trend of increasing investments by institutional investors in these sectors. In addition, the share of ownership concentration is increasing through various forms of common ownership, with capital consolidation manifesting itself in some parts of the value chain through mergers and acquisitions (e.g. retail and trade chains), in others through strategic alliances (e.g. joint ventures, joint use of patent rights) and in some through horizontal shareholder ownership (e.g. in the seed industry).

Different investment motives lead to different strategic behaviors of companies, shareholders and managers, which in turn has different effects on companies, markets and consumers. Every investment logic is essentially aimed at maximizing returns. Depending on the investment horizon and management style (i.e. asset management costs), owners are more or less interested in actively managing their assets, which has an impact on management engagement. Conversely, the level of engagement of owners will determine the behavior of management, which will enable strategic management of the company to varying degrees depending on their personal interests.

In this context, debates on horizontal shareholder ownership highlight potential challenges related to the regulation of anti-competitive behavior. In particular, the avoidance of competition between competitors may be motivated by self-interest. This chapter analyzes situations in which competing companies are jointly owned by a third party. The third party in this analysis is an institutional investor who considers it beneficial not to exert pressure on the management of the companies in its portfolio. The owner — an institutional investor— - can achieve a higher return on investment by aligning the business policies of several related companies, possibly at the expense of optimizing the operations of individual companies. In this case, the main stakeholders (owners and managers) may achieve higher profits through inaction (the passive role of the owner in management) or the coordination of activities between competing companies in the portfolio (which could be interpreted as inappropriate behavior, although the boundaries of such actions are not easy to define).

In summary, it is unclear and possible that common ownership alters corporate behavior in companies with common shareholders and has anti-competitive effects in concentrated markets. Institutional investors with horizontal holdings have an interest in influencing companies in a way that increases portfolio value. Contrary to the logic of the free market, they can achieve this by reducing competition. Strategies to reduce competition, such as avoiding price competition (which leads to higher prices for consumers), limiting supply and restricting entry, would be detrimental to competitiveness as well as the economy and society as a whole. Relatively small ownership stakes in a large number of companies within the same sector can lead to a concentration of power in the hands of certain investors, resulting in a disproportionate influence on the regulation of the industry.

Horizontal concentration of ownership in the agri-food sector, driven by institutional investors, presents both opportunities and challenges. While these ownership structures can lead to efficiency gains and innovation, they also pose

significant risks to sustainability, food security and equitable economic development. Addressing these challenges requires comprehensive policies and strategies that promote a more balanced and sustainable food system and ensure that the benefits of modern agriculture and food production are shared by all.

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PART TWO

The second part focuses on key issues related to business challenges, innovation and market positioning within the agricultural sector. Seven chapters analyse how agricultural businesses, whether family farms or larger business systems, can operate successfully in an increasingly complex and competitive environment. Various topics are addressed, from ecology and the circular economy to quality management and efforts to gain market recognition, shortening supply chains and the financing of agriculture through European funds.

Chapter 7 contains a bibliometric analysis of research papers dealing with sustainable agriculture focusing on efficiency research using data envelopment analysis. The chapter shows that this method can be extremely useful in understanding the technological challenges in achieving sustainable agriculture. Organic farming is the topic of the Chapter 8. It examines the new trends and regulations in the European Union and focuses on the economic and social benefits of the transition to organic production. Chapter 9 is dedicated to the challenges associated with the introduction of a circular economy. It emphasizes the benefits of circular economy and stresses the need for a detachment form the linear model due to environmental and technological demands of today.

Chapter 10 analyses quality management for agricultural products and focuses on the "Certified Quality" label in Croatia, which gives producers better visibility and a competitive position on the market. Chapter 11 discusses the importance of reputation for experiential goods as are agricultural products and how small producers can use their reputation to gain a competitive advantage. The use of social media by family farms is analysed in Chapter 12, with a focus on how digital platforms can help small producers connect with consumers.

Chapter 13 looks at the options for financing European agriculture and analyses the funds and financial instruments that are crucial to ensuring the sustainability and progress of the European agricultural sector. Chapter 14 examines the prospects for utilising short food supply chains and gives an analysis of consumer preferences in terms of local agricultural products, highlighting the benefits of such chains for rural development and sustainability. Chapter 15 explores the possibilities of exploiting synergies between agriculture and tourism given the seasonality of these economic activities. The final chapter of Part Two, Chapter 16, presents the opportunities for improving education in rural areas through smart villages.

DATA ENVELOPMENT ANALYSIS IN AGRICULTURE VIEWED THROUGH THE LENS OF BIBLIOMETRICS

CHAPTER 7

Jelena Jardas Antonić *

ABSTRACT

As one of the priorities of the Sustainable Development Program, the United Nations has set 17 goals to be achieved by 2030. The second goal relates to the eradication of hunger, and the promotion of sustainable agriculture, which is also anchored in the same goal. Since sustainable agriculture also implies efficiency, i.e. achieving the same or a greater amount of output with the same input, it is justified to investigate how Data Envelopment Analysis (DEA) is used in research work in the field of agriculture. In order to feed the world population, especially the poor parts of the world, Data Envelopment Analysis is a method worth investigating within the context of sustainable agriculture, especially since it is strongly recommended in the *Guidelines for the measurement of productivity and efficiency in agriculture* of the Food and Agriculture Organization of the United Nations as a suitable method for measuring technical efficiency and productivity. The aim of this chapter is to investigate how this method is used and in what type of work in the field of agriculture, and, more specifically, in the field of economics. To this end, a bibliometric analysis of 863 scientific publications from the last 10 years was carried out, filtered through the Web of Science Core Collection database using the keywords "data envelopment analysis" and "agricult*". The chapter also aims to identify the trends and guidelines for further research based on the analysis of keywords and areas. The analysis shows that there are quite a number of papers in this area based on the selected keywords, and that his number has increased in the recent years, as well as the number of citations. However, although the method is very popular in analysing productivity efficiency in the field of agriculture and in various scientific fields there are very few works by Croatian authors and authors from the region.

Keywords: *Data Envelopment Analysis, efficiency, agriculture, sustainability, bibliometrics*

INTRODUCTION

Preservation of natural resources combined with the provision of sufficient food for a large number of people is a major challenge for today's agriculture, which is emphasized in the United Nations' Sustainable Development Goals for 2030. It is therefore not surprising that the second goal of sustainable development is precisely related to the sustainability of agriculture and the aforementioned problem of food production. In addition to the Sustainable Development Goals, the Food and Agriculture Organization of the United Nations itself highlited methods for measuring productivity and efficiency in agriculture in its guidelines at the end of

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2018 in the document *Guidelines for the measurement of productivity and efficiency in agriculture*, which also includes the Data Envelopment Analysis - DEA. In this context, it is quite understandable to look at the problem of efficiency through the prism of Data Envelopment Analysis, which reduces this problem to the production of a sufficient amount of output with a minimum of resources and energy input.

The efficiency of inefficient DMUs can be achieved in two ways: The production or output can remain at the same level while the amount of input used is reduced, or with the same amount of input, i.e. resources, a higher production or output should be achieved. Depending on this, either an input-oriented model or an output-oriented model can be used in the data envelopment analysis. This way of looking at the efficiency and use of natural resources can ensure their preservation and sufficient supply for future generations.

Data Envelopment Analysis works by comparing decision making units (DMUs) that work under the same or similar conditions and achieve a certain level of output with a certain level of input. In relation to their results and resources used, an efficiency frontier of efficient DMUs is spanned, which thus form a reference group for those that are not efficiently estimated. In contrast to parametric methods such as regression models, non-parametric methods, of which data bounding analysis is a representative example, do not require a strict theoretically based functional dependency. It is based on a linear programming model whose goal is to improve the performance of those DMUs that do not perform efficiently by following the example of their efficient models from the reference set. This approach works by projecting onto the efficiency frontier to find a reference unit that the inefficient unit should follow as a good example and thus improve its performance. We therefore conclude that Data Envelopment Analysis is based on a form of benchmarking and thus, by comparing efficiently performing DMUs from the reference set with inefficient units, enables the latter to improve their efficiency level. In view of all this, DEA does not require any assumptions describing the relationship between input and output, unlike parametric methods that presuppose this functional relationship.

Since Data Envelopment Analysis provides a calculation for each inefficient unit in the form of concrete projections, many authors have worked on improving the method. Thompson et al. (1996), for example, proposed a fairer way of benchmarking in their work dealing with less conventional models. The so-called super-efficiency models are also very popular, in which the efficiency of units classified as efficient is graded in such a way that they are excluded from the reference set (Anderson and Petersen, 1993).
In the production process, network DEA models are very popular, which examine the efficiency of DMUs according to the stages of the production process instead of focusing only on inputs and final outputs, which reduces the mystification of the method itself as a black box between inputs and outputs. In addition, *window analysis* is a very common model that is also used as part of Data Envelopment Analysis when decision makers evaluate the performance of DMUs over time. The latter model was successfully applied to agriculture in the 2021 paper by Pishar-Komleh and colleagues, which analyzed the eco-efficiency of the agricultural sector of EU countries from 2008 to 2017. A review of papers in the Web of Science database revealed that only four papers have been published on the topic of the

bibliometric approach from 2015 to 2023, none of which examine the connection between agriculture and the application of this method in detail. However, the papers focus primarily on methodology, and it was found that within the papers cited, agriculture stands out alongside air transport and utilities and banking as the sector with the greatest influence in the application of Data Envelopment Analysis (Lampe and Hilhers 2015). A more recent work dealing with the circular economy concludes through a bibliometric analysis from this field that the most popular methods for analyzing and evaluating sustainable agriculture on farms are multi-criteria analysis, Data Envelopment Analysis and life cycle assessment (Rodino et al. 2023). From all that has been described, it can be concluded that Data Envelopment Analysis is a very popular and used method to analyze efficiency in the field of agriculture, as it can link multiple inputs to multiple outputs without assuming their functional connection, while providing the possibility of benchmarking with the best. Therefore, in light of the observed and analyzed results, the objectives of this chapter are as follows:

- identify which agricultural problems are most often addressed and solved with DEA
- using key words, identify areas where the methodology is being used successfully and explore the gap between the methodology and future research and current research topics in the field of agriculture
- explore ways in which DEA can be used more widely in the field of agriculture in a way that is useful to researchers and practitioners.

DATA ENVELOPMENT ANALYSIS IN AGRICULTURE

About method and its application

The two basic models of Data Envelopment Analysis are:

- CCR model (Charnes-Cooper-Rhodes model), which is based on the assumption of constant return to scale (CRS), and the envelope of this model is the line that crosses all efficiently estimated units. All inefficiently estimated units lie below the envelope (Figure 1),
- BCC (Banker-Charnes-Cooper model), a model also set up two years later by three academics and which, unlike the first model, assumes variable return to scale (VRS), manifested in the convex shape of the envelope, which is linear in parts and whose peaks are formed by efficient units, while the inefficient units lie below the envelope spanned by the efficiently estimated units, as in the first case (Figure 1).

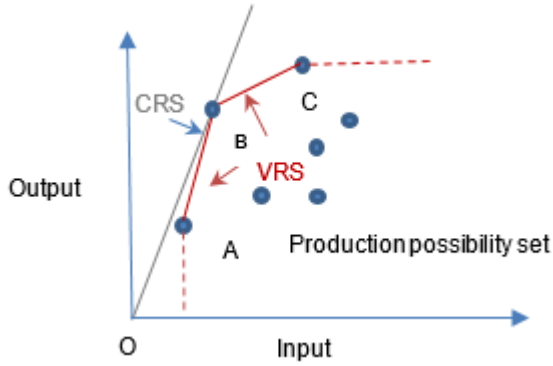

Figure 1 Graphical representation of CCR and BCC model respect to one input and one output
Source: author's

The basic CCR and BCC models also imply an orientation, i.e. they can be input or output oriented, depending on what the model wants to optimize. The choice of orientation depends on whether you want to increase the level of output with the same amount of input or whether you want to produce the same amount of output with a smaller amount of input. Depending on this, the Data Envelopment Analysis calculates the projections of the inefficiently estimated units to improve the efficiency according to the example of the efficiently estimated units from its reference set. In this way, Data Envelopment Analysis becomes an excellent tool for benchmarking, where any unit that performs or produces worse can improve its business or production by following the example of a unit from the reference set.

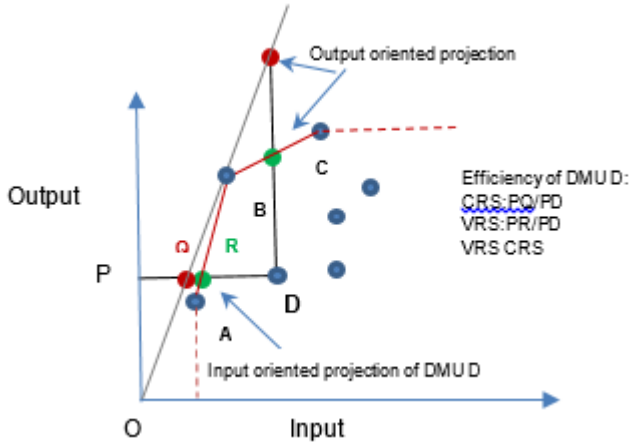

Figure 2 Graphical representation of projection in CCR and BCC model respect to one input and one output
Source: author's

In mathematical notation, the basic CCR model has the form of fractional linear programming and is formed in the following way:

$$(RP_o) \qquad \max_{u,v} \theta = \frac{u_1 y_{1o} + u_2 y_{2o} + \ldots + u_s y_{so}}{v_1 x_{1o} + v_2 x_{2o} + \ldots + v_m x_{mo}}$$

$$\text{respect to} \quad \frac{u_1 y_{1j} + u_2 y_{2j} + \ldots + u_s y_{sj}}{v_1 x_{1j} + v_2 x_{2j} + \ldots + v_m x_{mj}} \leq 1 \quad j = 1, \ldots, n$$

$$u_1, u_2, \ldots, u_s \geq 0$$
$$v_1, v_2, \ldots, v_m \geq 0$$

The constraints ensure that the ratio of "virtual output" to "virtual input" cannot be greater than 1 for each observed unit. The goal is to obtain the value of the weights (v_i) and (u_r) that maximizes the given ratio of the decision unit being evaluated, while the variables x_i and y_j represent the known input and output values, respectively, for each unit. The given problem can be linearized very easily and the following form is obtained:

$$(LP_o) \qquad \max_{\mu,\nu} \theta = \mu_1 y_{1o} + \mu_2 y_{2o} + \ldots + \mu_s y_{so}$$

$$\text{respect to} \qquad v_1 x_{1o} + v_2 x_{2o} + \ldots + v_m x_{mo} = 1$$

$$\mu_1 y_{1j} + \mu_2 y_{2j} + \ldots + \mu_s y_{sj} \leq v_1 x_{1j} + v_2 x_{2j} + \ldots + v_m x_{mj} \qquad j = 1, \ldots, n$$

$$\mu_1, \mu_2, \ldots, \mu_s \geq 0$$
$$v_1, v_2, \ldots, v_m \geq 0$$

The difference between the BCC model and the CCR model manifests itself only in the additional condition $e\lambda = \sum_{j=1}^{n} \lambda_j = 1$ that defines the convexity condition

As mentioned above, there are not many papers with bibliometric analysis based on Data Envelopment Analysis in agriculture, but through reviews it is possible to highlight some others that are not represented in the Web of Science database but have made an important contribution to the overview of the field. For example, in 2018, Zhou and the authors provided an overview of papers on the application of Data Envelopment Analysis with the concept of sustainability by analyzing more than three hundred publications over a twenty-year period, specifically from 1996 to 2016. The main findings of this work focused on undesirable outcomes as well as how the results can be appropriately used by policy makers and managers for business improvement and the shortcomings of including social factors in the three observed aspects of sustainability. Tsaples and Papanthasiou (2021) come to a similar conclusion regarding the application of Data Envelopment Analysis and the inclusion of social factors when applying the method in the field of sustainability, but they also concluded through the review that the terms eco-efficiency and sustainability are often misunderstood and frequently confused. The last paper that provides a comprehensive literature review based on the keywords DEA+sustainability+agriculture is a paper that is not included in the Web of Science database and includes 120 papers in the systematic review following the PRISMA

approach titled A Systematic literature review of Data Envelopment Analysis implementation under the prism of sustainability (Kyrgiakos et al. 2023). In addition to providing insight into the detailed analysis according to the keywords mentioned above, this chapter provides valuable conclusions for improving the application of the method and is characterized by suggestions on aspects of sustainability that are not sufficiently covered in the analysis by this method. Specifically, the authors suggest that more weighting should be given to the application of the method in the area of agriculture so that the results obtained have greater explanatory power. Regarding the three aspects of sustainability observed, they agree with the authors Tsaples and Papanthasiou (2021) mentioned above that it is very necessary to include social factors in the analysis, especially in cases whose main objective is to provide information to policy makers after benchmarking, which the analysis of data constraints based on these factors provides.

Bibliometric Analysis

The analysis was performed by filtering articles in the Web of Science database based on the terms "data envelopment analysis" and "agricult*", which included all terms containing the word agriculture and its derivatives in English, in relation to the Topic category by which the articles were filtered in terms of title, abstract, keyword plus and author keywords. In this way, 1122 articles were filtered out of the observed category over the years (Figure 1), 863 of them in the last ten years. This shows that this method has been the most popular in the last ten years, as 78% of the articles were written based on the selected keywords in the observed period.

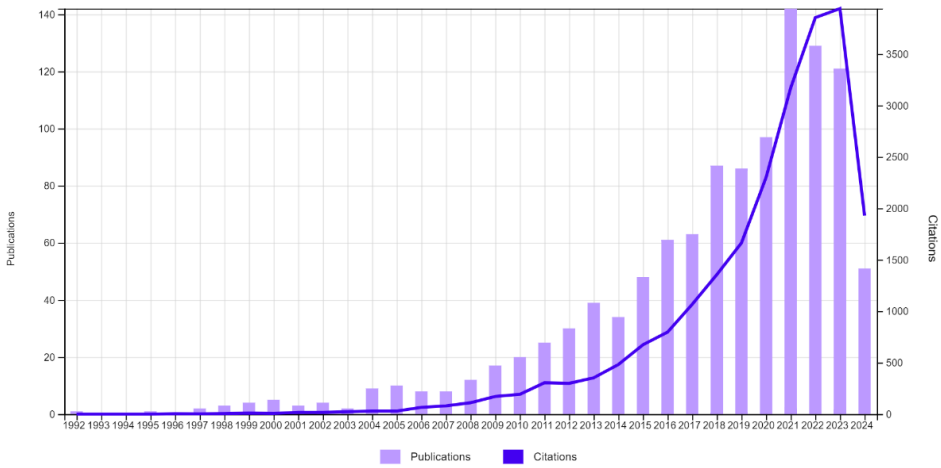

Figure 3 Graphical representation of the number of published papers and citations over the years
Source: Author's based on the Web of Science database

The graph shows that the number of citations increases over the years, while the number of publications peaks in 2021 with 142 publications, which can be interpreted as a consequence of the COVID 19 pandemic, during which everyone,

including scientists, turned back to nature, the land, agriculture, sustainability and ecology and thus efficiency in agricultural production, for the measurement of which this method is crucial. The number of citations of publications is increasing from year to year. The situation is similar when the publications are filtered according to the scientific field of economics. The number of works and citations increases until 2021, when the production of works begins to decline.

If we analyze the scientific fields from which articles were published across all years, it can be seen from Figure 3 that these are primarily environmental sciences, business economics and agriculture, and then also the field of technology, while the other fields are less strongly represented

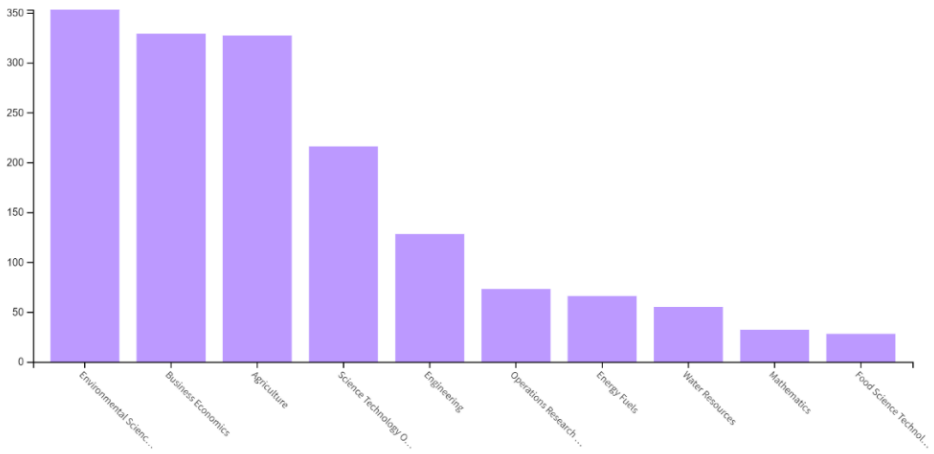

Figure 4 Graphical representation of the number of publications in relation to the scientific fields across all years
Source: author's based on the Web of Science database

If we focus on the last ten years, the number of research papers in the business economics category decreases, falling from second to fourth place. The remaining three are still holding on to a firm place, which clearly indicates that although Data Envelopment Analysis is still highly valued in the context of agricultural and economic sciences, it is less interest for researchers in this field than it used to be.

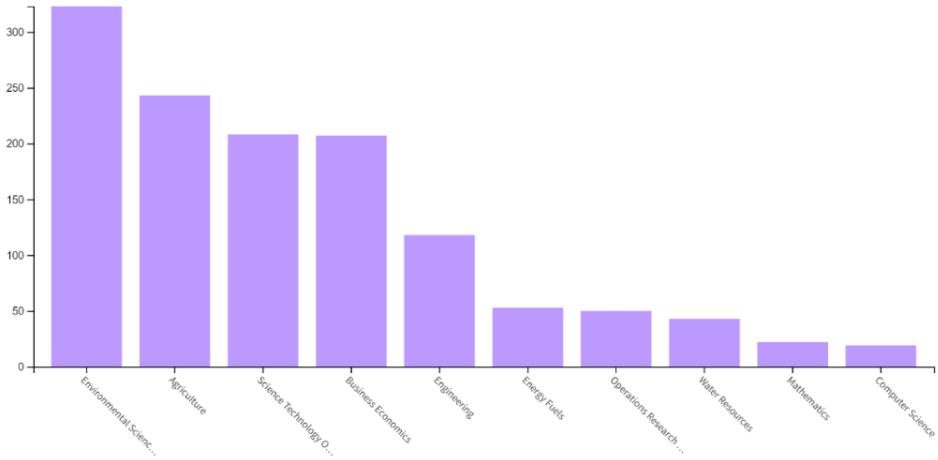

Figure 5 Graphical representation of the number of published papers and citations over ten years
Source: author's based on the Web of Science database

A closer examination of the papers suggests that the basic models were developed in 1978 and 1984 and their application in agriculture began ten years later, considering that the first research paper using Data Envelopment Analysis was published in 1992. The paper was written specifically in the field of economics and published in the journal *Applied Economics*. The paper examined the technical efficiency of agricultural production of 41 Texas farms in terms of four inputs: harvested grain, cropland used for grazing, land used for grazing only, and farm production costs, as well as two outputs: Market value of crops sold and market value of livestock sold. Most other scientific papers in the 1990s also refers to farms and the analysis of their efficiency through inputs such as labour, capital, equipment, costs, etc. and outputs such as profit (Lund, Jacobsen and Hansen 1992). The observed works used the method as a kind of benchmarking approach, where they tried to find the causes of inefficiency on other farms based on the results of efficient farms and thus suggest improvements. More recent works address similar issues to those of thirty years ago, such as the efficiency of farms as observed units and the production of specific crops or livestock, but they are approached from the perspective of current trends such as ecology, sustainability, the adoption of new technologies and organic production (Mergoni, Dipierro , Colamartino 2024; Lei, Yang 2024; Sintori, Gouta, Konstantidelli, Tzouramani 2023). This trend was also confirmed in the bibliometric analysis.

A more detailed bibliometric analysis is limited to scientific works from the last ten years. Figure 6 shows the keywords clustered by topic in three areas. The first cluster relates to the technological aspect of agricultural activity and includes keywords mainly related to methodology. Keywords such as *data envelopment analysis, technical efficiency, total factor productivity* appear in it, which are associated with less frequent words such as *wheat production, food security, regional differences*, indicating that it is a cluster in which the accent is on the technical aspect of the method, while the application is less frequent. The second cluster relates to

agriculture and the use of the method for applied purposes in countries that are oriented towards food production due to a large population such as China, or in countries that do not have enough of it. The third cluster (green) is oriented towards new trends in agriculture, such as ecological, energy and climatic aspects.

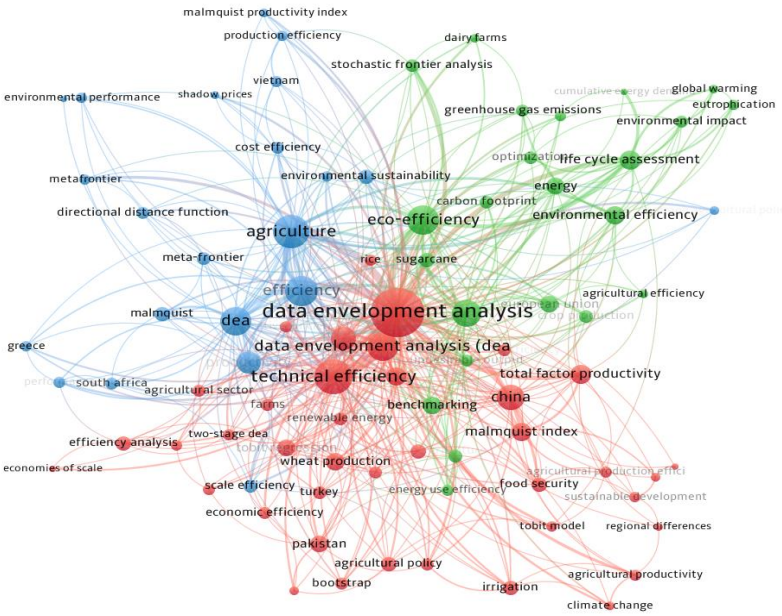

Figure 6 Graphical representation of the most frequent keywords clustered in three areas
Source: author's based on the Web of Science database and VOSviewer

Figure 7 shows the most frequent words, but considering how they have been used over time and which ones have been trending recently. In light of this view, one could examine what the current trends are in scholarly research in the field, considering the methodology observed, and consequently it may provide guidelines for topics in future research.

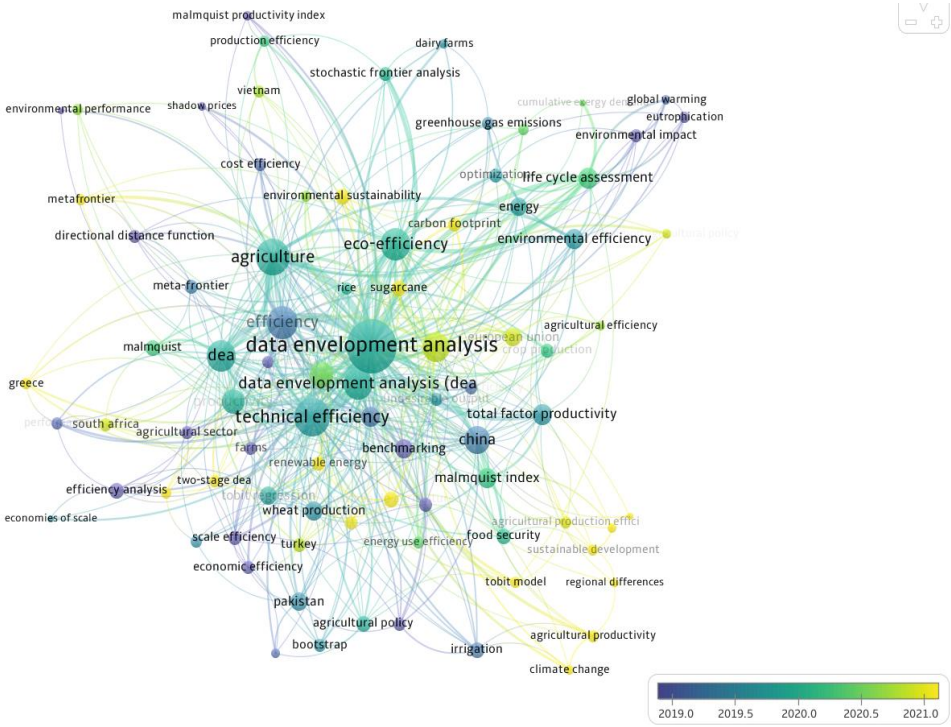

Figure 7 Graphical representation of the most frequent keywords clustered in three areas over the last five years
Source: author's based on the Web of Science database and VOSviewer

If we look at the keywords of the last five years, it becomes clear that the words that have recently been included in the keyword pool related to thematic trends are precisely expressions such as "climate change", "carbon footprint", "climate change", "renewable energies", "regional differences" and the like. This illustration also shows us in which direction and around which topics future scientific research related to the observation of efficiency in agriculture in combination with Data Envelopment Analysis should be oriented.

The preceding thesis is further confirmed by the following illustration from Figure 8, which shows the 16 most recent and most frequently cited key words from the papers included in this analysis. From this it can be seen that they are clustered into two segments, the first (red) where the keywords are related to methodology and agriculture, while the second, green cluster contains words related to topical issues such as ecology, sustainability, energy and life cycle, which can be seen from keywords such as " eco-efficiency", "energy", "sustainability".

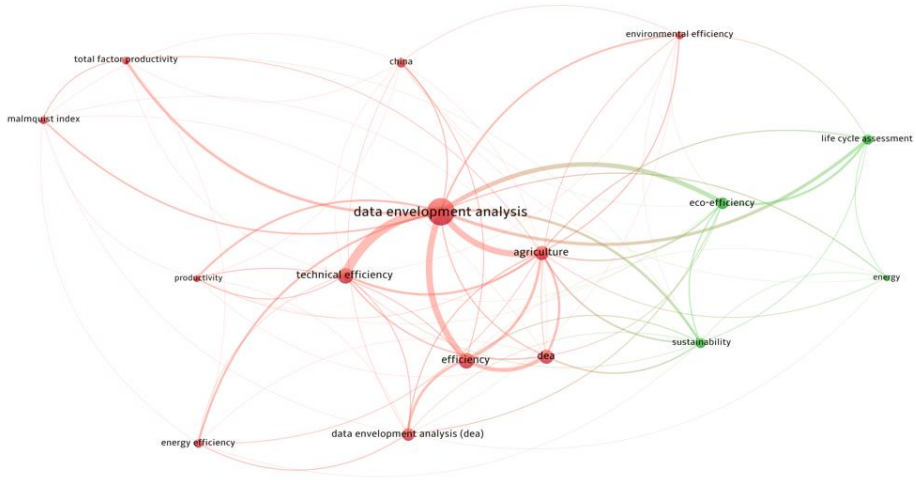

Figure 8 Graphical representation of the 16 most frequent keywords
Source: author's based on the Web of Science database and VOSviewer

Among the keywords, "data envelopment analysis" still has the strongest conection along with "agriculture", "efficiency" and "technical efficiency".

If we analyze the journals and their relevance to a particular topic and the number of papers published, then the journals are classified into two categories, i.e. clusters (Figure 9). The first cluster refers to journals whose topics are more focused on methodology, agriculture and productivity, while the green cluster includes journals whose thematic coverage is mostly related to environmental and energy topics.

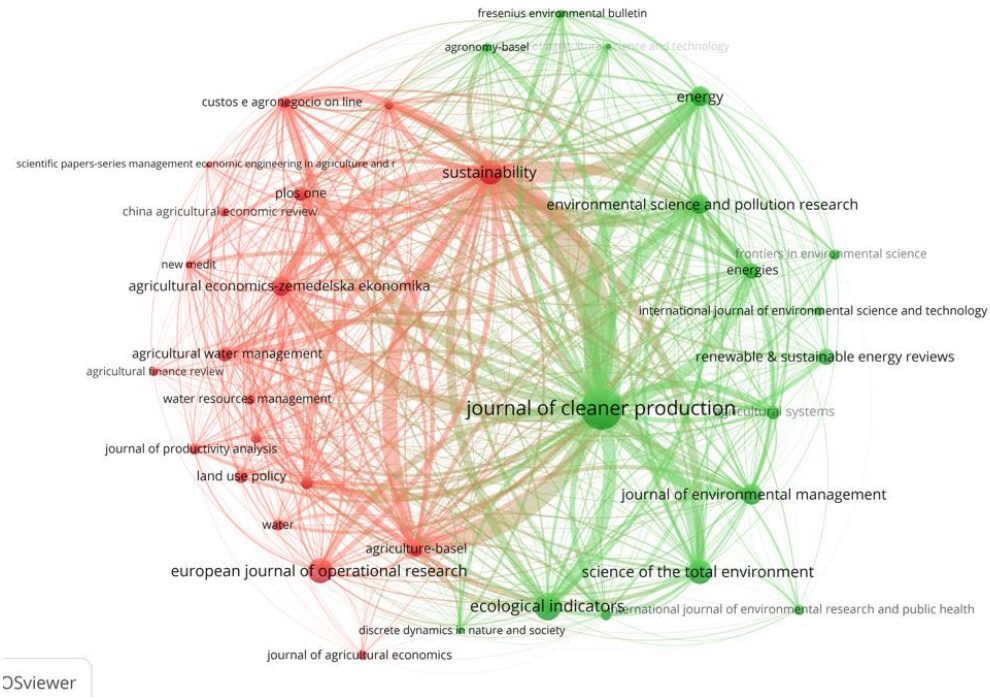

Figure 9 Graphical representation of relevant journals from the field according to filtered topic
Source: author's based on the Web of Science database and VOSviewer

The best journals according to the graphical representation are Sustainability and Journal of cleaner production (Figure 10). The visibility of the journal Sustainability is not surprising, considering the galloping growth in publication in monthly issues with a large number of publications per issue, the speed of reviews and a particularly attractive open approach that, despite the high publication fee, is attractive to researchers because it increases their visibility. However, the Journal of Cleaner Production is still the leader in the number of publications using Data Envelopment Analysis in agriculture and in the field of economics and business economics.

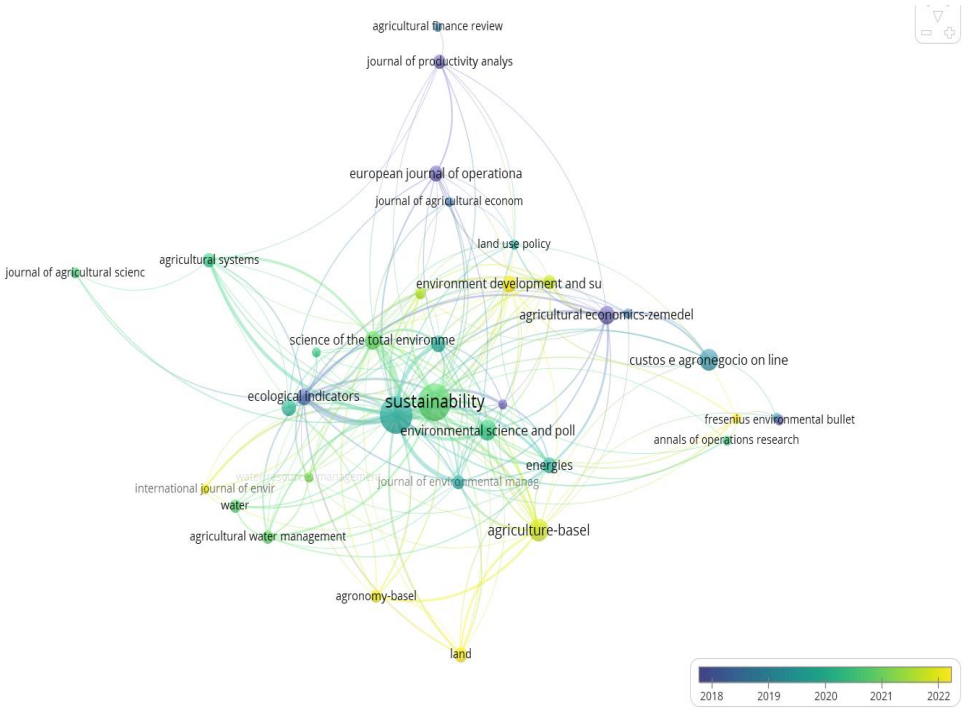

Figure 10 Graphic representation of the journals with the strongest thematic representation in the last five years
Source: author's based on the Web of Science database and VOSviewer

If we look at the data in Table 1, we can see that the two journals leading in the application of Data Envelopment Analysis in the field of agricultural economics by number of articles and keywords follow the previous cluster analysis. This conclusion results from the fact that the first publisher is Elsevier, whose representative is the Journal of cleaner production, which is represented thematically with a total of 232 papers, i.e. more than a quarter of all papers found, while in second place, with almost 12% fewer papers, is MDPI, whose journal Sustainability occupies the second place in the analysis of papers on the topic by keywords.

Publisher	No of records	% of 863 records
Elsevier	232	28,883%
MDPI	147	17,034%
Springer Nature	108	12,514%
Wiley	53	6,141%
Emerald Group Publishing	27	3,129%
Taylor & Francis	25	2,897%
Univ Fed Rural Pernambuco, dept Administracao	22	2,549%
Czech Academy Agricultural Sciences	18	2,086%

Public Library Science	14	1,622%
Hindawi Publishing Group	10	1,159%

Table 1 Tabular representation of publishers according to the number of works from the observed topic area
Source: author's based on the Web of Science database

According to the Web of Science database, the most prolific author in terms of number of publications is Tomas Balezentis, who has published no less than twenty papers using Data Envelopment Analysis in the field of agricultural economics in the last ten years. His contribution in such a narrow field in the last two years relates to topical issues such as the analysis of the impact of informatization in agriculture on the shadow carbon price (Meng et al. 2024), the energy sustainable agriculture of EU Member States considering overall productivity and structural efficiency (Zhu and authors 2023), the use of biomass and its impact on bioeconomic development, observing the efficiency of EU countries in relation to the resources of each country (Ramanauske, Balezentis and Streimikiene 2023). In addition, there are work in which DEA was used to analyze the efficiency of European agriculture in terms of greenhouse gas emissions and sustainable agriculture through a structurally efficient approach (Shen, Balezentis, Streimikis 2022; Streimikis et al. 2022; Dabkiene, Balezentis and Streimikiene 2022). Later work from this period focused on labor productivity in Chinese agriculture (Balezentis, Li, TX and Chen 2021) and the efficiency of Chinese farms (Niu et al. 2021; Liu et al. 2019) as well as the efficiency of family farms in Lithuania (Namiotko and Balezentis 2017; Asmild, Balezentis and Hougard 2016; Balezentis and De Witte 2015).

If we focus on the most frequently cited authors, they are closely related to the journals that have the most citations in relation to the field and keywords studied. Accordingly, based on the citations, we can identify the authors Liu D., Zhu X. and Wang Y. (2021) and their paper China's Agriculture Green Total Productivity based on carbon emission: An analysis of evolution trend and influencing factors, which deals with the current topic and the methodology used, stands out with a total of 279 citations and was published in the Journal of Cleaner Production. The second- and third-placed papers with a total of 216 and 206 citations were by Dapko, Jenneaux and Latruffe (2016) and Lampe and Hilgers (2015). These papers made a methodological contribution and were published in the European Journal of Operational Research, which is one of the three most cited journals in this analysis.

If we look at the Web of Science database, compared to the most prolific author, Croatian authors have published 679 papers exclusively on agriculture in the last ten years, which is a sufficient number. However, if we filter these papers to the field of economics, the number is reduced to only 34 papers, so among them we can highlight the recent works Croatian authors writing on the topic of economics in the context of sustainability and the use of natural resources (Zec Vojinovići et al., 2024). This number decreases even more if we focus on the works from this analysis, which includes the Data Envelopment Analysis method. Although the Republic of Croatia is known for the production of wine and autochthonous wine varieties, there are very few works from the business economic field and the wine industry on this topic, considering that according to the analysis of the WoSCC and Scopus databases, only 26 authors have written on this topic, which was also found in the previous

bibliometric analyzes (Jardas Antonić, Kružić and Prudky 2022). If we filter out the works on the application of the DEA method in the wine industry, the number of publications by Croatian authors is zero. This is not surprising, because over the years there are only eleven such papers in the Web of Science database in the field of economics, and only nine in the last ten years, while in all the years observed there are only three papers in which DEA is combined with the term "grape", and only one in the last ten years.

If we look at the scientific works of Croatian authors in the filtered publications more broadly, through the prism of agriculture as a whole in the field of economics and business economics, we can see that very few of them have written on the topic of the application of Data Envelopment Analysis in agriculture. Thus, in the last ten years, only one Croatian author has written a paper in which envelopment analysis was applied in agriculture (Table 2). It is important to emphasize that the paper was co-authored with Hungarian scientists, because the aim of the paper was to compare the technical efficiency of Hungarian and Croatian livestock farms. The main objective of their research was to compare the efficiency of the livestock sector in Hungary and Croatia using the Data Envelopment Analysis method. By calculating the technical efficiency of the poultry, cattle, sheep, goat, dairy cattle and pig farming sectors, the authors compared the farms of the two countries in the period from 2014 to 2017. In the paper, the authors compared farms of different sizes, which were determined on the basis of the standard production value. It was found that Hungary achieves better results in terms of technical efficiency in the dairy and cattle farming sectors, while Croatia has better results in sheep farming. The efficiency in the poultry and pig farming sectors is almost the same in both countries. In addition to the comparison of the two countries, it was found that in the Hungarian poultry, pig, sheep and goat farming sectors and in the Croatian dairy, cattle and pig farming sectors, the technical efficiency of small farms is better than that of medium-sized farms (Kovács et al. 2022).

Country	Number of published papers
Serbia	6
Kosovo	2
Bosnia and Hercegovina	1
Croatia	1
Slovenia	1

Table 2 Countries from the region and their publication in the last 10 years
Source: author's according the data from the Web of Science database

From all of the above, it can be pointed out that the application of DEA in the field of agriculture by Croatian authors from Croatia and the region is very rare and represents an opportunity in which a certain group of authors from the field of agricultural economics could distinguish themselves and thus enable valuable analyzes based on which the results can be applied to improve the efficiency of

inefficiently operating units. This can be achieved by benchmarking within the framework of reference sets and calculated projections, with the application of which inefficient units can improve their business.

CONCLUSION

This study provides an overview of bibliometric indicators of papers related to the use of Data Envelopment Analysis in the field of agricultural economics. The bibliometric analysis has shown that Data Envelopment Analysis is a valuable and desirable tool in the field of agriculture, which has also been confirmed in the " *Guidelines for the measurement of productivity and efficiency in agriculture* " of the Food and Agriculture Organization, which recommends it in its document as one of the methods desirable for measuring technical efficiency. The analysis also revealed a significant increase in the number of published scientific papers and citations during the three years marked by the COVID-19 pandemic. The authors did not recognize the method in the field of agricultural economics until ten years after its establishment, when they began to apply it in the field of agricultural efficiency assessment. In the later period, the method has been adapted to trends, and more recently it is being used in assessing the efficiency of entities in the areas of sustainability, eco-agriculture, ecological efficiency, greenhouse gas emissions from farms and other topics observed as burning and important research topics in this analysis. It was also noted that the number and citation of these papers is increasing.

Although the popularity of the method in the field of agricultural economics is increasing, Croatian authors in the field have not yet recognized the method, as evidenced by the only paper by a Croatian scientist written in collaboration with foreign authors. The paper itself emphasizes that this is the first paper in which the DEA method was used to calculate the efficiency of Croatian livestock farms. Therefore, this analysis shows a scientific gap between Croatian authors and authors from the region compared to other European authors.

The topics of the published papers address the pressing issues of ecology, self-sustainability and efficiency improvement in the agricultural sector of EU countries, as well as efforts to increase the efficiency of family farms in terms of productivity, self-sustainability and ecological efficiency. The themes of the contributions were confirmed by analyzing keywords, as well as the most productive contributions of the last ten years. From the perspective of trends and popular topics in the field of agriculture and the application of the DEA method, it can be concluded that the method is used in conjunction with current hot agricultural topics such as climate change, agricultural policy, ecological efficiency and sustainable agriculture. We therefore conclude that Croatian authors have the opportunity to take advantage of the niche in this gap and fill it with valuable works in this field.

It should also be noted that this analysis is limited to the use of only one database, selected keywords, the nature of the scientific work and the English language, and the scientific field of economics. Further research can therefore focus on a detailed review of the literature in this area to examine the topic and the significance of DEA methodology in more detail.

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ORGANIC FARMING - NEW TRENDS

CHAPTER 8

Igor Cvečić *

ABSTRACT

Organic farming, that is, ecological food and animal agriculture, is an increasingly significant part of modern agriculture, trade, but also nutrition and daily life - both globally and within the European Union. Given the specific context and conditions of such agriculture, there is a need for a clear and transparent, but also effective legal and financial framework that seeks to facilitate and encourage farmers to give up conventional practices, which sometimes results in lower incomes and more intensive production. Numerous questions are raised - from the motivation and benefits of launching organic farming, to its effects and necessary measures to create a desirable legal and financial framework. Therefore, this chapter seeks to clarify the key terms related to organic farming, to display the specifics of organic farming in the European Union (and the EU position on the global scene), and to determine the legal and financial frameworks that affect European farmers and consumers. The research shows that several EU Member States have been in the process of conversion from conventional into organic farming (primarily Austria and northern members), among which Croatia shows significant progress. The analysis has shown that the European organic food market is being upgraded through adequate legislative and financial frameworks aligned at EU level, but also beyond. Although the EU seeks to help everybody in their 'green transition' engaging its financial and strategic determinants, the more prosperous states lead in high investments directly from national sources. Finally, the research confirms that in certain conditions and environments, organic farming reduces costs and results in higher incomes of workers (compared to conventional farming).

Keywords: *ecological agriculture, organic farming, European union, action plan, regulation*

INTRODUCTION

Organic farming is a management system that improves natural regenerative processes and stabilizes interactions within local agricultural systems (FAO 2009). It covers organic and other cultivation forms that include the use of synthetic intakes. Organic farming aims to encourage the application of practices and organic cultivation methods in agriculture that are useful for the environment, from the point of view of reducing greenhouse gas emissions, adjustments and moderation of climate change, as well as the transition toward and maintenance of organic farming (Gugić, 2023). Organic farming increases the ability to deal with the harmful effects of climate change by increasing resistance within the agroecosystem (Gamage et al., 2023), and is based on the principles of health, ecology, righteousness and precaution (IFOAM 2020). Organic farming seeks to eliminate dependence on

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Cvecic, I. (2025). Organic Farming - New Trends, in book Katunar, J., Vretenar, N., Jardas Antonić, J. (eds), Agriculture Through Sustainability Perspectives, University of Rijeka, Faculty of Economics and Business, Croatia.

chemical substances and, since it is work intensive, it provides employment and development options in rural areas (Selvan et al. 2023).

According to the European Commission (2024), organic farming is the agricultural cultivation method which aims to produce food using natural substances and processes. It has a limited environmental impact because it encourages:

- Responsible use of energy and natural resources
- Maintenance of biodiversity
- Preserving regional environmental states
- Improvement of soil fertility
- maintenance of water quality.

It also stimulates a high level of animal welfare and requires farmers to meet the specific needs of animal behaviour.

The rules of the European Union in organic farming segments cover agricultural products (including aquaculture and yeast), and are designed on the basis of general and specific principles to promote environmental protection, maintenance of biodiversity and evolution of consumer trust. The rules include all stages of the production process (from seeds to final processed food), and there are also special provisions that cover a wide range of products, such as seeds and cuttings rules, processed nutrition products, then, for example, natural cork plugs, essential oils, raw cotton and wool, etc. The basic principles of the Union include prohibitions of genetically modified organisms (GMOs), ionizing radiation and hormones, and limitations for artificial fertilizers, herbicides and pesticides, but also antibiotics (which can be exceptionally used – only when necessary).

In addition to specific production rules, contemporary trends impose the need for clearly set rules in consumption and sales segments and cross-border trade – especially as the flow of agroecological products intensifies on the global market. Given the frequent demanding adjustments of organic farming, in addition to clear rules, crucial are appropriate incentive measures that include various financial support and programs, as well as other forms of help to those who consider quitting conventional in order to switch to organic farming (including information, education, etc.).

The described broader issues indicate multiple opportunities for the research of causes, consequences and the inevitability of a stronger involvement of society, politicians and the scientific community in the context of understanding and shaping a kind of "green" transition within the "green" sector, i.e. organic farming. The research poses numerous questions – from the fundamental question of the definition of organic farming; that is, what encompasses organic farming and how it is different from the conventional, to questions that seek to explain and display the specifics of the "organic" approach in Europe and the motivation of those involved in organic farming, or seek to determine and clarify the benefits of the "organic" approach to farmers, consumers, the whole economy, but also to overall society. Ultimately, one of the key questions is exactly what the European Union and its Member States are doing to create a favourable environment for the "organic" transition and an environmentally friendly future for Europe and the world. The answers to these questions also represent the main sense of this research, especially

for clearer and faster adjustment (above all) of Croatian farmers with a dynamic legal and financial framework that follows the "green transition", but also (Croatian) consumers who (do not) understand the repercussions of organic farming on nutrition, health, well-being and the daily habits.

THE CONTEXT – STATISTICAL OVERVIEW OF ORGANIC FARMING

Compared to 2015, organic sales within the European Union almost doubled in 2020, while the area under ecological cultivation increased by as much as 41%. On average, organic farms in the EU are larger than the conventional ones, and are more often managed by younger farmers. However, in 2020 only about 3.6% of the EU farms were either organic or partially organic (European Commission – Organic farming in the EU: A decade of organic growth 2023).

Organic arable farms save 75 - 100% of the costs of products for plants protection per hectare and 45 - 90% of costs for fertilizers per hectare, compared to conventional farms. However, such farms, on average bring about higher or similar revenue per work unit. Despite lower yields, organic farms usually generate a similar or higher income per worker thanks to higher prices and higher levels of European Union support (mainly from resources of the Common Agricultural Policy - CAP). Finally, organic farming is knowledge intensive and depends less on the intensity of production inputs, which clearly indicates to the crucial importance of research and innovation (European Commission – Organic farming in the EU: A decade of organic growth 2023).

The recent statistics indicate that in 2022, the European Union officially disposed of 16.9 million hectares of agricultural area under organic farming, which made up 10.5% of the overall EU agricultural area (Eurostat - Developments in Organic Farming 2024). Compared to 2021, it is an increase of approximately one million hectares of area, and as many as +78.7% compared to 2012. A significant increase in the share of area under organic farming in the EU is visible precisely by comparing data from the last decade (Figure 1).

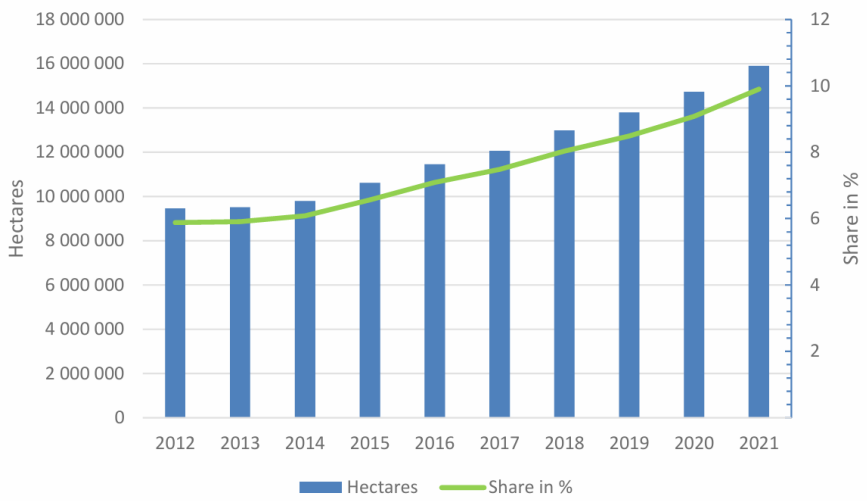

Figure 1 Total Utilised Agricultural Area (TUAA) under organic farming - hectares and percentage shares (of TUAAs) for the EU in the period 2012 - 2021
Notes: The annual evolution review is based on annual statistics of environmental crops (collected using certified environmental bodies).
Source: Taken and modified from the European Commission (2023), p. 5

Until recently, Europe was a leading continent. At the global level, the total area under organic farming in 2022 increased to 96.4 million hectares, with an impressive growth in Australia, which resulted in a share higher than 50% of the overall official organic areas of the world. Europe follows with about 19% of world areas under organic farming (Willer et al. 2024).

The largest EU areas under organic farming are in France (2.9 million hectares; 17% of the share of all organic farming areas in the EU), Spain (2.7 million hectares; 15.8%), Italy (2.3 million hectares; 13.9%) and Germany (1.6 million hectares; 9.7%). In addition to Greece (5.5%) and Portugal (4.5%), they made up 2/3 of the total share of the EU organic areas in 2022. All other Member States, including Croatia, but also Poland, Romania, the Scandinavian members and the Netherlands, make up the remaining 33.6% of the EU organic farming areas (Eurostat - Organic Area 2022, 2024). However, the importance of organic farming for a particular EU Member State is more clear when observing national statistics and the share of areas under organic framing compared to the overall agricultural areas (Figure 2).

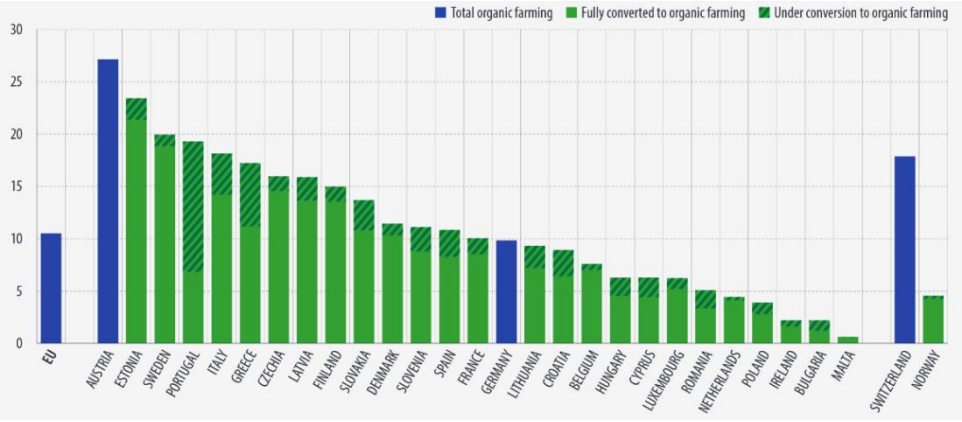

Figure 2 Share of the area under organic farming in the total Utilised Agricultural Area (UAA), by states, 2022
Notes: Estimates for France, Portugal and Slovakia; temporary data for Cyprus; Austrian data relate to the sources of the Federal Ministry of Agriculture, Forestry, Regions and Water Management; data from 2021 for Norway.
Source: Modified from Eurostat, 2024 (Organic area 2022)

The presented data indicates major differences in the importance of organic farming among farmers from individual Member States. More precisely, differences in areas that have been fully converted in comparison to the overall agricultural areas. Furthermore, Figure 2 indicates that some countries, such as Portugal and Greece, are experiencing an intense conversion process toward organic farming. In any case, Austria is clearly the leading Member State in the proportion of areas under organic cultivation, followed by Estonia, Sweden, Portugal, Italy and Greece – all of them significantly being above the EU average. Malta, Bulgaria and Ireland, with a negligible proportion of organic areas (2% or less) achieved much weaker conversions, while the situation is slightly better in Poland, the Netherlands and Romania (4 - 5%). Croatia approached the EU average with about 9% of organic areas, but at the same time it is the Member State which has progressed the most in the 10-year period – between 2012 and 2022 in Croatia, the share of areas under organic farming has quadrupled. In terms of progress, it is followed by Portugal (+278%), Bulgaria (+182%), France (+179%) and Hungary (+145%) (Eurostat - Developments in Organic Farming 2024).

If EU Member States are observed by their structure of organic farming, significant differences can also be detected; which depends on geographical, climate and topographic preconditions, but also on tradition and strategic priorities. While, for example, in Ireland, Czechia and Slovenia, permanent grasslands prevail (80% and more), in Finland (98%) and slightly less in Denmark and Sweden (about 80%) arable land prevail, while permanent crops appear mostly in the Southern Member States – 20 - 40% (Cyprus, Malta, Spain, Portugal, Italy, Bulgaria). In Croatia, most of the area are permanent grasslands (approximately half of the organic areas), while the arable land is just under 40% (Eurostat – Developments in organic farming 2024).

Despite the rapid growth, livestock organic farming in the European Union remains modest in comparison to the overall achievements of the EU organic agriculture. It was estimated that about 6% of livestock herds (2020) and 7.2% of sheep and goat flocks (2019) were organically grown, while the shares for the farming of poultry and pigs (2020) were estimated at 3.6% and 1% respectively (European Commission – Organic farming in the EU: A decade of organic growth 2023).

As for the total number of organic producers in the EU, it is constantly increasing and in 2022 reached the number of 419,112, which is as twice as much compared to 2010. As many as 82,593 manufacturers were registered in Italy, followed by Greece and France with about 58,000 and Spain with 56,024. Germany is slightly lagging behind with 36,688, followed by Austria (26,251), Poland, Portugal, Romania and Croatia (Willer et al., 2024).

Ultimately, the context indicating the importance of organic production indispensably indicates to the importance of the perspectives of organic farming for Croatia, which was the last to join the European Union ten years ago. At that time, Croatia also joined the Common Agricultural Policy, which was a key turning point for Croatia and Croatian farmers. The adjustment of the sector was intensified with new legislative and financial frameworks, placing the foundations for certain incentives for the development of organic farming in Croatia (Figure 3).

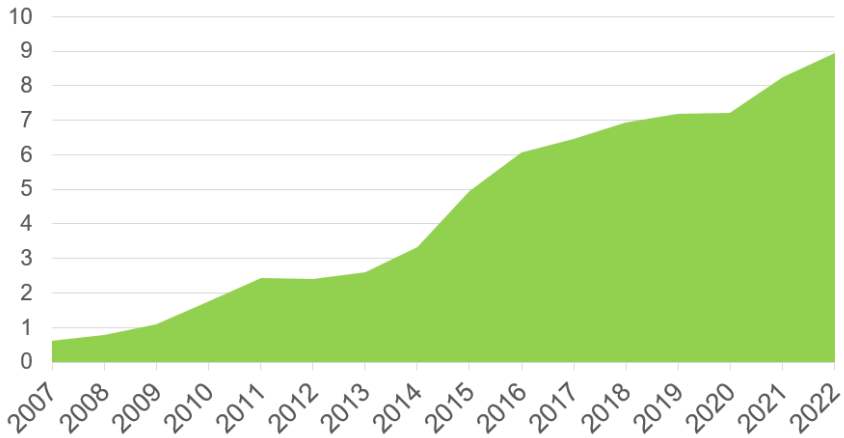

Figure 3 The share of areas under organic production in the total Utilised Agricultural Areas of Croatia (%); 2007 - 2022
Source: Author's work according to the Croatian Bureau of Statistics – DZS (2024)

A representation of the trend of organic farming developments in Croatia (Figure 3) clearly indicates a darting increase in the proportion of the areas under organic farming. The acceleration is particularly expressed just after Croatia's joining the European Union, but it is also interesting to follow a new upswing (or a rebound trend) after 2020. The Croatian Bureau of Statistics (2024) indicates that the number of organic farming entities in the Republic of Croatia increased from 1,789 in 2013 to 6,512 in 2022, an increase of as much as 364%.

THE EU ORGANIC SECTOR SUSTAINABILITY - EFFECTS

The sustainability of organic production in the European Union emanates from environmental, economic and social benefits of such an approach in the agricultural production. For a better understanding of the fundamental effects of the green transition toward organic farming, it is crucial to compare it to the 'conventional agriculture', which is based on traditional and often extensive, commercialized approaches, primarily directed to profits and the minimization of costs.

Successful economic development must find an optimal combination of development and the enabling of environmentally sustainable and economically effective changes in the use of land (Host 2023). Figure 4 compares the structure or distribution of agricultural land in the EU territory according to the forms of exploitation of these areas. Key differences between conventional and organic farming are reflected in the proportion of areas intended for the cultivation of cereals: In the case of organic farming, the share of such areas is 16%, while in the conventional case it is as much as 34%. Twice the share of conventional cultivation is also reflected in industrial plants (oilseeds, fibrous cultures, tobacco, hemp, hops, flax seeds, crops for renewable energy production, etc.). In contrast, in the case of organic farming there is a significantly higher proportion of permanent grasslands (42% vs. 30%), permanent crops (11% vs. 7%), green fodder (17% vs. 12%) and dry pulses (3% vs. 1%).

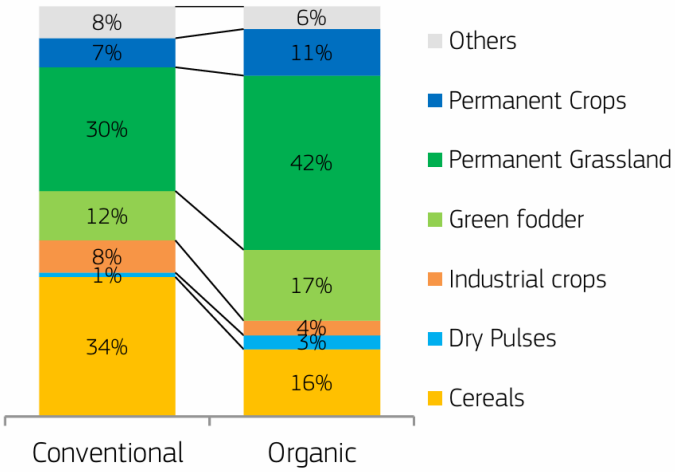

Figure 4 Utilisation of land in conventional and organic agriculture, 2020, according to crops (%)
Source: Modified from the European Commission (2023). Organic Farming in the EU: A Decade of Organic Growth; p. 6

In addition to comparing the proportions relevant to individual cultures, i.e. specific crops in the total area, the difference between conventional and organic farming is also evident in the average size of agricultural holdings. On average in the EU, organic holdings are 2.5 times bigger than the conventional ones: 41 hectares vs. 16 hectares. However, the difference is more pronounced in countries such as Lithuania, Portugal or Slovakia, while in the case of Bulgaria, Czechia, France and Luxembourg, organic farms are 20 - 40% smaller than the conventional (European

Commission - Organic Farming in the EU: A Decade of Organic Growth 2023). The differences in the average size are also reflected in the prevailing cultures that are grown on these holdings, especially in the case of livestock and the production of specialized cereals and oilseeds.

Table 1 summarizes estimated effects on the output and production costs by specific organic sectors, based on an analysis conducted between 2017 and 2020 in selected EU Member States, as part of the European System FADN (*Farm accountancy data network*). The system monitors revenues and business activities of a representative pattern of "commercial" farms in the European Union (about 80,000 farms that depict the cross sections of different type, as well as different regions and economic sizes of agricultural holdings). FADN is the only relevant source of EU microdata based on aligned accounting principles, which at the same time enables easier assessment of the effects of the EU Common Agricultural Policy. The evaluation of the effects summarized in Table 1 is based on the comparison of farms that deal with organic production and conventional farms of a more traditional type.

Plant production	***Income per worker***	***Work per unit of output***	***Costs of fertilizers and pesticides per output unit***
Cereals, oil seeds, protein crops	*significantly higher*	*unclear*	*significantly lower*
Other arable crops	*higher [slightly lower in 3 of 14 Member States]*	*higher*	*significantly lower*
Wine	*unclear*	*unclear*	*lower [slightly higher for fertilizers in 2 of 8 Member States]*
Fruit	*unclear*	*higher [slightly lower in 2 of 8 Member States]*	*unclear [for fertilizers], lower [slightly higher for pesticides in 1 of 8 Member States]*
Livestock production	***Income per worker***	***Work per unit of output***	***Veterinary costs per unit of output***
Milk (cow)	*higher [slightly lower in 4 of 27 Member States]*	*higher [slightly lower in 4 of 27 Member States]*	*lower*
Beef (and a combination of beef and dairy products)	*higher*	*higher [slightly lower in 7 of 26 Member States]*	*unclear*
Sheep and goats	*higher [slightly lower in 1 of 9 Member States]*	*unclear*	*unclear*
Poultry, pigs and other granivores	*unclear*	*unclear*	*lower*

Table 1 Effects of organic production on costs and incomes of selected sectors in relation to conventional farming
Source: Author's work based on European Commission (2023), Organic farming in the EU – A decade of organic growth, January 2023. European Commission, DG Agriculture and Rural Development, Brussels

Organic farming in most of the analyzed sectors and in most Member States brings greater income to workers, especially in the production of organic cereals, oilseeds and protein crops. In the sectors of wine production and fruits, as well as the cultivation of poultry and pigs, the effects of the trend are unclear. The level of work per unit of output is higher than in the conventional farming in the production of milk and beef, as well as fruits and various arable crops (except cereals and oilseeds), while in other observed sectors the effect is unclear. Production costs per output unit (for pesticides and fertilizers) are lower or significantly lower in plant cultivation sectors. In the animal products segment, the effect of veterinary expenses per unit of output is unclear – especially in the sectors of beef, sheep and goats farming, but the costs are lower in the milk production sector, as well as in the production of poultry and pigs.

Basically, organic farming generally brings similar or higher levels of income per worker, and lower costs of inputs and a more intensive production compared to conventional farming. But the economic effect is different depending on the sector as well as the Member State. For example, the incomes of organic farms in the production of wheat and corn (2015 - 2020) in Italy were approximately 15 - 18% lower than with conventional farms, while in Germany that gap was 40-50%. The European Commission estimates that the average income of organic farming is 5 - 30% weaker than in the conventional farming (European Commission – Organic farming in the EU: A decade of organic growth 2023).

In the same period, the costs of organic farming were lower, for example, in Austria, Italy and Poland, compared to conventional farming of arable crops, but in France the situation was significantly different. However, it should be borne in mind that public support for arable organic crops in France is noticeably smaller. In the milk production sector, organic farming had less costs than the conventional production in the Netherlands, France, Latvia and Poland, but in the case of Austria, Germany, Denmark and Sweden the costs have been higher (European Commission – Organic farming in the EU: A decade of organic growth 2023).

Furthermore, the price premiums of organic compared to conventional wheat production in France and Germany were on average 2.5 times higher in the period 2017 - 2019, while in Poland and Italy, premiums were only slightly higher. The premiums in the milk production sector were on average 20 – 40% higher in the observed Member States, but in the case of Latvia and Poland they were even lower than in the conventional production. In the case of organic beef premiums, in the period 2015 - 2020, they were lower by 5 - 30% compared to conventional farming in most of the observed Member States. But, in the case of most EU Member States, the beef production sector significantly depends more on public support, i.e. subsidies (European Commission – Organic farming in the EU: A decade of organic growth 2023).

Organic farming has an indisputable effect on the environment and climate change – to which various indicators such as biodiversity, energy consumption, biological quality and loss of soil nutrients, greenhouse gases and carbon sequestration emissions indicate. For example, the diversity of species in organic farming is higher by a 1/3 compared to conventional farming (Smith et al. 2020; Bengtson et al. 2005).

Although there is numerous evidence of reduced greenhouse gas emissions, the effects vary on the type of production. For example, the production of organic fruits truly results in reduced emission of harmful gases, but in the production of milk and eggs the differences with conventional production were nor clearly proven (Clark and Tilman, 2017).

Given that organic farming does not foresee the use of pesticides, this also means that supervision changes its character, but there are still appropriate methods of pest protection – e.g. thermal processing, rotation of crops, protection of natural enemies of individual pests, and similar. However, the Regulation EU 2018/848 also allows exceptions in situations where a limited use of individual substances is still necessary. Similarly, in the case of animal diseases, the Regulation prescribes strict veterinary rules for the use of antibiotics, if necessary. Ultimately, in the case of energy consumption it genuinely decreases when applying organic growing methods, but not in all sectors. In fact, Clark and Tilman (2017) determine that within the production of fruit and meat energy, the energy consumption remains at a similar level compared to conventional methods, while in the production of vegetables, the energy consumption is even higher in organic farming.

Organic farming also affects the social aspect. First of all, this is evident if the engagement of the younger population and women regarding organic farming is observed. At the EU level, about 21% of organic farms had an administrator under the age of 40 in 2020, while this share was only 12% on conventional farms. Despite the lower share of women managing organic farms at the EU level (which is not the case for individual Member States – more precisely, for Germany, France, Ireland, Denmark, Czechia, Finland, Austria and Bulgaria), a gap between the farms led by women and men was smaller in organic farming (-29%) than in the conventional one (-43%) for most EU Member States in 2019 (European Commission – Organic farming in the EU: A decade of organic growth 2023).

The comparative assessment of conventional and organic farming on the example of specific effects indicates their fundamental differences, or repercussions, clearly showing that in most of the analyzed elements, the sustainability and advantages are on the side of the organic concept of production. However, the level of support for green and sustainable transition in the Member States should also be taken into account. Therefore, a summary of the importance of financial support for organic farming follows.

In 2020, 61.6% of areas under organic farming in the EU received specific payments of organic supports (an average of € 144 per hectare of CAP support and € 79 per hectare of national co-financing). Figure 5 shows the dynamics of the growth of the areas covered by organic farming in the EU, which received the support of the Common Agricultural Policy from 2015 to 2022. An increase in 5.2 million hectares to 12.1 million hectares was realized, an increase of 231%.

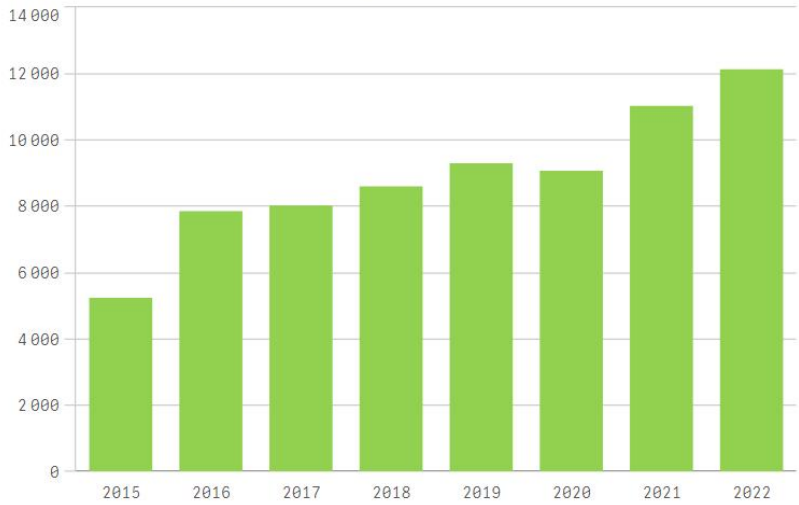

Figure 5 Areas under organic farming receiving the support of the Common Agricultural Policy (1000 ha); 2015 - 2022
Source: Organic Production (2020) European Commission – DG AGRI: Agridata System

Austria leads by organic production in the EU thanks to a significant proportion of organic grassland, milk production and livestock farming, which is supported by high domestic demand. Specifically, the annual consumption per capita of € 274 on organic food is one of the highest in the world. In the context of financial support, EU support is on average 119 euros per hectare, but is topped up by 115 euros per hectare of national co-financing (European Commission – Organic farming in the EU: A decade of organic growth 2023). Figure 6 shows the share of Utilised Agricultural Areas that receive support for organic farming related to individual EU Member States.

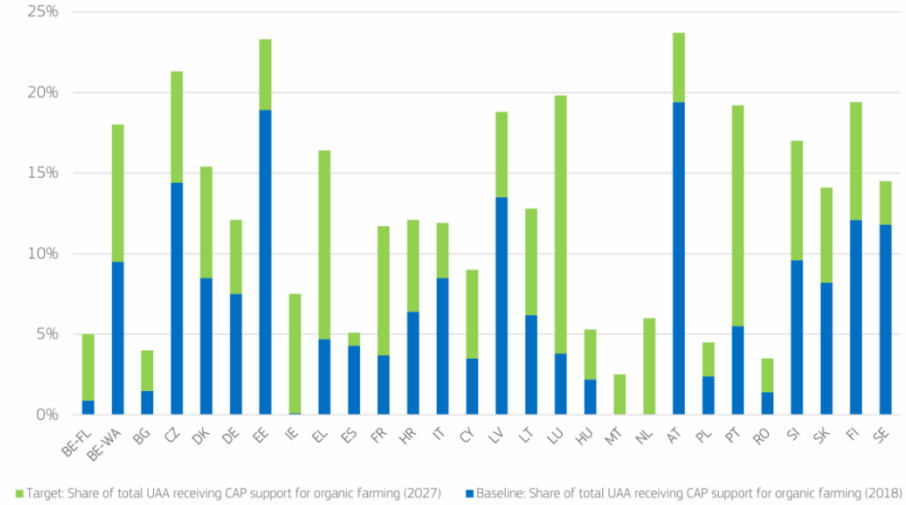

Figure 6 The share of total UAAs receiving CAP support for organic farming
Source: Modified from the European Commission (2023). Organic Farming in the EU: A Decade of Organic Growth; p. 26

Data regarding the level of utilisation of the supports of the Common Agricultural Policy for organic farming makes it clear that there are significant differences between EU Member States. Differences in the support relate somewhat to performance statistics in the organic farming sector, but Figure 6 also shows plans for the support in 2027. Significant are the ambitious plans of countries such as Portugal, Luxembourg, Ireland, Greece, the Netherlands, as well as Belgian Wallonia. On the other hand, it is a matter of concern that there is an obvious inertia or inability to improve the level of financing in the case of Bulgaria, Romania, Poland, but also of Belgian Flanders or Spain, where current modest amounts are not planned to be changed significantly.

SUPERVISION AND IMPLEMENTATION; CONSUMPTION AND TRADE

In order for farmers to realize the benefits of using organic farming methods, consumers must also believe that the rules of organic food production are followed. Therefore, with its rules, policies and measures, the European Union seeks to maintain a strict system of supervision and implementation to guarantee that the rules and regulations on organic farming are properly followed. The basic determinants of the supervision system are contained in the Regulation EU 2018/848.

Each EU Member State appoints competent and supervisory authorities to monitor the operators in the organic food chain. Usually, a ministry (e.g. for agriculture or for healthcare) is competent, while manufacturers, distributors and traders of organic products must be registered in their local supervisory authority or institution (which is a delegated competent authority) before allowing them to market their own food as organic. The relevant supervisory body (e.g. the Ministry) is responsible for the functioning of the entire inspection system, although certain functions may be delegated.

After the organic products are examined and verified, they are awarded with a certificate that confirms that those products fill out organic farming standards. The harmonized certificate form facilitates supervision, and usually contains a mandatory and non-mandatory part. Compulsory data relate to: A unique number of the certificate, the entity to which the certificate is issued, and a possible list of members of the subject group, data on supervisory authorities and competent institutions, the activities of the entities under certification (production, preparation, distribution, storage, import/export), product information and information on the certificate validity periods (Indications on how to fill in the model of certificate for organic production 2018).

The system operates because of the appropriate exchange of information at the European level. The key instrument is the Organic Farming Information System (OFIS), which includes relevant data for organic production in the EU and facilitates networking. OFIS contains information on the authorization of ingredients, competent and supervisory authorities/institutions in the EU (plus four EFTA countries) and supervisory authorities authorized to assess the equivalence (relevant for the trade with third countries – outside the EU) (OFIS 2024). All operators are assessed at least once a year to ensure the continuation of the

following of established rules. Certainly, the imported organic food from countries which are not EU Member States is also subject to supervision.

The wider context of the supervision system is associated with other sources of information, primarily by the IMSOC (Information Management System for Official Controls), which is relevant to ensure the respect of the rules of the agricultural food chain. IMSOC integrates four existing information systems operated by the European Commission (the Rapid Alert System for Food and Feed – RASFF; the Animal disease information system – ADIS; the European Union Notification System for Plant Health Interceptions – EUROPHYT; the TRACES system of supervision of trade and export) (EUR-Lex 2020).

Regarding the awareness on organic production, 61% of Europeans were familiar with the Organic Production Logo (Special Eurobarometer 520, 2022), an increase of 5 percentage points compared to 2020 and as much as 34 percentage points compared to 2017. In a broader sense, from the consumer point of view, the advantages of "sustainable" food feature the following characteristics: Nutrient and healthy; Better quality and taste; Little or no use of synthetic pesticides; Accessibility and availability, Limited effect on the environment and climate; High standards of animal welfare; Minimal packaging (completely without or a little plastics); Fair salaries; Minimally processed and traditional food; etc. However, as many as 92% of respondents agree that eco-friendly products are more expensive than other foods (Special Eurobarometer 520, 2022).

The European Union is second in the world in organic food consumption (37%; 46.7 billion euros in 2021), while the USA occupies the largest share of the global market (39%; 48.6 billion euros in 2021). China is third but with a significantly smaller share (Global organic area grows more than ever before 2024). EU Member States with the highest level of retail sales of organic products are: Germany, France, Italy, Sweden, Spain, Austria and Denmark (Willer et al., 2024).

Furthermore, as many as six EU Member States are among the ten leading countries in the world with the largest amount of consumed organic food per capita: (2nd) Denmark (365 EUR), (3rd) Austria (274 EUR), (4th) Luxembourg (259 EUR), (5th) Sweden (248 EUR), (6th) Germany (181 EUR) and (7th) France (176 EUR). However, in Bulgaria, Hungary, Portugal and Romania the share of retail food value related to the sale of organic products is close to the value of zero (Willer et al. 2024).

The import of organic products in the EU increased from 2.71 million tons in 2018 to 2.87 million tons in 2021; an increase of 6%. Organic products from more than 120 countries are imported to the EU. The import of organic products can be achieved on the basis of equivalence recognition and equivalence agreements or through recognized supervisory authorities. There are currently 14 recognition and equivalence agreements in force, with the following countries: Argentina, Australia, Canada, Chile, Costa Rica, India, Israel, Japan, Tunisia, the Republic of Korea, New Zealand, Switzerland, the United Kingdom and the United States of America. For other countries and for products, the EU has established a series of supervisory authorities and operators in charge of certification of those who want to export their organic products to the EU, based on the recognition of equivalence (European

Commission – Organic farming in the EU: A decade of organic growth 2023).

Figure 7 shows data on imports of organic products from partner countries from 2018 to 2021. The key partners for imports in the observed period were Ecuador, the Dominican Republic, Ukraine, China, India and Peru. The key import products were organically produced tropical fruit – primarily bananas, as well as oil cakes and soybeans, and than sugar and coffee. However, it should be borne in mind that the global market of organic agricultural products is rapidly changing, so the trend of imports of the European Union from third countries in 2022 slowed by 5.1% compared to 2021. But, imports to the United States increased by as much as 18.8%. Moreover, the number of organic producers in Asia (primarily India) increased by more than 300% in the previous decade, and they represent now more than 60% of the total number of organic farmers at the world level. Simultaneously, Australia rearranged a huge proportion of their agricultural land, taking over the primacy in the areas under organic farming (Willer et al., 2024).

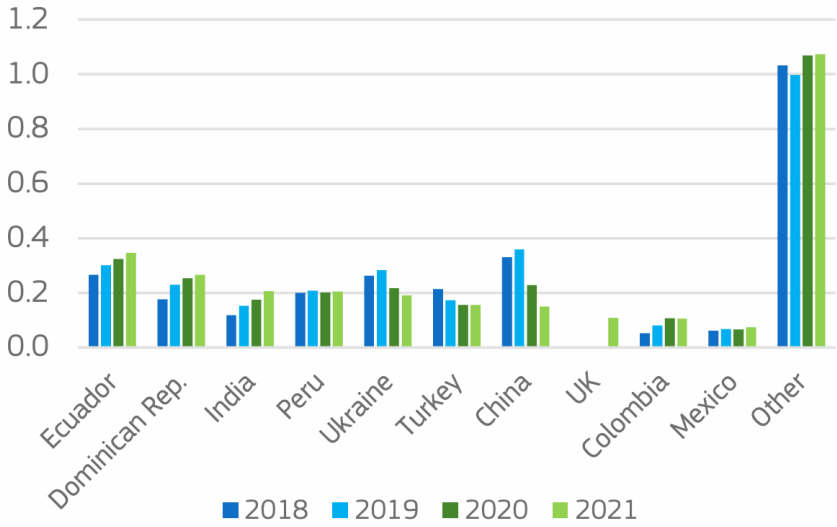

Figure 7 Import of organic products to the EU according to origin countries (millions of tons)
Source: Modified from to the European Commission (2023). Organic farming in the EU: A decade of organic growth; p. 23

The most significant imports of organic agricultural products in 2021 and 2022 was recorded by the following EU members: The Netherlands, Germany, France, Belgium, Italy and Sweden. The total EU import in 2022 was 2.7 million metric tons and only 0.7 million metric tons of exports. These numbers place the Union in the leading position in global imports, in front of the USA (with 2.2 million metric tons), and on the second place of exports, behind Latin America (with as much as 2.8 million metric tons). An interesting figure is represented by the authorized exporters and importers of organic agricultural products in 2022: Here Europe leads with 57% of the exporters and 90% of importers (Willer et al. 2024). The statistics clearly indicate the importance of international trade for the EU organic agricultural sector.

THE FUTURE OF ORGANIC PRODUCTION AND THE MODERNIZED EU LEGISLATION

By the end of 2022, 96.4 million hectares in the world were under ecological cultivation (2% of total agricultural land), which represented an increase of 26.6% (+20.3 million hectares) compared to 2021. A strong increase in the share indicates an increasingly important role of organic farming in the world, which is a continuation of the trend. By 2023, as many as 75 world countries introduced regulations on organic farming (Global organic area grows more than ever before 2024). This area is becoming increasingly complex in nature due to the growing volume of relevant regulations and new social, economic and environmental trends.

The new organic legislation has been implemented in the EU since January 2022 (Regulation EU 2018/848), which is further elaborated by an Action plan for organic production. The demanding preparations and designing of suitable rules in the form of counselling began in 2012, more recently relying on the European Green Plan and principles of the New Common Agricultural Policy. Which, in the period until 2030, seeks to encourage a large range of transition to organic farming in the EU. More than a third of the CAP budget is scheduled for agro-ecological and climate measures, although practice shows that in some EU members there is a lack of ambition in the specific implementation of this transition, especially if farmers do not recognize its advantages (Willer et al. 2024).

The 2018 Basic Regulation is supplemented by a number of delegated (21) and implementing (11) acts, as well as the new regulation on organic pet food labelling (Regulation EU 2023/2419). In 2023, the implementing regulations 2021/1165 (on the authorization of certain products and substances for organic production) and 2021/2325 (on the list of third countries and supervisory bodies and authorities in charge of importing organic products in the Union) have passed regular audit and modification. The adaptations of the rules were implemented in the certificate model (established by the basic Regulation) in order to align the system with technological progress, allowing the supervisory bodies and authorities within the Union to issue a digital signature system within the TRACES system (Willer et al. 2024). Also relevant, the negotiations of most existing equivalence agreements with third countries are underway, which could extend to 2026. Specifically, the authorized equivalence supervisory authorities will have to start the recognition of alignment according to the new EU regulation by 2025, which means that starting from then, third countries will implement new EU rules when exporting their organic products to the Union.

In addition to the growing legislative and strategic framework (*From farm to fork*, the Regulation on organic products footprint, climate regulation, supervision and soil resistance, new genomic techniques, sustainable use of pesticides…), key activities related to the future of organic farming are especially related to various research and innovation in organic farming, which is significantly supported by the Horizon Europe programme. In the period 2021 – 2027, 95.5 million euros are scheduled for the entire program; within which cluster 6 (*Food, Bio-economy, Natural Resources, Agriculture and Environment*) provides € 8.95 million to mitigate environmental degradation, stopping and reversal of the decline in biodiversity on

land, inland waters and the sea, as well as to the better management of natural resources (Willer et al., 2024).

Within the Horizon frameworks, the Core Organic Pleiades Network was founded, which brings together about forty partners from 28 European countries/regions with the aim of joint financing of cross-border projects of research and development in the field of organic farming (About CORE Organic Pleiades 2024). This is just one example of numerous projects and initiatives at the European level, not only as part of the Horizon but also other European instruments – from associations, laboratories and research bases, to scientific meetings and thematic conferences. Furthermore, the European Innovation Partnership for Agricultural Productivity and Sustainability (EIP-AGRI) includes a focus group on organic farming – *Optimizing arable yields*. While the European Institute of Innovation and Technology (EIT) has a working group called "EIT-Food", which focuses on entrepreneurship and innovation in the food sector. All this indicates a wide variety of interests and opportunities for the development of organic farming and innovation in the sector.

It is crucial for the whole Union to think strategically about the future and sustainability of agriculture and especially the organic concept of future development. Therefore, the European Commission launched an Action plan for organic farming in the European Union in March 2021, as a support for the new Regulation. The plan intends to achieve the European Green Deal goal of 25% of agricultural land under organic farming by 2030. The plan consists of 23 measures divided into three axes (COM (2021) 141 final, Organic action plan 2024):

(1) Encouraging demand and ensuring consumer confidence
(2) Encouraging the transition to organic farming and strengthening of the entire value chain
(3) Organic farming as an example – improvement of its contribution to sustainability.

Table 2 brings a summary overview of the Action plan measures, including examples within the individually defined measures, paired with appropriate axes that represent the EU's priorities. The Action plan is aligned with the principles of the European Green Deal and two key strategies of the Union – the *Farm to fork* strategy and the Biodiversity strategy.

Axis	**Actions**
1. Encouraging the demand and ensuring consumer confidence	(1) and (2) Promotion of organic farming and the EU logo *(1 – information; 2 – promotion)* (3) Promoting organic canteens and increased use of green public procurements *(e.g. BestREMAP)* (4) Reinforcing organic schemes in schools (5) Preventing food frauds and strengthening consumer confidence *(e.g. development of an early warning AI system for data mining within EU databases)* (6) and (7) Improving traceability *(e.g. 6 – a certificate database and the digitalized inspection system through TRACES; 7 – innovative solutions for monitoring organic food*

	through blockchain, etc.) 8) Private sector contribution *(in terms of supporting and increasing distribution and sale of organic products through cooperation with dealers, suppliers, restaurants, etc.)*
2. Encouraging the transition to the organic production and strengthening of the entire value chain	(9) Encouraging conversion, investment and exchange of best practices (10) and (11) Development of sectoral analysis to increase market transparency *(10 – reporting; 11 – market observation)* (12) and (13) Supporting the organisation of the food chain *(12 – e.g. establishing special organizations of organic producers; 13 – 'group certification' as a support for small farmers)* (14) and (15) Reinforcing local and small-volume processing and fostering short trade circuit *(14 – e.g. development and implementation of 'Bio districts'; 15 – gender equality and youth employment in rural areas)* (16) Improving animal nutrition in accordance with organic rules *(e.g. the 'algae initiative'; avoiding GM microorganisms…)* (17) Reinforcing organic aquaculture
3. Organic farming as an example	(18) Reduction of the climate and environment footprint (19) Enhanced genetic biodiversity and increased yields (20) Alternatives to contentious inputs and other plant protection products (21) Increasing the animal welfare (22) and (23) Efficient use of resources *(22 – plastics; 23 – water, renewable energy, clean transport)*

Table 2 Summary of the Action Plan for the Development of Organic Production in the EU

Source: Modified according to the „Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on an Action Plan for the Development of Organic Production [COM(2021) 141 final]"

The Action Plan brings clarification of all of these measures, but also specifies specific activities and the obligations of the European Commission in the coming period (e.g. stimulating the use of EU organic farming logo, green public procurement, consumer confidence measures and fraud prevention, sector analysis and strengthening of transparency, more efficient use of resources…). It also explains the benefits of all this and ends with the conclusion that increased organic production is crucial for the transition to a sustainable agricultural sector that provides farmers to "*equitable income*" and contributes to the dynamic European rural areas (COM(2021) 141 final).

CONCLUSION

The European Union sets a whole range of rules and regulations that regulate the production, distribution and sale of organic products on the Internal Market, and there are special regulations that apply to specific products. The new EU legislation

related to the organic sector is applied since January 1, 2022, and some of the important changes relate to: Strengthening the system of surveillance of ecological products, new rules for manufacturers that will make it easier for smaller farmers to transition to organic farming, new rules for imported organic products and a larger selection of products that can be placed as organic ("*ecological*"). Such adjustments and changes are imposed in the context of current economic, social and environmental trends, where the European Union has imposed itself as one of the leaders of the so-called "green" transition, which also affects the agriculture sector. The research showed that an entire series of Member States led trends with strong conversions, that is, conventional agriculture switching to organic (primarily in Austria, Denmark, Estonia, Sweden…), with a significant progress of Croatia, which practically quadruped its areas of organic cultivation and significantly increased the number of officially certified producers during the EU membership period. The analysis has also shown that the European organic food market is covered with appropriate legislative and financial frameworks, aligned at the EU level, but also beyond, given that the imported eco-friendly products from third (partner) countries must also meet strict European standards and procedures in order to reached the increasingly demanding European market. In this way, not only European consumers but also competitive farmers in the EU are protected, but there are still significant differences between the EU Member States in the distribution of organic farming and the volume of public financial support. Although the Union strives to assist everyone with its financial instruments and strategic determinants in the transition process toward organic production, more advanced countries such as Austria, Sweden or Finland, however, lead the process with high investments directly from national sources of financing. This is also the result of the awareness of the entire public and primarily the consumer requirements in these countries. Likewise, as one of the priorities of the Union, the need for a broader education and exchange of information and good practice has emerged, especially to reduce the gap between the "rich" and "poorer" members, in which the organic farming is just starting to be affirmed. The research also confirmed that organic farming in comparison to conventional agriculture results in certain benefits. Thus, the impact of costs (e.g. pesticides and fertilizers, or veterinary needs within livestock production) is reduced, and organic farms are often more intense than conventional, but despite lower yields, organic farming results in similar or higher incomes of workers (per capita). Primarily, thanks to higher prices and higher levels of subsidization in relation to conventional agriculture.

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CIRCULAR ECONOMY IN AGRICULTURE

CHAPTER 9

Hrvoje Katunar *

ABSTRACT

The circular economy is an economic model that aims to avoid waste and to continuously reuse resources. Compared to the traditional linear economic model, the circular economy model aims to minimize the use of resources, reduce waste and promote the regeneration of natural resources needed for production. The key goal of the circular economy model is to create a sustainable and resilient agricultural economy that benefits society and the environment. Traditional family farming in the Mediterranean region is a pioneer in circular economy and an exemplar of the concept of reuse and recycling. Transforming linear, resource-intensive agriculture into a circular, sustainable and resilient production model brings many benefits to the society and the environment and involves a shift from the traditional "take-use-throw" model to one that emphasizes waste reduction, reuse, recycling and resource recovery. The EU and developed societies promote circular and sustainable practices in agriculture with the aim of protecting and improving the environment by ensuring quality nutrition for the population, preserving the climate, reducing the impact of climate change on society, increasing the robustness and resilience of agricultural production and reducing dependence on external suppliers of raw materials and inputs. The necessary capital investment, at the beginning of the implementation of the concept, and the lack of knowledge of farmers reduce the intensity of the transition to circular and sustainable concepts. Viticulture and winemaking as well as olive growing and livestock farming in the Mediterranean are "returning to their roots", albeit at a new, more sophisticated technological level.

Keywords: *winemaking and viticulture, circular economy, Mediterranean agricultural crops, circularity in agriculture, resource loops*

INTRODUCTION

The projected population growth, the expected increase in resource consumption, especially of water, energy, food and raw materials, global climate change, environmental degradation and the rising demand for food are increasing the pressure on farmers and legislators who see the circular economy as a promising strategy to promote sustainable, restorative and regenerative agriculture. EU Member States and central regulatory and financial support agencies have

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committed to lead the way in implementing sustainable development agendas. These include formulating climate policies, strategies and action plans and modelling greenhouse gas emissions with the aim of slowing down negative climate change, supporting the decarbonization of electricity systems and creating regulatory frameworks suitable for renewable energy, transitioning to a climate-neutral economy, improving the quality of life for rural residents and ensuring the economic stability of rural areas, and transitioning to a circular economy with reduced waste production and environmental impact.

In the 2030 Agenda, the EU and the United Nations have defined 17 goals for a sustainable society, including the eradication of poverty and hunger, affordable and clean energy, sustainable cities and communities, responsible consumption and production, and the protection of the climate, oceans and soils (*EC, The 2030 Agenda for Sustainable Development*).

Studies show that global agricultural production must be increased by 70% to meet food demand by 2050. (Velasco-Muñoz et al. 2021; FAO 2009). There are two possible ways to achieve this goal in a typical economic scenario:

(i) the expansion of arable land, which accounted for around 37% of the total available area in 2017 (FAOSTAT, 2020), or
(ii) the expansion of production on currently cultivated land, which can lead to an increase in cultivated land of up to 38%, with water consumption increasing by 53 worldwide (Alexander et al. 2015; Aznar-Sánchez et al. 2020; Velasco-Muñoz et al. 2018).

While increasing agricultural production has maintained the balance between production and conservation, it therefore represents a key challenge for the long-term sustainable management of natural resources (Geissdoerfer et al. 2017; Rufí-Salís and Associates 2020; Vanhamäki et al. 2020). In addition, it must be taken into account that land must be used for other activities and for housing (Host 2023), which is why it is not realistic for agricultural land to increase to the extent required, but sustainable technological solutions must be found that allow production to be increased without significantly affecting biodiversity and achieve production efficiency.

In that context, the circular economy is a promising strategy for saving relevant and scarce resources and reducing the negative environmental impact of agricultural activities while improving economic performance (Kuisma and Kahiluoto 2017; Stegmann et al. 2020). The circular economy in agriculture is primarily about maximizing the use of currently available and produced agricultural inputs, e.g. natural fertilizers, and by using the shortest possible supply chains instead of the inputs to be produced. In the context of environmental protection, circular economy in agriculture also means the use of more sustainable practices for carrying out agricultural activities and mechanical versus chemical tillage. Sustainable practices also include the use of animals and insects in soil management and plant pollination, further promoting biodiversity in the environment. Fundamentally, the conceptual model of the circular economy is based on the idea of using resources in a way that

minimizes waste, optimizes resource use and keeps materials in the economic cycle for as long as possible. It differs fundamentally from the linear model of "take – produce – throw away" as it strives for a more sustainable approach through recycling, reuse, repair and regeneration.

The most important components of the circular economy include:

1. Product design for longevity – products are designed to last longer, be more durable and easier to repair and reuse. This also means avoiding harmful materials and making them easier to break down for recycling;
2. Resource optimization – using resources in a way that reduces the need for raw materials. This includes increasing efficiency, using renewable energy sources and reducing resource consumption;
3. Recycling and reuse – materials that have already been used are processed and fed back into the production process, reducing the need for new raw materials;
4. Maintenance and repair – products are designed to be easy to repair, which extends their lifespan and reduces waste;
5. Closed loops – the aim is to create "closed loops" in which the waste from one process becomes raw materials for another, reducing the need for new resources and the negative impact on the environment. With this model, the economy focuses on sustainability, waste reduction, resource conservation and efficiency gains, achieving long-term economic, social and environmental benefits. (Circular Economy Council, 2024)

The following is a schematic of a circular economy model that aims to reduce the use of virgin resources and maximise the use and reuse of existing resources.

Figure 1 Circular economy model
Source: Andabaka A.

The reduction or elimination of waste and the reduction of energy consumption or the use of energy generated locally and from renewable sources form the basis of *re-use*, *re-cycle* and *re-generate* model of agricultural production. Through the cooperation of all stakeholders, including local, regional and national legislators and the EU, research centres, NGOs and private producers in all organisational forms, it is possible to develop robust and sustainable agriculture and food production (FAOUN 2022).

The aim of this chapter is to examine the current implementation and application of the circular economy model in Mediterranean agriculture, the benefits and limitations of the circular model and the challenges farmers face in implementing the model. It also proposes a basic conceptual model of circular economy in Mediterranean crop agriculture.

CONCEPTS OF CIRCULAR ECONOMY APPLICATION IN MEDITERRANEAN AGRICULTURE

The basic concepts of applying the circular economy to the cultivation of Mediterranean crops are a continuation of the historical concept of Mediterranean agriculture, in which a family farm usually cultivates the available land and breeds and cultivates vegetables, vines, olive trees, sheep, goats or, more rarely, cows, depending on the soil category and available area. Historically, bees have also been kept on the family farm. The livestock is mostly grazed extensively, on Mediterranean pastures in summer and in stables during shorter winter periods. Meat and milk are used for food and cheese production, the manure is used to regenerate and enrich the soil on which vegetables, cereals, wine and olives are grown. Wool and leather are used to make clothing. Goats and sheep are released into the vineyards and olive groves in a controlled manner to control soil overgrowth. Bees live in open pastures, in the zones of vineyards, olive groves or pastures. In addition to producing honey, they help pollinate the plants, and when the crops are in bloom, the beehives are deliberately moved closer to the crops. The grapes from the vineyards are used to make wine, the pomace is first used to make brandy and then, like the pomace from the olive groves, to aerate and fertilize the soil. The fruit from the olive groves is used to produce oil. The remains of pruning from the vineyards and olive groves are used to feed livestock in winter and for heating or cooking and distilling spirits. Vegetables and cereals are used as fodder for humans and livestock.
The following is a historical diagram of the functioning of a Mediterranean farm, illustrating the interdependence of the crops with which the farm is involved, the robustness of such a farm and the dispersion of the risk of producing a "factory under the sky".

A diagram of the traditional circular economy in a typical Mediterranean farm is shown below (Diagram 2).

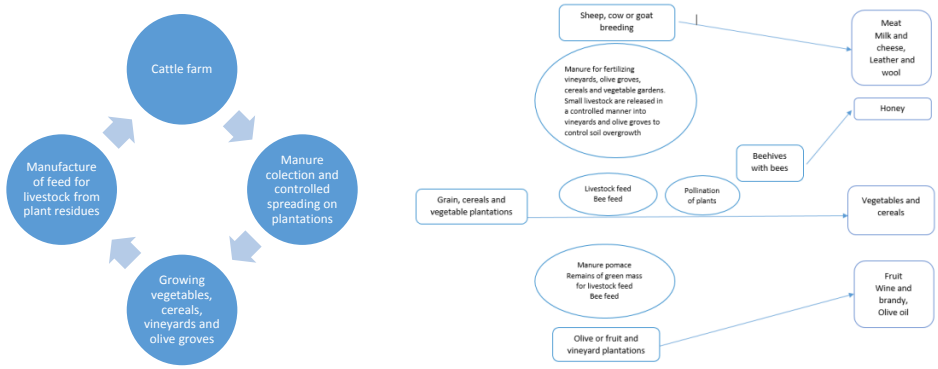

Figure 2 Traditional circular agriculture
Source: Author

The historical concept of agricultural production in the Mediterranean was largely abandoned in the second half of the 20th century with the development of tools, artificial fertilizers, plantation protection products (spraying and chemical protection of plantations), and the development of industrial monoculture production based on a linear model (known as *take-make-dispose*) of agricultural production that ultimately led to unsustainable overuse of resources and environmental degradation (Esposito et al. 2020).
Over the last twenty years, the FAOUN (Food and Agriculture Organization of the United Nations) as well as the European Food Safety Authority (EFSA) and the European Commission through the Directorate-General for Agriculture and Rural Development (DG AGRI) have promoted the model shift and adapted the legal framework and financial incentives to the development of a sustainable circular model of agricultural production in order to preserve and improve biodiversity as well as soil and food quality. In 2019, the European Commission presented the European Green Deal as a fundamental strategic document that directs all future European policies towards sustainable food production while protecting biodiversity and achieving climate neutrality by 2050 at the continent-wide level. The European Green Deal provides a roadmap of actions to increase resource efficiency through the transition to a clean, circular economy and to mitigate climate change, biodiversity loss and pollution. It outlines the investments required and the financing instruments available and explains how to ensure a just and inclusive transition (*EC document 52019DC0640*). The European Green Deal is a broader strategy to achieve climate neutrality by 2050 and implements its objectives through the Common Agricultural Policy, which is an important instrument for managing agricultural production and rural development.

The historical concept of an economy closing the entire production loop and being almost completely self-sufficient is probably impossible to realize while ensuring that a typical economy is economically efficient and that production levels of food, meat, wine and oil are available to the market in quantity and at affordable prices, given the absence of even minimal commercial economies of scale in the production of each element in the economy's production spectrum. Today's approaches involve

a series of locally networked players that complement each other, and each of them achieves a level of efficiency in one or more products that also enables economically sustainable production. The Green Deal and sustainability plans do not assume a single farm managing livestock, bees, cereal production and viticulture, but expect and financially encourage multiple farms to work together, acting as a production ring in a given location, producing one or more agricultural products commercially and supplementing their production with output and income from additional and complementary activities such as energy production or tourism.

The complementarity of several producers who make up the production ecosystem and who, by working together, achieve sustainable circular production, is the aim of the process of developing sustainable European agriculture. It should be emphasized that the production results also include energy obtained from agricultural production residues, e.g. the production of electricity from biogas or the production of thermal energy from wood chips or the production of electricity using a system of solar panels installed on pillar structures in vineyards and vegetable gardens, as well as agrosolar and solar panels on the facilities of agricultural producers in barns, machine parks and garages. In modern circular agriculture, it is expected that a number of producers, forming a robust production ring, complementing each other while paying attention to environmental sustainability and biodiversity conservation, will form a stable pillar of local food production. Each of them will specialize in a specific segment and seek their input in the waste of the other producers in the chain. In this way, the recovery rate and the recycling and reuse segment of the circular economy will be increased.

Diagram 3 shows the modern circular economy in the following figure.

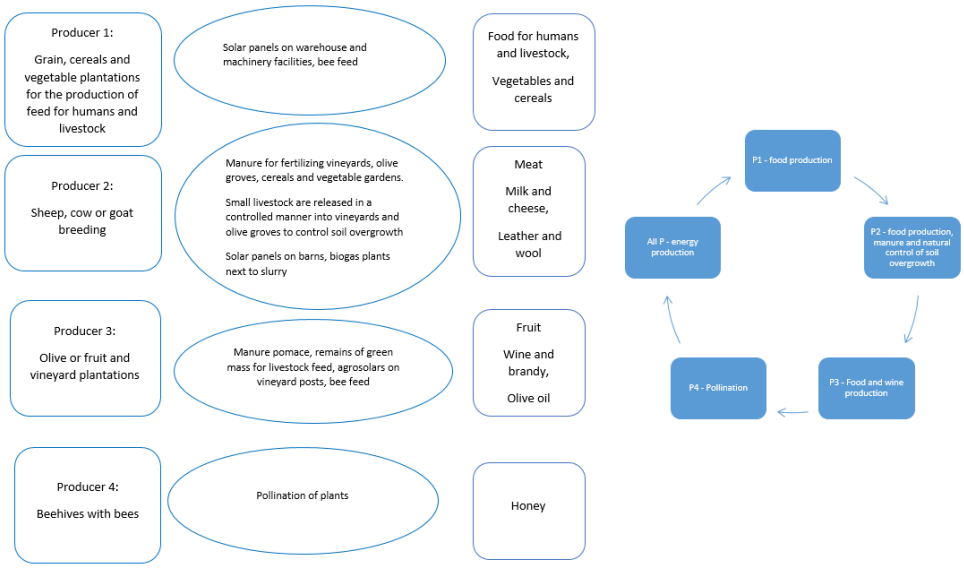

Figure 3 Modern circular agriculture
Source: Author

Green deals and sustainable strategies aim to ensure that all producers in a given area are networked in the future and work together to ensure robust and sustainable food and energy production. The supply chains for the population are short and ensure that the population is fed with healthy and locally produced food in a system in which the producers are specialized and economically efficient, avoid the use of pesticides and are careful with soil resources and water consumption. The plantations are adapted to modern cultivation, but also to the control of soil overgrowth by small livestock (high stem plantations), and the infrastructure for irrigation and soil nutrition is installed.

In line with technological development and available technological innovations, the producers use the available precise agrotechnical methods, such as soil moisture sensors for the application of targeted and efficient irrigation, meteorological stations with an algorithm for monitoring the possible development of diseases and the monitoring of the plantations with drones with sensors to check the condition of the leaves and fruit and the occurrence of pests in order to minimize the use of protective cemichal agents.
The products produced are competitive on the market in terms of both volume and price and are distributed to consumers in a wider area via trading systems. Examples of sustainable agriculture and networked production chains can also be seen in the photos below.

Figure 4 Control of soil overgrowth in the vineyard with small livestock
Source: https://chatelaine.com/food/drinks/natural-wine-canada-faq/, https://xforest.hu/okologiai-gazdalkodas/

Figure 5 Control of soil moisture and targeted irrigation and fertilization of soil, energy production by agrosolars
Source: https://swarajyamag.com/science/young-chennai-startup-develops-cutting-edge-radar-imaging-technology-tailored-to-indias-needs, https://www.rivulis.com/drip-irrigation/, https://www.airclim.org/acidnews/agri-pv-useful-synergy-between-agriculture-and-solar-energy

The implementation of a sustainable circular economy in agriculture is possible, it has many advantages, both ecologically and economically, but it also has a number of limitations that need to be overcome in the transition from linear to circular economy. The concept of circular economy in Mediterranean agriculture can be presented in different ways. There are different designs of conceptual models of the circular economy that illustrate the main processes and interactions within the circular economy system.

Some of the best known models are:
1. butterfly diagram (*Ellen MacArthur Foundation 2015*) This diagram shows the circular economy through two main loops:
- Biological loop – focuses on materials that can be returned to nature through processes such as composting and regeneration. These materials are reintegrated into the biosphere.
- Technical cycle – refers to products and materials that can be reused, repaired, remodeled or recycled. The aim is to keep products in use for as long as possible through processes such as maintenance and refurbishment;
2. Material flow diagram (Eurostat 2024). This model shows the flow of materials through the stages of production, use and recycling. It aims to highlight the role that materials play in each step, including:
- Material sources
- Production and distribution

- Use and maintenance
- Collection and recycling;

3. Resource wheel – It shows how resources, energy and materials enter the system, go through different stages of treatment, use and regeneration, and how waste is managed. It also emphasizes the importance of reuse and regenerative practices;
4. circular economy model – emphasizes five key steps: Design, production, distribution, consumption and return (Knighton B. 2023). The model shows how resources constantly circulate within the system instead of ending up as waste. These blueprints help to better understand the principles of the circular economy and are often used as a reference for planning sustainable practices in different industries. This is discussed in more detail in the following chapters.

REASONS AND CHALLENGES FOR THE APPLICATION OF THE CIRCULAR ECONOMY IN THE CULTIVATION OF MEDITERRANEAN CROPS

In the cultivation of Mediterranean crops, especially vines and olives, climate change and the associated risks have become one of the main sources of production risk. Therefore, Mediterranean winegrowers and olive growers tend to adopt measures that include precision viticulture, organic viticulture and olive growing, the use of new crop varieties, diversification of production with complementary crops and the like (Gugić, 2023).

Beside climatic conditions, a major incentive for the application of circular economy concepts and environmentally sustainable practices is the development of new technologies and tools for soil and crop management, which reduce labor input and enable more environmentally friendly mechanical processing, but require significant financial capacity on the part of farmers. Improving the efficiency of agricultural production makes it possible to produce larger quantities at a constant cost, and farmers who do not follow the technological evolution of the sector will soon no longer be competitive. The monitoring of technological development and the application of more sustainable practices is further encouraged and guided by legislation, as it prohibits the use of protective chemical agents that have a negative impact on the environment from year to year (Katunar 2023: 131–139). In the Mediterranean, the circular economy primarily seeks to contribute to solving the problem of the efficient use of resources, especially water, the problem of biological and other waste, the problem of maintaining soil health and the application of agrotechnical techniques to restore soil quality, the problem of reducing the consumption of water and energy as a resource whose availability is becoming increasingly limited. The survival of Mediterranean agriculture depends on the adoption of sustainable practices, as existing practices are likely to become expensive and some resources are no longer available. For this reason, the EU promotes and funds model research and the application of best practices as one of the ways to preserve agriculture in the Mediterranean (CESAM 2024).

Scientists continue to explore the positive effects of the circular economy, but some also take a critical look at the circular economy by analyzing the cost of its application, expensive and unavailable technologies, and the aspect of regulatory challenges it creates.

Environmental effects such as waste prevention and efficient use of resources (e.g. water and energy) are usually cited as positive reasons for the introduction of the circular economy. In addition to the environmental benefits, empirical research also emphasizes the economic advantages of introducing a circular economy. Cost reductions are achieved through cheaper raw materials, cost reductions for recycling or redesigning products or by switching to new, more efficient business models. A 2013 study by the Ellen MacArthur Foundation (Towards the Circular Economy: Economic and business rationale for an accelerated transition) highlights waste reduction as one of the main benefits of implementing a circular economy. Kounani et al. (2023) developed tools to evaluate the success of the implementation of circular economy strategies. As an example, they cite that the uncontrolled disposal of waste from olive mills poses a major environmental problem in Mediterranean countries and conclude that the transition to a circular economy is necessary. Sustainable water management and the reduction of CO2 and greenhouse gas emissions are also the subject of scientific research.

Regardless of the incentives at EU level for implementation, the circular economy and the possibility of its application in agriculture are also criticized. Critics emphasize that the transition from a linear to a circular model is difficult and expensive. The transition requires changes in industrial processes, supply chains, business models and consumer habits. The upfront costs are extremely high, as investments need to be made in innovative technologies that are not available to everyone or are currently too expensive for widespread use (Khana M., 2024). The insufficiently regulated market in connection with the legal and regulatory framework should also be emphasized. For the transition to a circular economy to take full effect, people's awareness of the need to protect soil, climate, resources and biodiversity must change. Studies show that the more economically developed countries, the countries of Western and Northern Europe, are more willing to accept and finance investments in the circular economy, while the Eastern countries are still focused on economic growth. Only when a country is at a stage of economic development where it no longer has to worry about its inhabitants not being able to provide for their minimum existential necessities, is it prepared to think about problems relating to the climate and the threat to the environment.

At the level of all EU Member States, more education is needed on the methods and sustainable practices applied in the circular economy. Although the European Union financially supports the implementation of the circular economy, incentives need to be customised to the economic development and specific needs of each Member State. In agriculture, the introduction of new varieties and so-called resistant varieties is necessary (Pavlešić 2025) so that agriculture can "survive" the increasing problems caused by climate change (hail, too high/too low temperatures,

floods and the like). Varieties that have thrived in a particular area for centuries may no longer be suitable for a particular area in ten years' time due to climate change. Farmers therefore need to keep pace with change and be prepared for investments and major changes in the way farms operate.

CONCLUSION

The circular economy in agriculture offers significant environmental benefits and, if implemented correctly, long-term economic and social benefits for the area concerned. With the right support and investment, it can become a key element of sustainable agricultural practices. The main benefits include reducing waste, conserving resources, reducing greenhouse gas emissions, cost efficiency, building and increasing the resilience of food production in an area or country. The circular economy in agriculture is certainly the future and the goal of the development of agriculture in Croatia, Europe and the world. The example of viticulture shows that the application of technological solutions such as regenerative viticulture, which aims to restore soil health, increases biodiversity and the presence of pollinators, uses local fertilizers and biological residues for fertilization and thus benefits the farm and society in the long term. The use of precise agrotechnical techniques, sensors, drones and soil condition sensors enables the optimization of the use of pesticides, water and fertilizers, and thus a more sustainable and efficient management of costs and resources. The control and recycling of residues and waste and the application of the zero-waste concept contribute to innovation and offer new sources of income and new products from residual materials. Market and marketing differentiation from standard practice enables sales at higher prices and brand development in conditions where consumers are willing to pay more. The use of sustainable circular practices contributes to the robustness and resilience of farms, and the EU and developed societies encourage circular and sustainable practices in agriculture with the aim of protecting and improving the environment, ensuring high-quality nutrition for the population, preserving the climate, reducing the impact of climate change on society, increasing the robustness and resilience of agricultural production and reducing dependence on external suppliers of raw materials.

The application of circular economy models in practice also has significant limitations that need to be taken into account, mainly the necessary capital investments at the beginning of the implementation of the concept and the lack of knowledge of farmers about methods and sustainable practices that reduce the intensity of the transition to circular and sustainable concepts. Society in the Mediterranean region and beyond is not yet sufficiently aware of the need to protect the soil and climate, resources and biodiversity. Waste raw materials are not always suitable for re-use & re-cycle applications and need to be further processed, which requires knowledge and resources. The market is not always prepared to pay more for a product from sustainable cultivation. There are not enough examples of scaling up a circular production concept on the basis of which a successful and efficient model for its development can be created and replicated. All existing areas need to

be adapted to the circular model, which leads to disruptions in production and requires significant financial investments. Viticulture and winemaking, as well as olive growing and livestock farming in the Mediterranean are returning to their roots, but at a new, high technological level. The concept is not unknown in the Mediterranean, but its implementation requires knowledge and resources that are not always available to farmers.

The limitations of this chapter are: Lack of empirical research and empirical results of the application of circular economy in agriculture in commercial production, ignoring social, financial and political factors in each area where the circular economy model in agriculture is to be implemented, focusing on technology while ignoring business models within which farmers have learned to function and generate income, unequal opportunities for application in developed areas and less developed countries due to the different availability of the necessary financial resources, leading to an increase in inequalities.

It is expected that future research will aim to conduct an empirical study that will show the actual impact of the circular economy in practice and investigate new business models that need to be developed for the development of circular economy practices. It is also necessary to design and establish new systems to measure success and develop indicators to monitor the implementation of circular economy activities in agriculture and other economic sectors, as the objectives of the circular economy are different from the objectives of the activities of linear economic production models.

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QUALITY MANAGEMENT IN AGRICULTURAL PRODUCTION

CHAPTER 10.

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ABSTRACT

This chapter examines the quality management of agricultural products and foodstuffs, focusing on the *Proven Quality* label introduced by the Ministry of Agriculture of the Republic of Croatia. The chapter emphasises the importance of quality labels in achieving greater visibility of products on the market and in enhancing their value. The research focuses on producers who have introduced this label and assesses how the respective label affects their production, market position and business results. Using a survey, as the method of data collection, the chapter analyses variables such as product specificity, market relevance, and legal and voluntary regulations to determine the motivation behind the producers' choice and the impact of introducing the label through statistical tests. The results show that market relevance is the most important variable for achieving a good market position, while product specificity and legal regulations also play an important role, but are less decisive.

Keywords: *quality management, Proven Quality label, agricultural and food products, Republic of Croatia*

INTRODUCTION

Numerous studies deal with product quality, including the quality of agricultural products and foodstuffs. One particular segment of this research concerns quality labelling. The labelling of quality with different signs takes place at the level of the European Union, but also at the level of national economies. The aim of labelling the product with appropriate labels is to highlight additional quality characteristics of the product, on the basis of which its sales could be increased. Most of the research to date is based on the consumer's perception of the quality of labelled products and, consequently, the desire to buy such products.

In the Republic of Croatia, there are several quality labels recognised by the EU, as well as national quality labels regulated by law and voluntary quality labels regulated by regulations. This study focuses on producers who have introduced the voluntary label. This is the *Proven quality* label, which was introduced by the

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Ministry of Agriculture through the Agricultural Act ("Narodne novine", No. 118/18, 42/20, 127/20 - Decision of the Constitutional Court of the Republic of Croatia, and 52/21) and the Regulation on the National Quality System for Agricultural Products and Foodstuffs ("Narodne novine", No. 18/20 and 93/21) as a voluntary quality system.

Products with the *Proven quality* label contain specific requirements in relation to their production that are higher than for products that do not bear such a label. This mark proves that the products are local, that they are produced and processed according to high standards that guarantee high quality, that the environment and animal welfare are respected during production and processing and that the distance from the field and farm to the table is as short as possible.

To find out to what extent a voluntary quality label motivates producers to join the national certified quality scheme, the authors of this article turned to producers rather than consumers. The introduction of higher quality standards than the mandatory ones certainly requires greater investment and additional costs, but also brings certain benefits. The authors assume that producers whose products carry the *Proven quality* label will have greater visibility on the market, higher added value of the products and thus higher sales and business results. This study aims to confirm the extent of these assumptions.

QUALITY IN AGRICULTURAL PRODUCTION

There is a whole range of international and national quality labels that are regulated by international or national laws. In addition, there are various non-binding certification systems that are not regulated by law but are based on a voluntary basis and aim to inform consumers about the properties or special characteristics of products that distinguish them from similar products on the market. The aim of awarding quality labels is to improve the quality of products and services, to protect products with a certain technology or production method or from a certain area, to increase competitiveness, etc. Quality labels are awarded to products and services in almost all sectors. This article focuses on the quality of agricultural products. The most well-known quality labels in agriculture include the following international and national labels: Protected Designation of Origin (PDO), Protected Geographical Indication (PGI), Traditional Specialty Guaranteed (TSG), Product from Mountain Areas and Product from the Most Remote Regions of the EU.

In Croatia, in addition to the recognition and application of the above-mentioned quality labels, there are a number of non-binding certification systems awarded by various ministries, agencies and the Croatian Chamber of Economy (HGK). There are labels such as: Honey from beautiful Croatia, Croatian island product, Croatian quality, original Croatian, Green Mark, meat from Croatian farms (born and raised in Croatia or raised in Croatia), milk, honey and eggs from Croatian farms, flour and bread from Croatian fields, tested quality and similar seals of approval can be awarded.

All quality labels are aimed at consumers and their information about the product. The aim is for consumers to choose the product that meets their needs. In many countries, different labels and different consumer groups have been studied to determine whether there is a correlation between the consumption of labelled products and consumer preferences for these products. These studies also refer to quality labelling, although the number of studies published annually on the terms "quality", "quality labels", "quality systems" and "agricultural food" is increasing. According to the Web of Science Core Collection database and taking into account the keywords mentioned, 31,682 articles were published in 2022 alone. This shows that researchers as well as producers and consumers have a need for new research results. Most previous research has focused on determining the relationship between quality labels and consumer perceptions of such products. The present research focuses on the relationship between the introduction of quality labels and producers' perceptions of the role of these labels. Before explaining this research and its findings, we provide an overview of some of the most interesting findings from previous research.

Overview of the research and its results

The research conducted by Chifor et al. (2022) was based on a comprehensive and systematic literature search based on keywords such as "Romanian geographical indications" and "Romanian food labels". These terms should be included in the title, abstract and keywords of the paper. Agricultural products and foodstuffs with a geographical indication (including wine and spirits) are included in the study. Products and foods unrelated to the agricultural environment and services were not included. The main findings of the literature review were that consumers are willing to pay for geographical indication (GI) products, that they tend to buy local GI food products, that the premium price of a GI product decreases when another differentiated product is available, that consumers consider the origin of food products in terms of quality and cultural preferences, that EU quality labels are not always recognized, i.e. that consumers prefer traditional products, and that consumers are not always willing to pay for GI products. i.e. that consumers prefer traditional products and that the reasons for this are sensory appeal, unprocessedness, health, safety issues, origin, ethical issues and price. Chifor (2022) concluded in relation to Romania that the situation regarding GIs in Romania needs to be improved and that consumer awareness of the importance of the claims should be raised.

Geographical indication was the focus of research by Bahaciu et al. (2023). The researchers focused on the main categories of food and beverages with geographical indications, such as Protected Designation of Origin (PDO), Geographical Indication (GI), Protected Geographical Indication (PGI), Traditional Specialty Guaranteed (TSG) at the EU and Romanian level. The results are based on eAmbrosia EU, the database of the Romanian Ministry of Agriculture, the registration process and the role of this certification for producers and the reputation and branding of the Community. The conclusions of the study are as follows:
- The interest in quality registration through certification marks is increasing, both in the EU and in Romania.

- More and more producers are following the interest and need of consumers for better, safer, less processed and traditional food.
- Authorities and stakeholders are increasingly willing and active in supporting producers on the path to certification in order to protect the brand and promote the rural community.

Kovačević et al. (2022) examined the situation in the field of GI regulations, the obstacles to future development and made recommendations for the development of GIs in Serbia, Bosnia and Herzegovina and Montenegro. They started from the premise that GI schemes should reassure consumers that the food is a traditional product produced in a specific area and has certain characteristics. The study used a comparative methodology, a literature review and field research using EU Commission databases and data from national statistical offices and national ministries of agriculture. It was found that although the Western Balkan countries have well-known traditional products and excellent agro-ecological conditions for production under the GI scheme, these quality schemes have not been developed. The authors concluded that the way to improve the GI sector lies in harmonizing the legal framework with the EU legal framework, supporting producer organizations, amending the national GIs recognized by the EU and systematically promoting GIs.

Researchers from Poland have conducted a very interesting study. Malak-Rawlikowska et al. (2023) investigated the problems faced by Polish producers of PDO, PGI and TSG products with the aim of developing a set of recommendations that can support the development of food quality schemes (FQS) in Poland. The results of their research show that many factors hinder the functioning of the Polish market for FQS products. They are related to product specificity, market relevance, supply chain management, legitimacy and law enforcement. In addition, most products are characterized by low added value, which makes it difficult to differentiate them on the market and thus protect them from counterfeiting. There are also products with higher added value, but the lack of collective action by farmers reduces the potential impact that economies of scale could have. In addition, the limited number of certified producers and small acreages limit the use of effective marketing strategies and prevent producers from achieving greater visibility for their products. As a result, Polish FQS producers are unable to create more profitable market niches and often sell their certified products at normal market prices without the expected price premiums. In addition, consumers do not recognize FQS labels well, which indicates a serious problem of information asymmetry in the value chain.

Mesić et al. (2017) investigated how familiar producers of traditional agricultural foods in Croatia are with geographical indications. The aim of the study was to determine their expectations regarding the impact of geographical indications on increasing the competitiveness of their products. The research was conducted through a telephone survey of 120 producers of four traditional agri-food products (Pag cheese, Zagorje turkey, Slavonian kulen or kulin and Virovitica pepper). All four products were in the process of being registered with geographical indications (PDO/PGI) during the survey period (April to June 2008). The results of the survey showed that only a small proportion of producers were fully familiar with the concept of GIs and the benefits that GI protection would bring them. Most producers

believed that protection would increase consumer confidence in the health safety of their products, increase market awareness and prevent misuse of the product name. More positive expectations regarding the impact of GIs on the competitiveness of traditional products were held by better educated and younger producers with better knowledge of GIs. The research results show that producers need to be better informed and educated about the benefits and advantages of GI protection.

A study conducted by Bryła (2017) in Poland examined the perception of European quality labels in relation to origin (protected geographical origin, protected geographical indication, traditional quality guarantee) and organic food. The study was conducted on a representative sample of 1000 Polish consumers using a computer-assisted online interview. Respondents emphasized the role of quality labels in positioning the origin of products and organic products in the premium price segment, in building a competitive advantage based on a differentiation strategy and in emphasizing authenticity. The correlation between the frequency of purchase of food with protected origin and organic products and the role attributed to quality labels was confirmed. A strong correlation was also found between the perception of European quality labels and attitudes towards food with a protected origin and organic food. Finally, the correlation between the positive perception of European quality labels and the willingness to pay a higher price for food with a protected origin and organic food was confirmed.

In their study, Velčovska et al. (2011) assumed that the purpose of food quality labels is to promote and identify food, but also that quality labels should be a guarantee of high-quality, healthy and safe products. In this context, they posed a number of questions, such as: Is the guarantee of food quality expressed by quality labels important to consumers? If consumers recognize quality labels, how do they perceive them? Are quality labels an important factor influencing consumer behavior? The aim of the study was to determine consumer perceptions of food quality labels and to compare the attitudes of Czech and Icelandic consumers. The empirical results from 150 Czech and 117 Icelandic respondents showed that there are significant differences between the attitudes of Czech and Icelandic respondents in relation to the following factors: Preferences for food products in relation to country of origin, awareness of quality labels and interest in information about food quality labels. The research results show that food quality labels are of interest to respondents from both countries, but unfortunately respondents have limited information and knowledge about these labels. This is the main reason why respondents are not able to make full use of these labels in their purchasing decisions. They know these terms, but most people do not know what they mean. In the Czech Republic, the national quality marks have a good position, as they are well recognized by the respondents. The situation is even worse for the European and global quality marks, as only a very small percentage of customers are familiar with these marks and know what they mean. In Iceland, about half of the respondents know the Fair Trade label, while the domestic labels TÚN and IRF (fishery label) are partially known. Knowledge of other labels is minimal. The problem is that the respondents react to the seals but do not know the exact meaning of the seals. Therefore, quality labels on product packaging should be perceived by customers not only as labels on the packaging, but as labels that provide useful information.

The work of Velčovská and Hadro (2018) also deals with the topic of food quality labels. The main aim of this research was to investigate the perceptions and expectations of Generation Y in relation to food labels in the Czech Republic and Poland. The data was collected through an online survey with 372 respondents, of which 221 were from the Czech Republic and 151 from Poland. The results show that the number of food labels is perceived as extremely high and confusing, which is particularly evident in the Czech Republic. The impact of labels on food purchasing is therefore limited and the benefits of labels are not fully understood. Czech and Polish respondents differ in their opinion about the certification fee and the credibility of the labels. It is recommended to reduce the number of quality labels and focus on those that have a clear benefit, as well as to develop mobile applications and websites to better and more easily inform Generation Y about product quality.

Saxena and Jain (2022) also conducted a study on food labels. The objective of the study was to determine the influence of consumer attitude and their perception of food quality on the claims made on labeled products in Rajasthan. The results show that consumer attitude and perception of food quality have a significant and moderate influence on the provision of information on food labels. Consumer attitude has a strong influence on perception of food quality. Food quality perceptions were also found to partially mediate the relationship between consumers' attitudes and their use of information about products with a quality label. Most consumers believe that products with appropriate quality certificates are of better quality. They also had a very positive attitude towards and believed the claims made by food manufacturers. Consumers do not associate product quality with objective quality parameters, but believe that products are of better quality if they have the fewest ingredients, the least processing and if they are nutritionally balanced. This suggests that consumer perceptions of food quality are very different from the actual quality parameters recommended by regulators and stated by food manufacturers. Regarding the use of food labels, consumers mainly used them to check the production and expiration dates as well as compliance with food quality standards. The research findings highlight the dilemma for food manufacturers that providing correct information on food labels requires greater efforts to enable consumers to make correct purchasing decisions.

Jakubowska (2021) conducted a study to determine how consumers perceive traditional food labels and to compare consumers' expectations with producers' motivation to offer certified traditional products. The results are very interesting. Producers indicated that consumer awareness of traditional food labeling is low. Therefore, many of the producers interviewed questioned the purpose of certification and claimed that the commercial impact is disproportionate to the benefits achieved. In terms of practical impacts, the results have shown that traditional food producers need marketing strategies where the quality characteristics of traditional foods are easily recognizable, thus reducing information asymmetry.

McLeod et al. (2023) conducted a study that aimed to determine (a) the impact of label information on consumer preferences when choosing foods associated with a sustainability label and (b) the existence of a correlation between food labels and

food value. The research investigated the understanding of twelve different food labels and their influence on food value preferences and was conducted under laboratory conditions (in a survey). The results showed that respondents changed their preferences when they were given more information about different labels. The researcher believes that food labels should present the basic values of food to increase the number of consumers who prefer such a product and that it is crucial to improve consumers' knowledge and understanding of labels on food packaging.

Asmalovskij and Sadílek (2016) investigated consumer attitudes towards food labels in the Czech Republic and their influence on purchasing behavior. The results showed that the three most influential factors that affect consumers when buying food are the price, the origin of the product and its appearance. The research conducted suggests that quality labels are not a key factor that significantly influences purchasing behavior. In 95% of cases, respondents agree that labeled products meet their expectations, but only 58% believe that labeled products are of better quality. Almost 61% of respondents believe that quality labels are credible and 72% of respondents are willing to pay more for labeled food.

Košičiarová et al. (2016) investigated the opinion of Slovak consumers on the purchase and quality level of agricultural and food products produced in the Slovak Republic and tried to determine their knowledge and preference for the national quality mark "Značka kvality SK". According to the research results, it can be said that the situation on the Slovak market is quite good - more than 44% of respondents believe that they buy higher quality products and more than 49% of respondents believe that agricultural and food products produced in Slovakia are of much higher quality. The most important factor that encourages consumers to buy higher quality products is the fact that they consider these products to be better (33.31% of respondents). The most important factor that prevents them from buying higher quality products is the higher price (48.66% of respondents). More than 58% of respondents are familiar with the "Začka kvality SK" quality mark. More than 56% of respondents knew how to describe the logo; more than 60% of respondents could spontaneously name five brands with this mark; 47% of respondents would like to see more food products with this mark; more than 39% of respondents saw two different labels on one product; almost 50% of respondents also buy organic products (more than 35% of respondents), and the most important reason for this is the better quality of these products, i.e. good previous experience (about 28% of respondents).

Gregorić et al. (2018) chose the importance of branded products with one of the quality marks (EU or national quality marks) and their awareness on the Croatian market as the subject of their study. The main objective of the study was to determine the recognition value of agricultural products with one of the quality marks among consumers and the importance of branding for such products. Other objectives were to determine the level of awareness of such products among Croatian consumers, to what extent products with quality labels are important to consumers, how they perceive the quality of such products and whether it is sufficiently promoted on the Croatian market. The results obtained by the authors show that consumers of agricultural products would prefer products with EU quality labels or national market labels, even if they do not know what they mean. The data

shows that 79.5% of respondents were not aware of the quality marks for agricultural products and foodstuffs. Only 2.6% of respondents said that products with quality marks are sufficiently advertised. The survey revealed that the majority of respondents are familiar with local quality marks such as "Zagrebačka cherry, Jagoda purgerica, Zagrebački pušlek" or "Zagrebački fresh cow's milk cheese", which are recognized by more than 70% of respondents. Due to the tradition and culture of food, Croatian consumers recognize the national products, but they do not know enough about the quality marks, the origin of the food, its production, the process of soil cultivation, agriculture, environmental protection, etc. Only 30% of respondents confirmed that they have heard of agricultural quality labels and food products with "Protected Designation of Origin and Protected Geographical Indication". Consumers are familiar with agricultural products and food at a national level, but not because of the label and its promotion. Consumers are willing to pay a higher price for a product that has been produced according to controlled standards. However, EU-level agri-food labels are not sufficiently recognized by Croatian consumers, which indicates that the marketing activities of EU-level agri-food label holders should be adapted to the domestic consumer.

Velčovská and Del Chiappa (2015) investigated consumer attitudes towards quality labels in the food sector in the Czech Republic. The aim of the research was to analyze consumers' awareness and perceived credibility of food quality labels, to determine their willingness to pay a higher price for certified products, and to determine whether there are significant differences in the way consumers perceive food quality depending on their socio-demographic characteristics. The results showed that respondents know little about quality labels, that they are poorly informed about them and that advertising for some quality labels is minimal, especially for EU quality labels. It also showed that consumers are not able to make full use of quality labels in their purchasing decisions and that some of the quality labels are not credible to them. It was found that Czech consumers prefer national or regional products over foreign products, with women more often responsible for food shopping than men; the reason for this is their interest in supporting Czech producers or the perceived higher quality of domestic products.

Dardak and Habib (2010) investigated the relationship between customer value, satisfaction and loyalty in the agri-food sector and identified relevant dimensions of consumer value perception in this context. The results showed a strong relationship between customer value towards the brand and loyalty. Economic brand values appear to be more important in determining customer satisfaction than emotional and social values. Another important finding of this research was the influence of satisfaction on customers' loyalty intention. The more satisfied customers are with a particular brand, the more loyal they are and the more likely they are to buy that brand again. It has been shown that the economic value of a product is an important factor for customer loyalty to a particular brand.

Priya and Kumar (2019) focused on the preferences and awareness of organic products as consumer preferences for these products are increasing globally due to high health awareness. The research was conducted using a structured questionnaire administered to consumers of organic agricultural products in Coimbatore district. The results showed that most consumers are aware of the

importance and role of organic agricultural products in health. Although they have neglected organic agricultural products for a long time, consumers are now increasingly turning to these products. The research also showed that people are well aware of the image and availability of organic products, but are not completely loyal to them. Respondents were attracted to organic agricultural products, which means that marketers need to develop promotions that are both practical and moral. Availability in different quantities and varieties is essential for successful marketing of organic agricultural products. Consumers are willing to pay higher prices for organic produce, which can be seen as an investment in health.

Nowadays, e-commerce is increasingly present in the purchase of a range of products, including agricultural products. It could be said that online shopping is becoming increasingly popular and improving consumer satisfaction is becoming more and more important. Yanyan (2018) recognized the new trends and investigated consumer satisfaction in online shopping. The results showed that logistics service, customer service and website security have a great influence on the purchase of Internet users, while the quality of agricultural products has an even greater influence. At the same time, consumers have preferences for agricultural products and e-commerce websites. In addition, the e-commerce of agricultural products not only helps to better meet the needs of consumers, but also helps to accelerate the industrialization of agriculture and improve the efficiency of agricultural product operation.

Liu and Kao (2022) investigated the factors that influence customer satisfaction when purchasing typical agricultural products online. They analyzed five influencing factors: pre-purchase expectations, product quality, brand image, e-commerce platform and logistics distribution. The results showed that pre-purchase expectations have no significant negative influence on customer satisfaction, while product quality, brand image, e-commerce platform and logistics distribution have a significant positive influence on customer satisfaction.

Joni and Made (2023) investigated the loyalty of customers who buy products online. The aim of their research was to test and explain the mediating influence of customer satisfaction, service innovation and product quality on customer loyalty at Tanihub Bali. This research was conducted in the Badung region and the city of Denpasar. The results show that service innovation and product quality have a positive and significant impact on customer satisfaction and loyalty. In addition, customer satisfaction had a favorable and strong influence on customer loyalty as well as the ability to partially mediate the relationship between service innovation and customer loyalty and partially mediate the relationship between product quality and customer loyalty. Based on the results obtained, the researchers concluded that Tanihub Bali should introduce several new innovations such as cash on delivery, clear delivery time and complaint time so that customers become loyal customers of Tanihub Bali app. Tanihub Bali must continue to maintain the quality of its products in terms of freshness, cleanliness, size and product packaging. This can increase customer loyalty when shopping on Tanihub Bali because according to previous research and discussions, product quality also has a positive and significant impact on customer loyalty.

Yuanita and Sutanto (2023) examined the role of quality management in maintaining organic vegetable production and emphasized its close relationship with consumer satisfaction and the resulting impact on purchasing decisions. In the organic food market, which is mainly purchased by the upper and middle class in Batu (East Java, Indonesia), consumer preferences dictate higher product specifications and consequently require a focus on quality. To strengthen market presence, this study advocates the direct involvement of organic farmers in the entire chain from production to marketing, so that they are not only producers but also entrepreneurs. As producers face increasing competition, product quality is proving to be the most important competitive factor. The main objective of the research was to identify consumer demands and develop corrective measures to increase their satisfaction. The research was conducted using an online survey. The respondents were consumers who had purchased organic vegetable products from Batu farmers at least twice. Data analysis revealed that the most important quality attributes for respondents were the purity of the vegetables, product price and accessibility. It was found that technical interventions such as introducing good handling practices, internal control systems and improving service quality in organic vegetable production had a significant impact on consumer interest and increased their satisfaction.

Lončarić et al. (2015) conducted an interesting study. The subject of their study was traditional agricultural foods, which are now an important part of European culture, identity and heritage. The aim of the study was to investigate the attitudes of consumers in Osijek-Baranja County towards the traditional products of Slavonia and Baranja and their importance for the wider social community. The main research questions were: Familiarity with and preferences for certain traditional products, frequency of purchase, place of purchase, opportunities to consume traditional products, quality evaluation, satisfaction with the offer and willingness to pay a reasonable price. The research results showed that although Croatia is rich in many traditional products, only a few of them have gained the interest of consumers and the reputation of top gastronomic products. Higher prices for traditional products and their position on the market have become one of the most important factors for greater interest in family farms. Among the traditional products of Slavonia and Baranja, consumers emphasize the following products: prosciutto, sausages, smoked bacon, crackling, schvargl, plum brandy, fresh cow's milk cheese and honey. Consumers generally have a positive attitude towards traditional products. They cite their quality, originality, naturalness and taste as the main advantages. The main disadvantages cited by respondents were not too little supply, but too high a price, unsuitable labeling and preparation for the market.

Finally, we should mention another study aimed at understanding consumer preferences in relation to a product to which consumers are not indifferent. It is about wine. The research conducted by Vretenar (2023) aimed to determine whether wine consumers' preferences differ depending on the demographic characteristics of the respondents. The results show that respondents did not differ in their preference for products from local producers. Respondents also prioritized quality over price, while confidence in their ability to distinguish the quality of wines was significantly lower. When looking at demographic characteristics, men were found to be more confident in recognizing wine quality, more likely to make

considered purchases and more likely to prioritize quality over brand than women. In addition to gender, education level, marital status and frequency of wine consumption were also found to be significant for certain attitudes and preferences. Differences in preferences according to age were only found between the oldest and youngest respondents, while differentiating respondents according to the price of the wine purchased did not reveal any significant differences. According to the author, these results can contribute to a better understanding of wine consumer behavior, which is particularly important for companies in the wine industry, but also for other industries with similar consumer behavior patterns.

Proven quality label

As mentioned in the introduction, the *Proven quality* label was introduced by a voluntary national quality system of the Ministry of Agriculture. The aim of this quality system is to further label agricultural products and foodstuffs in certain areas that have special quality characteristics and to protect producers from unfair practises. The special characteristics of the products relate to specific requirements in connection with the production of the labelled products, which are determined by the producers themselves. The special requirements represent higher standards than the conventional production of the same product that is not labelled with the *Proven quality* label.

Agricultural and food products labelled with the *Proven quality* - Croatia quality mark guarantee the consumer high quality, local origin, special product characteristics and controlled production and processing. Products from the areas of milk production and processing, meat production and processing, fruit and vegetable production and processing, honey production, egg production, oilseed production and processing, olive production and processing, grain production and processing, sugar production, mushroom production and processing, production of agricultural reproductive material, fisheries and aquaculture bear the *Proven quality* label.

Products that have been produced in accordance with the regulations of the national quality system can be labelled in three ways. The first, shown in Figure 1, contains the word "Croatia". This label may only be used for agricultural and food products that are produced and/or processed in the Republic of Croatia and for which Croatia is also the country of origin of the main ingredient.

Figure 1 "Proven Quality" mark for products from the Republic of Croatia
Source: https://www.google.com/search?q=znak+dokazana+kvaliteta+slike

The second label contains the word "State" instead of the word "Croatia". It may only be used for the labelling of agricultural products and foodstuffs where the State

indicated on the label is the country where the product was produced and/or processed and which corresponds to the country of origin of the main ingredient.

The third label does not contain a country indication and is used for the labelling of agricultural products and foodstuffs where the country of production and/or processing is not the same as the country of origin of the main ingredient.

The document that certifies the specific characteristics of agricultural products and foodstuffs is the product specification. This document is publicly available and can be consulted on the website of the Ministry of Agriculture. For each production area, the product specification lists the criteria that affect the quality of the products, i.e. the production, processing or quality requirements and the origin of the main ingredient. The product specification must contain the following information (www.poljoprivreda.gov.hr):

1. An indication of the sector and type of agricultural products and foodstuffs for which the "Proven quality" label is requested.
2. A description of the production processes.
3. Specific characteristics of the products based on objective, measurable and other criteria, such as composition of the product, production method of the main ingredient, quality of the main ingredient, animal welfare, feeding of the animals, duration of transportation, speed of processing of the main ingredient, treatment during storage and transportation, origin of the main ingredient and environmental protection. The specific characteristics of the products must guarantee particular properties of the products or particular methods of agricultural activity or production or the quality of the final product that go well beyond the usual commercial standards for goods in terms of public health, animal health or environmental protection.
4. Description of the traceability system throughout the production and/or processing of the products.

The specific characteristics of the products are defined by the producers and processors, who are organised in a representative group that decides by consensus on the requirements contained in the product specification. The quality label for *Proven quality* must be clearly visible on the packaging and on the products. The minimum permissible size of the *Proven quality* label is 30 mm in width. In special cases, e.g. for small packaging and products, the size can be reduced to 20 mm.

Like any system, this national system of *Proven quality* has its advantages, but also the obligations that come with it. The main advantages are: a unique label, better recognition of local products, better visibility of local products on the shelves, products with added value and a possible increase in production (www.poljoprivreda.gov.hr).

The most important obligations of manufacturers and processors are: to comply with all criteria according to the product specification, to keep all necessary records according to the product specification, to choose a notified body and to initiate the procedure to confirm the conformity of the product with the specification and to label the product with the label for *Proven quality*.

An overview of the research to date shows that most studies focus on determining the relationship between quality labelling and consumer perception. Very few studies address the relationship between quality labelling and manufacturers' desire to introduce it. The aim of this study is to analyse manufacturers' attitudes towards quality labelling. The participation of manufacturers in a quality assurance system is associated with additional costs. This also applies to participation in the national *Proven quality* system, which is a voluntary system. The question arises as to whether it is worthwhile for manufacturers to make additional investments in quality, i.e. whether the effects of such investments outweigh the costs. This study therefore examines manufacturers' motives for introducing the *Proven quality* label and the effects of its introduction. It examines which product specifics are important for agricultural and food producers, whether they have achieved better market results through the introduction of the quality label and whether they have achieved better protection for their products.

RESEARCH ON THE QUALITY OF PRODUCT WITH THE LABEL PROVEN QUALITY

Research Methodology

The investigation of the relationship between agricultural and food products with the *Proven quality* label and the motives and effects of the introduction of such a quality label by producers has raised the following **research problem**: Which specific company characteristics have the greatest influence on the market and business position of companies, namely are these specific product characteristics, market relevance or the application of legal and voluntary regulations?

The **objectives** of this study are as follows:

1. To determine whether the sales of agricultural products and food products increase as a function of the duration of holding the *Proven quality* label.
2. To assess whether the investment in quality (the cost of obtaining the label) justifies the results obtained.
3. To determine whether there is a difference in the results achieved between producers who entered the market earlier and those who entered the market later.
4. To determine the motivations of producers for adopting the *Proven quality* label and whether they differ according to the length of time they have held the label.
5. To determine whether certain product characteristics, market relevance or legal requirements are more important for a good market position of the company.

Three main hypotheses and corresponding auxiliary hypotheses were formulated in order to obtain answers to the research problem and achieve the set objectives.

Hypothesis 1: Companies differ in terms of the characteristics that determine their market position, i.e. specific product features, market relevance and the application of legal and voluntary regulations.

Producers of various agricultural and food products carry the *Proven quality* label, and almost all types of products carrying this label are subject to strong competition. In order to differentiate themselves from similar products without the label, the producers of these labelled products emphasise the special characteristics of their products, make efforts to make their products stand out in the market and protect themselves against fraud, black market and similar problems. It is assumed that producers of agricultural and food products with the *Proven quality* label differentiate themselves in the area to which they give the highest priority (special product characteristics, market relevance as well as legal and voluntary regulations) in order to be more successful than their competitors.

Hypothesis 2: Longer possession of the *Proven quality* label improves the companies' market and business position.

It is assumed that companies that have been on the market for longer have a better business position than companies that have only been on the market for a short time due to their possession of the *Proven quality* label. The market position is assessed on the basis of the following criteria: product specificity, market relevance and statutory and/or self-imposed criteria in connection with the *Proven quality* label.

Auxiliary hypotheses:
H2.1 Specific product features with quality labels are better recognized by companies that have been on the market for a longer period of time.
H2.2 The longer agricultural and food products with the quality label have been on the market, the better they are recognised on the market.
H2.3 Companies whose products with quality seals have been on the market longer are better protected against counterfeiting and apply legal and voluntary quality criteria more consistently than companies whose products have been on the market for a shorter time.

Hypothesis 3: The socio-demographic characteristics of respondents influence the market effects of manufacturers of labelled products.

The following socio-demographic characteristics of the respondents were taken into account in this study: Gender, age, education, number of active farmers in the household, size (micro, small, medium, large farm), participation in the VAT system, recipient of state aid, experience in agricultural production (in years), number of products with the *Proven quality* label, which products have the *Proven quality* label, number of years the *Proven quality* label has been held for each product, number of years on the farm, total number of products. The following auxiliary hypotheses were formulated on the basis of these characteristics:
H3.1 There is a difference between the owners of agricultural and food products with the *Proven quality* label in terms of gender.
H3.2 Younger producers own more agricultural and food products with the *Proven quality* label than older producers.
H3.3 There is a difference in the number of agri-food products with the *Proven quality* label based on the level of education completed by producers.
H3.4 More years of experience in agricultural production improve market relevance.

H3.5 Companies that offer more products with the *Proven quality* label have a better market position.
H3.6 Companies that carry the *Proven quality* label for a longer period of time have a better market position.

With regard to the **geographical, content-related and temporal scope of the survey**, it was assumed that all persons trading in agricultural products and foodstuffs with the *Proven quality* label in the region of Croatia (66 persons) should be included in the study. For this purpose, the questionnaire was sent electronically to all respondents. The questionnaire survey began at the end of April 2024 and lasted three months. In the end, 23 questionnaires were duly completed and the results are presented in the following sections.

The **research instrument** was a questionnaire divided into three sections. The first section referred to the socio-demographic characteristics of the respondents. The second section contained statements aimed at analysing the impact of the introduction of the *Proven quality* label. These statements were used to determine the respondents' attitudes, in particular their level of agreement or disagreement with the individual statements. A five-point Likert scale with the following options was used to measure this: 1 – strongly disagree, 2 – disagree, 3 – neither agree nor agree, 4 – agree, 5 – strongly agree. The statements on specific product characteristics were numbered 1 to 7, the statements on the company's market position were numbered 8 to 19 and the statements on protection against the black market and the application of legal and voluntary criteria were numbered 20 to 28 (Appendix 1). The third part of the questionnaire contained two questions on the motives for the introduction of the *Proven quality* label and on the effects of its introduction.

Research results

Table 1 shows the socio-demographic profile of the respondents who took part in this study. The table shows that more men (69.6%) than women (30.4%) took part in the study. Looking at the age of the respondents, the population is predominantly middle-aged: 43.5% are between 36 and 45 years old and 56.5% are between 46 and 55 years old. In terms of education level, the majority of respondents have a secondary school degree (52.2%), followed by those with a university or university of applied sciences degree (30.4%) and a university or university of applied sciences diploma (17.4%). No respondents who had only completed elementary school or a postgraduate degree took part in the study.

Respondents with 10 to 20 years of experience in agricultural production (43.5%) took part in the study, followed by respondents with 5 to 10 years of experience (30.5%), more than 20 years of experience (21.6%) and finally respondents with up to 5 years of experience (4.4%). Respondents with four labelled products were the most represented in the study (34.8%), followed by respondents with five products (26.1%), two products (17.4%), one product (13%) and three labelled products (8.7%).

Variable	Number of Respondents	Percentage (%)
Gender		
M	16	69.6
F	7	30.4
Total	23	100
Age		
Up to 25	0	0
26 – 35	0	0
36 – 45	10	43.5
46 – 55	13	56.5
56 – 65	0	0
Over 66	0	0
Total	23	100
Educational level		
Elementary School	0	0
Secondary School	12	52.2
University Undergraduate / Professional Undergraduate Degree	7	30.1
University graduates / Professional graduates	4	17.4
Postgraduate university degree (doctorate)	0	0
Total number	23	100
Years of experience		
Up to 5 years	1	4.4
5 to 10 years	7	30.5
10 to 20 years	10	43.5
Over 20 years	5	21.6
Total years	23	100
Number of Quality-Labeled Products		
1	3	13
2	4	17.4
3	2	8.7
4	8	34.8
5	6	26.1
Total	23	100

Table 1 Sociodemographic Characteristics of Respondents
Source: Author's work

The results of testing the research hypotheses are presented one after the other together with the corresponding statistical tests. The data obtained was analysed using the IBM SPSS Statistics software package.

The first hypothesis, which states that the companies differ in terms of the specific factors that determine their market position — specific product characteristics, market relevance and legal regulations — was analyzed using the Friedman test (Tables 2 and 3).

	Mean Rank
Specific Product Characteristics	1.93
Market Relevance	3
Legal Regulations	1.07

Table 2 Results of Testing H1
Source: Author's work

N	23
Chi-Square	44.652
df	2
Asymp. Sig.	0.000

Table 3 Results of the Friedman Test – Differences in Mean Ratings
Source: Author's work

As can be seen from Table 3, the significance of the test ($p < 0.05$) is 0.000, i.e. well below 0.05. This indicates that there is a statistically significant difference between the assessments of specific product characteristics, market relevance and legal regulations. The high value of the chi-square indicates significant differences between these factors. These results indicate that the companies do indeed differ with regard to the specific factors that determine their market position (specific product characteristics, market relevance and legal regulations). The differences in the mean ratings for these factors are statistically significant and confirm the hypothesis that they are rated differently by the companies.

The mean values from the Friedman test can be used to interpret which of the factors contributes most to the differences between the companies:

1. Legal regulations: Mean rank = 1.07
- This factor has the lowest mean rank, meaning that it is rated as the least important compared to the other factors.
2. Specific product features: Mean rank = 1.93
- This factor has a medium rank, meaning that it is more important than legal requirements, but less important than market relevance.
3. Market Relevance: Medium rank = 3.00
- This factor has the highest mean rank, i.e. it is classified as the most important of the three factors.

According to the mean values, market relevance is the most important factor contributing to the differences in the market position of the companies, while legal regulations are considered the least important. The results in relation to hypothesis 1 indicate significant differences between companies in terms of the specific factors that determine their market position. The results show a different ranking of the factors between the companies, with the differences in the mean ratings being statistically significant. This confirms hypothesis 1, which states that the companies attach different importance to the factors examined in order to be successful in the market.

In particular, legal regulations were rated as the least important with the lowest mean score of 1.07. This indicates that although legal regulations play a role in a company's market position, they are not decisive for its success. Specific product

features were given a mean score of 1.93, indicating that companies recognize the importance of product differentiation to stand out from the competition; however, this factor is even less important than market relevance. The highest mean score of 3.00 was assigned to market relevance, which clearly shows that companies pay the most attention to the relevance of their products in the market. Market relevance is seen as key to maintaining and improving market position, indicating that companies are aware of the importance of adapting to market trends and consumer needs.

To summarize, the results of this analysis confirm that companies do indeed set different priorities with regard to the characteristics that influence their market position. Market relevance proves to be the most important factor, while specific product characteristics and legal requirements are also important, albeit to a lesser extent. These findings can help companies to better understand how they can position themselves in the market and which aspects of their business they need to develop in order to better compete with their rivals.

The second hypothesis was tested using three supporting hypotheses. Tables 4 and 5 show the results of the test of the first hypothesis H2.1: Specific product features with quality labels are better recognized by companies that have been on the market for a longer period of time.

	Market Presence	N	Mean	Std. Deviation	Std. Error
Specific Product Characteristics	0.00	12	27.2500	2.86436	0.82687
	1.00	11	27.6364	1.36182	0.41060

Table 4 Results of Testing H2.1.
Source: Author's work

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Difference Confidence Interval Lower	95% Difference Confidence Interval Upper
Specific Product Characteristics	Assumed Equal Variances	3.760	.066	-.40	21	0.688	-0.38636	0.95011	-2.36222	1.58949
	Not Assumed Equal Variances			-.41	16.022	0.681	-0.38636	0.92320	-2.34325	1.57052

Table 5 Results of Levene's Test for Testing H2.1.
Source: Author's work

The results of the test of hypothesis H2.1 show that the t-value is low (-0.407) and the p-value (0.688) is significantly higher than 0.05. This indicates that there is no statistically significant difference in the recognition of specific product characteristics between the groups that have been on the market for up to one year and the groups that have been on the market for more than one year. The difference between the mean values of the two groups is -0.38636, which means that the average recognition of features is slightly lower in the group that has been on the market for more than one year, but this difference is not significant.

Based on the results of the t-test, **the hypothesis that certain product features with quality marks are better recognized by companies that have been on the market for longer cannot be confirmed**. The difference between the groups is not

statistically significant (p-value = 0.688), so it cannot be concluded that the duration of market presence is associated with better recognition of product features.

The results of the test of the second supporting hypothesis H2.2, which states that agricultural and food products with quality labels are better recognized by the market the longer they are on the market, are shown in Tables 6 and 7.

	Market Presence	N	Mean	Std. Deviation	Std. Error
Market Relevance	0.00	12	44.7500	4.30908	1.24392
	1.00	11	42.6364	2.20330	0.66432

Table 6 Results of Testing H2.2.
Source: Author's work

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Difference Confidence Interval	
									Lower	Upper
Market Relevance	Assumed Equal Variances	3.807	.065	1.459	21	0.159	2.113	1.448	-0.898	5.125
	Not Assumed Equal Variances			1.499	16.677	0.153	2.113	1.410	-0.866	5.093

Table 7 Results of Levene's Test for Testing H2.2.
Source: Author's work

The results of the test of hypothesis H2.2 show a relatively low t-test value (1.459), and the p-value (0.159) is greater than 0.05. This indicates that there is no statistically significant difference in the improvement of market position between the groups that have been in the market for up to one year and those that have been in the market for more than one year. **The hypothesis that companies that have been on the market for longer have a significantly better market position as a result of holding the *Proven quality* seal of approval than companies that have not been on the market as long can therefore not be confirmed**. The difference between the groups is not statistically significant (p-value = 0.159). This could indicate that other factors such as marketing activities, product quality or additional investments play a more important role in achieving competitive advantages.

The results of the test of the third supporting hypothesis H2.3, which states that companies whose products with quality seals have been on the market longer are better protected against counterfeiting and apply legal and voluntary quality criteria more consistently than companies whose products have been on the market for a shorter time, are shown in Tables 8 and 9.

	Market Presence	N	Mean	Std. Deviation	Std. Error
Legal Regulations	0.00	12	24.0000	3.64318	1.05169
	1.00	11	23.0909	2.30020	0.69354

Table 8 Results of Testing H2.3.
Source: Author's work

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Difference Confidence Interval	
									Lower	Upper
Legal Regulations	Assumed Equal Variances	0.190	.667	0.708	21	0.487	0.909	1.284	-1.762	3.580
	Not Assumed Equal Variances			0.722	18.74	0.479	0.909	1.259	-1.730	3.548

Table 9 Results of Levene's Test for Testing H2.3.
Source: Author's work

The results of the test of hypothesis H2.3. indicate that there is no statistically significant difference in the perception of the impact of legal and voluntary quality regulations between the groups that have been on the market for up to one year and those that have been on the market for more than one year (the t-value is small, and the p-value is significantly greater than 0.05). Based on the results of the t-test, **the hypothesis that companies that have been on the market for longer are better protected against counterfeiting and apply legal and voluntary quality criteria more consistently than companies that have been on the market for less time cannot be confirmed**. The difference between the groups is not statistically significant (p-value = 0.487), which indicates that the companies do not achieve any positive effects through the application of prescribed quality standards, regardless of the length of their market presence, or that these effects are not sufficiently perceived by consumers.

Overall, these results indicate that the duration of holding the *Proven quality* label is not a decisive variable for improving the companies' market and business position, meaning that hypothesis 2 is not confirmed. Therefore, further research is recommended to consider additional factors that influence the success of products in the market.

The third hypothesis investigated the relationship between the socio-demographic characteristics of respondents and the market effects of producers holding the *Proven quality* label. The hypothesis was tested using six supporting hypotheses. The results of testing the first hypothesis H3.1, which states that there is a difference between the owners of agricultural and food products with the *Proven quality* label in terms of gender, are shown in Table 10.

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Difference Confidence Interval	
									Lower	Upper
Market Relevance	Assumed Equal Variances	0.126	.727	0.228	21	0.822	-0.375	1.648	-3.802	3.052
	Not Assumed Equal Variances			0.222	10.930	0.828	-0.375	1.687	-4.091	3.341

Table 10 Results of Testing H3.1.
Source: Author's work

From the values shown in Table 10, it can be concluded that there is no statistically significant difference in market position between male and female owners of

agricultural and food products with the *Proven quality* seal of approval (p-value = 0.822). The study therefore **did not confirm that there is a gender-specific difference between the owners of agricultural products and foodstuffs with the *Proven quality* seal of approval.**

The results of the test of the second supporting hypothesis H3.2, which states that younger producers own more agricultural and food products with the *Proven quality* label than older producers, are shown in Table 11.

		Age	**Number of Products with Quality Label**
Age	Pearson Correlation	1	-0.638**
	Sig. (Two-tailed Test)		0.001
	N	23	23
Number of Products with Quality Label	Pearson Correlation	-0.638**	1
	Sig. (Two-tailed Test)	0.001	
	N	23	23

** Correlation is significant at the 0.01 level (two-tailed test).
Table 11 Results of Testing H3.2.
Source: Author's work

As can be seen from Table 11, the correlation coefficient of -0.638 indicates a strong negative correlation between the age of the producer and the number of products with the quality label. The p-value of 0.001 is well below the standard significance threshold of 0.05, which means that the correlation is statistically significant. This result indicates that as the age of producers increases, the number of products with the quality label decreases and vice versa. In particular, older producers tend to have fewer products with the quality label compared to younger producers. **The hypothesis that younger producers have more labelled products is thus confirmed**, possibly reflecting the proactive attitude of younger generations towards innovation and quality.

Hypothesis H3.3. was tested using the Kruskal-Wallis test. As the significance (0.835) is well above the standard significance level, it can be concluded that there is no statistically significant difference in the number of products with quality labels between producers with different levels of education. Based on these results, the education of producers is therefore not statistically significantly related to the number of products bearing a quality label.

The results of testing the third supporting hypothesis H3.3, which states that there is a difference in the number of agri-food products with the *Proven quality* label based on the level of education completed by producers, are presented in Table 12.

	Highest completed level of education	Number	Mean rank	Chi-square	Degrees of freedom (df)	Significance
Number of products with quality label	High school	12	11.58	0.360	2	0.835
	Undergraduate university degree / professional undergraduate degree	7	13.21			
	Graduate university degree / professional graduate degree	4	11.13			

Table 12 Results of testing H3.3.
Source: Author's work

The results of testing the fourth supporting hypothesis H3.4, which states that more years of experience in agricultural production improve market relevance, are shown in Table 13.

		Years of experience in agricultural production	Market relevance
Years of experience in agricultural production	Pearson correlation	1	0.446*
	Sig. (Two-tailed Test)		0.033
	N	23	23
Market relevance	Pearson correlation	0.446*	1
	Sig. (Two-tailed Test)	0.033	
	N	23	23

** The correlation is significant at the 0.05 level (two-tailed test).
Table 13 Results of Testing H3.4.
Source: Author's work

According to the results of Table 13, the correlation coefficient of 0.446 indicates a moderately positive relationship between years of experience and market relevance. This means that market relevance increases with the number of years of experience. The p-value of 0.033 is below the significance threshold of 0.05, which means that this positive relationship is statistically significant. **The hypothesis that market relevance increases with increasing experience in agricultural production has therefore been confirmed**. The relationship between years of experience in agricultural production and market relevance confirms that experience plays a crucial role in understanding market dynamics and recognizing opportunities to improve product quality.

The fifth supporting hypothesis was: H3.5 Companies that offer more products with the *Proven quality* label have a better market position; the results of testing this hypothesis are shown in Table 14.

		Market relevance	Number of products with quality label
Market relevance	Pearson correlation	1	0.595**
	Sig. (Two-tailed Test)		0.003
	N	23	23
Number of products with quality label	Pearson correlation	0.595**	1
	Sig. (Two-tailed Test)	0.003	
	N	23	23

** The correlation is significant at the 0.01 level (two-tailed test).
Table 14 Results of Testing H3.5.
Source: Author's work

The coefficient of 0.595 in Table 14 indicates a moderately strong positive correlation between market relevance and the number of products with a quality label. This means that a larger number of products with a quality label is generally associated with a better market position. The p-value of 0.003 is below the usual significance threshold of 0.01, which means that this correlation is statistically significant. To summarise, **there is a significant positive correlation between the number of products with a quality label and market position**. The results indicate that a larger number of these products can contribute to a better market position, which underlines the importance of diversifying the product range.

The final sixth supporting hypothesis was: H3.6 Companies that carry the *Proven quality* label for a longer period of time have a better market position. The results of testing this hypothesis are shown in Table 15.

		Market relevance	Years of holding the "Proven quality" label per product
Market relevance	Pearson correlation	1	0.586**
	Sig. (Two-tailed Test)		0.003
	N	23	23
Years of holding the "Proven Quality" label per product	Pearson correlation	0.586**	1
	Sig. (Two-tailed Test)	0.003	
	N	23	23

** The correlation is significant at the 0.01 level (two-tailed test).
Table 15 Results of testing H3.6.
Source: Author's work

The Pearson correlation coefficient is r = 0.586. This result indicates a moderately positive correlation between the number of years in which the *Proven quality* label has been used and the improvement in market position. The significance level is p = 0.003. As this value is less than 0.01, this means that the correlation is statistically significant. These results indicate that there is a statistically significant and moderately positive correlation between years of holding the Quality Tested label and the improvement of the company's market position. In other words, the longer a

company holds the quality seal, the greater the likelihood that its market position will improve**. The hypothesis that longer ownership of the quality label improves the market position is supported by this data**.

In summary, **hypothesis 3 is partially confirmed**, as only two of the six supporting hypotheses analysed are not confirmed, suggesting that the socio-demographic characteristics of producers have a significant influence on the market effects of producers of quality-labeled products.

CONCLUSION

The aim of this study was to investigate several objectives. One objective was to determine whether sales of agricultural products and foodstuffs increase as a function of the duration of the *Proven quality* label. The results show that the introduction of the *Proven quality* label is an important factor in increasing sales of agricultural products and foodstuffs, even if this is not always related to the duration of use of the label. The results show that there is no statistically significant difference in the improvement of market position between the groups that have been on the market for up to one year and the groups that have been on the market for more than one year. Sales of agricultural products and foodstuffs with the *Proven quality* label therefore do not correlate significantly with the duration of label ownership. In addition, the study wanted to find out whether the investment in quality (the cost of obtaining the label) is justified by the results and whether there is a difference in performance between producers who entered the market earlier and those who did so later. It was found that investment in quality can lead to positive outcomes, although no significant difference in business performance was found between early and later label entrants. Success depends largely on other factors, such as marketing, quality production and strategy, and not only on the duration of labelling. A further aim of this work was to understand producers' motivations for adopting the *Proven quality* label. According to the ranking of motives for introducing the label, respondents considered the improvement of their competitive position in the market as the most important motive, while the introduction of a specific production method or the use of a specific technology was considered the least important motive. The most important impact cited by respondents was the improvement of their own business processes, while the least important impact was seen to be on sales of the full range of labelled products.

Producers are often motivated by the desire to protect their products from the black market and fraud and to ensure high product quality. It was also found that younger producers are more likely to apply quality standards. The aim of this study was to determine whether product-specific characteristics, market relevance or regulatory and voluntary standards that protect and reinforce producers' obligations are more important for a strong market position. Market relevance appears to be the most important variable for achieving a strong market position, suggesting that companies focus primarily on adapting their products to consumer needs. Product specifics and regulatory standards also play an important role, but are less decisive.

These results suggest that producers need to be further educated and sensitised to the benefits of quality labels and that marketing strategies to promote quality labels to consumers need to be improved. Future research should investigate other factors that influence the success of labelled products and implement strategies that strengthen the relationship between producers and consumers.

The sample size is certainly a limitation of this study, as it is quite small (only 23 respondents/producers), which of course limits the statistical power of the results and the generalizability of the conclusions to the population as a whole. This limitation is due to the fact that the study focused exclusively on the *Proven quality* label and the products that carry it. Including a broader range of seals could provide a more comprehensive perspective on product quality and its impact on market position. Another limitation of this study is that it cannot conclusively demonstrate that an improved market position is a direct consequence of the presence of a quality label, even if there is a correlation. Another limitation could be the one-dimensionality of market relevance, as market relevance was measured as a single variable. However, the actual market position of a company may be more complex and depend on a number of other factors (e.g. price, advertising, distribution) that were not considered in this analysis.

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ANNEX

Questionnaire

Claims:

1. The "Proven quality" label for agricultural products and foodstuffs increases food safety and consumer health.
2. The "Proven quality" label increases the level of awareness of agricultural products and foodstuffs.
3. Agricultural products and foodstuffs with the "Proven quality" label taste better.
4. Agricultural products and foodstuffs with the "Proven quality" label are generally of higher quality than products without this label.
5. The quality characteristics of agricultural products and foodstuffs with the "Proven quality" seal fully comply with their specifications.
6. A product labelled with "Proven quality" guarantees the customer that he has received a product with certain characteristics.
7. The "Proven Quality" label significantly increases the quality of the product.
8. The company's competitive position has improved because of receiving the "Proven quality" label.
9. Agricultural and food products with the "Proven quality" label sell better than products from other manufacturers or our own similar products that do not have a seal of approval.
10. Agricultural and food products with the "Proven quality" label have a higher added value compared to products without a seal of approval.
11. Consumers are prepared to pay a higher price for agricultural and food products with the "Proven quality" label.
12. The income from the sale of agricultural and food products with the "Proven Quality" label exceeds the costs resulting from activities and improvements associated with obtaining the quality label.
13. The sale of products with the "Proven quality" label has increased precisely because of this label.
14. As a rule, all products with the "Proven quality" label are sold as a whole (no leftovers).
15. Producers' expectations of agricultural and food products with the "Proven quality" label have been met.
16. Companies that strive for excellence also introduce quality labels.
17. Labelling agricultural and food products with "Proven quality" label improves their position on the shelves.
18. The "Proven quality" label serves as good product advertising.
19. There are too many quality labels on the market, which confuses consumers.
20. Producers of agricultural products and foodstuffs with the "Proven Quality" label adhere to high ethical principles in their production.
21. The process of certification or obtaining the "Proven quality" label is too long.
22. The procedure for obtaining the "Proven Quality" label is too formalised.
23. Due to the "Proven quality" label on agricultural products and foodstuffs, the black market has declined.
24. Due to the "Proven quality" label on agricultural products and foodstuffs, misuse of the name has decreased.

25. Producers of products with the "Proven Quality" label respect the principles of cultivation, processing and final production in accordance with the label throughout the entire production cycle.
26. The producers of agricultural products and foodstuffs with the "Proven quality" label fully confirm that the product complies with the prescribed standards (e.g. produced without hormone treatment or genetic engineering, the main ingredient is produced locally, animal welfare or the impact on the environment is taken into account, etc.).
27. The certification system and the award of the "Proven Quality" label are fair and legitimate.
28. Rank the reasons for the introduction of the label in order of priority, with the first place being the highest.
    The "Proven Quality" label is introduced to:
    a) Increase sales of products with a quality label
    b) Increase prices (creation of premium prices)
    c) A better competitive position on the market
    d) A better overall business result
    e) Improvement of own business processes
    f) Introduction of a special production method or application of a special technology to improve product characteristics
29. Evaluate the effects of the introduction of the "Proven quality" label:
    a) A better competitive position on the market was achieved
    b) A better business result was achieved
    c) The entire product range is sold with a quality label
    d) The company's own business processes have been improved
    e) Product performance has been improved

SIGNIFICANCE OF REPUTATION FOR EXPERIENCE GOODS FROM AN ECONOMIC PERSPECTIVE

CHAPTER 11.

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ABSTRACT

This chapter aims to offer perspectives on market processes and competitive positioning of small agricultural producers. The chapter presents a selection of theoretical discussion parts focusing on the processes of value creation and value preservation. The aim is to point out the multidimensional nature of the concept of value and the influence that the conceptual-theoretical framework has on selected entrepreneurial strategies. Personal and socially mediated interpretations of value can deviate significantly depending on the pertinence of an economic good to a certain theoretical category. The general conclusion is that different entrepreneurs must base their behaviour, regarding the manner in which they dispose of value in order to build, or merely signalize the value of their own products and services, on different, inherently unique, strategic patterns.

Keywords: *value, market price, experience goods, reputation, agriculture, small producers*

INTRODUCTION

All sciences, including economics, tend to objectify reality. Therefore, conceptual clarity, as a guideline for gathering information on clear selection criteria, lies at the heart of managerial art. As such, clear concepts are the foundation for every strategic reflection and planning.

Economic theories, especially those recognizes as credible at a certain historical time, reflect in the strategic plans and activities of entrepreneurs, thus influencing reality. But plans do not always unfold as expected. When this occurs, not all entrepreneurs or the business-oriented theorists will reject the underlying theories. They prefer to attribute the "failure" to the unavailability of the data on which the plans have been based, or to look for reasons in an unexpected event (the popular black swan) that disrupted the usual market constellation. Only a few theorists will be inclined to attribute deviations from that that has been planned to insufficient

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elaboration of theoretical patterns. This work follows this track. It strives to draw attention to theories that look at financial results through entities' negotiating positions and the formation of market prices.

Here, we deal with the significance and the role reputation plays in the processes of creating and recognizing values. The starting thesis of this research is that all economic goods have value, and that, what can be the subject of discussion, even dispute, are the criteria for determining value. Namely, it is certain that value in the real world is often not a completely objective, analytically comprehensible measure. Indeed, what has given rise to the spread of theoretical discourse for centuries is precisely the limited reliability of different approaches to value estimation, in addition to the susceptibility of human perception to random and subjective influences.

Methodologically, the chapter consists of a theoretical discussion of value-creation processes. The goal is to offer explanations useful for understanding the complexity of the mere concept of value. The theoretical discussion also imposes the need for frequent interpretation of the origins of certain theories and the theory of typical linguistic expressions (concepts). Therefore, clarifications have been added in several places in the chapter, either in the basic text or in the footnotes.

The introductory part presents theoretical origins of theories interpreting value provenience. The second part elaborates on the relationship between values and prices; namely, the the selling price expected to be acceptable to a certain number of buyers will be based on projected estimations of value set by the entrepreneurs' business strategies, but could also be modulated by interventions of economic policy makers attempting to regulate the market. The third part dwels on the definition of reputation. It presents reputation as a social phenomenon serving a signalling role on the market and discusses how reputation projects on decision-making at an individualized level. The general-theoretical discussion closes with pointing out to particular features of experience goods. They form a category of products whose business-market fate is particularly sensitive to subjectively estimated value. In fact, the subjective aspect of value recognition is particularly pronounced. Appart from calrifying concepts, this section also highlights historical reports by offering examples of business practices of entrepreneurs who, building appropriate reputation, have managed significantly enhance their businesses. Subsequently, the ending section singles out general recommendations for examining the determinants of the strategic behaviour of small entrepreneurs in the agricultural production sector. These should be especially relevant to enterpreneurs whose competitive advantages rely more heavily on on natural/organic farming and unique quality, rather than on large quantities of industrially significant raw materials.

ORIGINS OF VALUE

Historically, economic science has always been interested in the process of creating and/or converting value. Namely, the questions arise as to what and how new value is created, how the system of distribution of value works, and how value is broken down, utilized or transferred. In doing so, some theoretical patterns try to "cover"

the entire cycle of value creation, conversion, utilization interactively, while others are more "phased" focused. Each approach is then elaborated, often singling out alternative patterns of development, i.e. it deals with the prediction of trends that should facilitate the decision-making taken by individual economic actors.

For centuries, theorits have been trying to grasp the origins of values. For example, over two hundred years ago, natural factors were considered as the source of value (Smith identifies the availability of natural factors as the sources behind the "wealth of nations" (*factor endowment*). Other theorists recognized the source of value in the invested (objectified) work, focusing attention on just one production factor. The third group, like the mercantilists, found the origins of wealth in successful trade and/or good negotiation. This group is also close to theories that emphasize entrepreneurship and/or innovation as the origins of values.

Contemporary discussions logically build on the previously mentioned approaches. They often integrate thus introducing additional elements, which are identified as significant for the contemporary society, but are not yet sufficiently elaborated. Such are, for example, resource theory, transaction cost theory, theory of incomplete contracts and related disciplines that seek to more clearly model the behaviour of entrepreneurs and market organization.

In general, these discussions are characterized by dichotomies, that is, the confrontation of two opposing patterns of organizational, business or market reality.[2] Alternative theoretical patterns (models) are nominally defined as: an invisible or a visible hand, markets and hierarchies, internalization or externalization, complete and incomplete information, complete or incomplete contracts, and the like. Basically, the models represent endpoints within a range of possible life situations that could be placed in a continuous line in the real world. Theoretical alternatives are described by key descriptive determinants. According to these determinants, the similarity of the existing situation in the real world and theoretical models should be recognized and confirmed. What remains is a strategic choice, that is, the choice of the form of action indicated by the model. This choice should be reliable enough to inform the more labour-intensive and cost-intensive elaboration of strategic and implementation plans.

One of the key theoretical dichotomies is presented below: the one that concerns hierarchies and markets. It is significant because it explains how the market and prices mediate the process of creating and preserving value. At the same time, it explains the process of creating the context in which economic actors interact.

Williamson (1975) describes the market as a system in which spontaneous, decentralized decision-making prevails, and "hierarchy" as a system of planned, centralized decision-making. Following the logic of transferring theory to practice as

[2] Theoretical discourse comes down to comparing the economic and business sucess of opposing situations. Economic and business sucess are related, but are not synonymous. An economically successful pattern of activity is one that builds and preserves value. A successful pattern of activity in terms of business is one that generates financial profit. The mediator between economic and business sucess lies in market and price activities.

described above, the opposition of alternative models implies that successful economic and business behaviour is achieved by recognizing one's own position in the market / business environment and by choosing the "right strategy". Individual or fragmented decision-making, more or less subject to theories, gradually generates social coordination mechanisms (institutions): markets and hierarchies. Within these extremes, in real markets, economic actors meet to decide whether to act independently, whether to cooperate, or to compete depending on the situation.

Basically, both models are intended to provide access to resources and as such are essential in the processes of value creation and preservation. In principle, they could be identified as internal and external mechanisms for coordinating resources. Internal activity is markedly more subject to own planning and supervision, and is, by nature, primarily production and technologically oriented. Such an organizational model is called **hierarchy**. In the opposing model, coordination is predominantly established through imposition i.e. rivalry and negotiation. The generic name for this model is the **market model** (Williamson, 1975, 1985). A third, hybrid model, the bargaining or contractual model is also encountered (Hart, 2017).[3]

It should be noted that in Transaction Costs Theory (TCT), the technological-production process is still the basis of value creation. Internally, the rationality of production is ensured by appropriate operational management[4] as a system of business-management processes that in immediate production maximize the newly created value. A production plan, based on data (information) derived from individual or collective experience, serves to rationalize the relationship between production factors. What remains, after production needs are met, is also allocated according to plan for the development of capacities important for enhancing market position.[5] Therefore, a part of the strategic activity and available value will be dedicated to "price control" of input resources and the construction of channels to access end markets. Here is where sporadic business collaborations occur, and in cases when it is strategically advisable, longer-term (more predictable, tightly controlled) contractual relationships are founded with business partners, especially those located along the supply chain.

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[3] In transaction costs theory, the mechanisms for achieving the right of disposal are threefold: in addition to the two extremes, there is a third, hybrid, model that combines hierarchical and market mechanisms. In other words, control is established by ownership (as the most reliable mechanism for planned control over key resources and processes) or contractually (bargaining models where the role of the contract is to limit the strategic choices of business partners). However, control is also possible in markets if the entrepreneur manages to achieve the so-called privileged market position through strategic behavior. Such circumstances occur in so-called imperfect markets, that is, in asymmetries of information and market power. Supervision over the permissible forms of the strategic behaviors of the most powerful entrepreneurs is carried out by public authorities through competition policies.

[4] The term refers to the activities of operational coordination of production factors and their interconnections, establishing optimal technological ratios, efficient production scales, and effective organizational systems..

[5] The term "strategic behavior" is often used to imply manipulation of market relations.

There is another important remark in regards to TCT. In this literature, the word *control* is often emphasized. The term implies the importance of having rights [6] over particularly scarce, critical or, as this theory calls them, specific resources. As with resources, one also aims to control relationships with partners, especially those who own resources one does not possess him/herself and which are necessary for the realization of one's business plans. The theory refers to these relationships as transactions; the partners that can significantly help or hinder the realization of plans are termed "critical" or specific, and the organization is treated as a network of relationships. Organizational development thus becomes a matter of choice as to the organizational solution (governance mode) most suitable for controlling a particular partner or transaction.

The role of prices, markets and strategic behaviour

A special subject of discussion in economic theory concerns the relationship between the concepts of value and price. Namely, the theory knows the concepts of producer prices and market prices**.** [7]

The market price, in accordance with the microeconomic approach, represents a **socially** established measure of value. Namely, the price is determined by means of a market (transaction), but not as a unique value in a particular case or for a particular market participant, but as an "average" value for a certain time and space. Since it is not related to individual judgments and decisions, it can also be considered as relatively objective. Therefore, in analyses, it serves as an approximate reliable reflection of the real values of products and services, and is therefore used in macroeconomic projections and in the development of business plans and strategies.

Price Theory (a scientific discipline of industrial organization) seeks to understand how markets function and provides insight into the reasons why selling prices sometimes differ significantly from producer prices. It also explains how an

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[6] Ownership *rights*, in theory imply some extent of control over the allocation or disposal of economic goods, as well as the ability to appropriate the outcomes.

[7] The list could be expanded to include the discussion on the origins and nature of profit. By the shortest definition, profit is the difference between revenues and expenditures.. Revenue projections can be considered as *available value* that will feed the investments necessary for the selection and development of the production program, the selection of business partners and suppliers, the organization of logistics processes, the organization of the production process and accompanying activities, etc. Conditionally labeled "internal" costs are expenditures incurred to support business strategies are sometimes referred to in the literature as production or "producer" price. Some of the strategies, and thus costs, will be directed by entrepreneurs to support and strengthen market opportunities. The purpose of these efforts is to, as actively as possible, influence perceived values and willingness to trade. It is precisely such activities, which could conditionally be considered activities aimed at manipulating the perception of value by various market participants, that some theoretical directions call "strategic behavior" (Milgrom, Roberts 1987). In fact, according to this approach, profit, as a positive difference between the costs actually incurred and the revenues generated, could be treated at least partially, as a consequence of active (strategic) building of social awareness of the desirability of the production and consumption of a good.

entrepreneur's profit or loss arises as a consequence of the power relations between market participants.

In the theory, the relatively stable states of power relations between market participants are called market structures. The form of the market structure determines the efficiency of individual markets, that is, the extent to which resources will be used collectively to maximize general social utility. [8] Those markets in which it is possible to recognize values more clearly, and "correctly" (more objectively) and in which it is possible to make "correct" decisions are economically more efficient.[9] Such market structures ensure socially (collectively) efficient use of economic resources: by relying on information expressed through market prices, it is clearly predictable what a society needs; nothing unnecessary is bought or spent, nothing is produced more than needed, and shortages are not possible.[10] Correct decisions are also privately (individually) effective because the decision outcome is the one most favourable for the decision-maker; the decision brings the maximum possible level of personally preferred utility. The notion of an 'imperfect' or dysfunctional market is reserved for market relations in which there is a marked asymmetry in market power.

In contrast to the theoretically determined model of perfect competition, the theory observes "imperfections" in real markets, that is, deviations from the determinants of fully competitive markets. From the entrepreneur's perspective, market functionality in the form of objective signalling of real values (real producer prices) would be a criterion for choosing a suitable (i.e. efficient) market solution.

The strategic implications of market and price theories are important to two theoretical directions. One of which the discussions evolve around the building of an organization and market "manipulation" in competitive markets[11], and the direction related to consumer behaviour. A brief review of both is given below.

In the literature of industrial organization, the commitment to improving one's own market position is called strategic behaviour. The literature defines **strategic behaviour** as self-serving, a behaviour that is not necessarily useful for other market stakeholders and the wider community. [12] The ways in which individual

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[8] Some of these terms will be defined later in the text.

[9] By definition, a perfect market model or economically maximally efficient market structure is complete or perfect competition. Such a perfect market implies complete information, available to all without additional efforts and costs (the assumption of symmetry of information holda). Market prices are transparent and clearly reflect objectively set production costs. At the same time, it does not allow any entrepreneur, even if they wanted to and could, to rise to a more advantageous position compared to others (the assumption of symmetry of power holds).

[10] market clearing prices

[11] These fall under the umbrella of industrial organization with an emphasis on competition policies, i.e. the establishment of a system of public oversight to prevent the abuse of a preferential market position that harms competitors or the public interest.

[12] Strategic behavior, by definition, is a behavior that should lead to profits (rent seeking behavior) for the entrepreneur implemeting it. Basically, every business strategy is a small "private" theory on how to boost stakes for your own gain.

entrepreneur acts may vary, depending on the structure of the market, the capabilities (strengths and weaknesses) of the particular entrepreneur and his/her (also possibly wrong) expectations. Most often, strategic choices are elaborated by thematic areas, talking thus of policies or strategies. These can be related to prices, market shares, product differentiation, restricting competition, entry deterrence, reputation building, etc. [13]

The process of building an organization as a form of strategic action

Since, according to the theory, more favourable negotiating positions are based on inside (privileged) information, and an entrepreneur that finds him/herself in a privileged position on the market will be able to negotiate more successfully. In this manner, such an entrepreneur is able to ensure lower purchase prices and higher selling prices for themselves, and thus, when using technologically identical or even inferior solutions, they are able to achieve higher profits in comparison to other competitors. Other entrepreneurs, those in a non-privileged position, will have a more difficult access to objective information, will have relatively higher input costs and/or lower selling prices, making their market operations riskier and less profitable. Namely, in structured markets, [14] market prices will be determined by the relations of the market participants' bargaining forces on the supply and demand sides of the market. The structure of the market (and bargaining power) will also determine the ratios of the distribution of jointly created value, i.e. gains that individual entrepreneurs can expect to get from their joint activities on the market.[15] Ultimately, market structures are the starting point for each individual entrepreneur in their appropriate choice of strategic behaviour and the building of their organization. Namely, each entrepreneur, in the expectation that other market stakeholders will build their own organization (integrate or separate activities), will take measures aimed at strengthening their own position in the market.

From TCT and incomplete contract theories perspective, it is essential to understand how a particular entrepreneur should lead the process of their own organization building in real markets. Namely, the process of gradual organization building is treated as another sphere of strategic choices. In this respect, a sustainable, long-term business and market position of an entrepreneur is seen as the result of a

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[13] These policies, although nominally delimited, are in fact mutually intertwined. For example, the pricing policy is related to the subjective perception of value by individuals as consumers: "The logic of setting prices becomes an issue of individually projected values and of recognizing utility generating attributes." At the same time, the pricing policy is related to the selection of the production program, product properties and production technologies, which in fact predetermine the cost side of a certain entrepreneur's business. The combination of these strategic choices can be viewed through the prism of utility generating attributes. According to Schroeter, C., Ritchie, J. and Rickard, B. J. (2011), the term first appears in Rosen (1974) and then again in Rosen (2002) to describe the process of consumer choice and to thus help entrepreneurs in the choice of pricing policies

[14] Structured markets are markets in which the market shares and the bargaining power of individual market players are relatively durable and predictable.

[15] It goes without saying that some entrepreneurs will be more severely affected by possible market disruptions.. The loss, which will usually be borne by weaker entrepreneurs, is also one of the processes that lead to the redistribution of value in society.

repeatedly correct selection of those control instruments capable of providing a sufficient level of reliability (predictability) and elaboration (administrative burden) of the rules for future behaviour.

To put it simply, the organization building process could take place according to the following scenario and steps:

First, it starts by identifying the problem. A situation of incomplete information is assumed. Depending on the assessments of the riskiness of the relationship, the uncertainties related to the future, the pronounced asymmetry of information, etc., the range of information that is necessary and possible to be additionally obtained is determined. A significant part of the information needed to develop strategies comes from monitoring the reported market prices and their movements over a long period of time. For more important transactions, those critical, a wider and more comprehensive information base is required, i.e. higher, information costs are expected.

In the second step, strategic positions are assessed based on the information collected. Existing entry and exit prices are seen as an outcome of the existing market structure (i.e. as a reflection of the current time extent of power concentration and the strength of the negotiating positions of market participants).

In the third step, alternative organizational solutions are explored: changes in the production program, market repositioning, internal business restructuring (shutting down or adding activities), concluding contracts and partnerships, etc. Feasible organizational solutions are assessed as possibilities for changing the business and market position of the entrepreneur in the future.

The next step is to choose the best solution. The theory's recommendations are as follows: where there is financial strength [16], and where the entrepreneur considers it strategically important to achieve a high degree of autonomy in the disposal of a critical resource, the theory will advise ownership control. If, in the existing constellation of market relations and forces, the entrepreneur estimates that sufficient control over the transaction can be ensured contractually, then the contract is a better choice because it leaves more free (liquid) resources for adapting to unpredictable business situations and opportunities. It should be noted that the desirability of the contractual type of relationship is higher in companies of which the institutions can effectively protect the rights of the parties in the contractual relationship. If institutions are not able to provide adequate protection and if there is no mutual will or agreement of the potential counterparties, the entrepreneur is left with the establishment of ownership control over the critical resource.

Reputation as a social projection of values

In linguistic terms, reputation can be defined as a general, prevailing opinion about the value of someone or something. The Cambridge Dictionary defines it as the

[16] Financial strength in the context of this chapter represents the sum of the value that an entrepreneur is free to dispose of for strategic investments.

opinion people have about someone or something or how much respect someone or something receives, based on past behaviour
(https://dictionary.cambridge.org/dictionary/english/reputation)

In economic and theoretical terms, building a reputation is one of the possible behaviours undertaken by an entrepreneur in the market. In the conditions of an imperfect market, reputation has the role of "signalling" the desirability of a good and leads to decision-making (selection). When building an "organization", it can be the choice of a certain partner and the willingness to accept certain terms of trade (transactions), followed by the establishment of a system of relatively permanent partnerships that are treated as an integral part of organization building. Once established, a system of reliable strategic partnerships (the term is used here as a generic term, not as a name for a specific type of legal transaction) improves planning, reduces the costs of administrative procedures and speeds up logistics flows, all of which are factors that contribute to the efficient operation of the business system. A similar thing happens in relation to the behaviour of entrepreneurs towards consumers. In the following, more will be said about the effects of reputation in the markets of final, individual consumption.

In order for strategic behaviour to make sense, it is necessary to assume that building a reputation changes beliefs and thus the relationship between stakeholders (Noe 2012). By some logic, the importance of reputation should be further strengthened in the end, individual demand, markets. Namely, in markets where participants are relatively less familiar with technological procedures and prices in general, personal purchasing decisions are based on relatively quick and simple assessments, or even more, on current impressions and instinctive decisions. For a significant number of decisions in terms of personal consumption, there is a limited possibility to have verifiable information. Moreover, the purchase can often be triggered by an unplanned event or a momentary mood (impulse buying).

Several studies have tried to empirically confirm the impact of reputation on consumer or user decision-making. This chapter mainly refers to those studies that have studied the behaviour of individuals who, under conditions of incomplete information, choose which product to buy or use. Interestingly, not all researchers agree on the significance of the impact of reputation on business success. Moreover, the approaches reported by researchers as to maintaining/ building reputation also differ significantly.

For example, an interesting paper by Rao (1994) talks about stimulating demand and, basically, the process of building a reputation in the US automotive industry from 1895 to 1912, when there was no specialized press or an organized system for comparing the quality of manufacturers according to generally accepted scales of criteria. In other words, it would be a typical case of information asymmetry, i.e. a product whose objective value is not able to be estimated by the average consumer. For the purpose of "signalling" values, i.e. differentiating their product and building their reputation, car manufacturers participate in car races. What is interesting are the conclusions of the research that indicate that good placement in races did not put the winning car brands in a more favorable position (better sales) compared to other manufacturers.

Bräuninger and Haucap (2003) conclude quite the opposite. They analyze the process of selection of scientific journals and articles by members of the scientific community (the decision refers to whether researchers will read and use a scientific source) and conclude that "in situations of imperfect information, individuals tend to economize information costs and rely on signals to form beliefs about quality".[17]

There are several authors (Noe 2012) who argue that the relevant theory of reputation has yet to be elaborated. Some of them offer guidelines for building a research model. They believe that the research model in question should have the ability to differentiate individual (specific) stakeholders and should unambiguously determine the impact strategic efforts undertaken by entrepreneurs (reputation-forming behaviour) have on changing the behaviour of those towards whom the promotional efforts are directed.

CONSUMER BEHAVIOUR AND INDIVIDUALIZED UTILITY

Utility models are important in microeconomic theory for determining the market equilibrium price.[18] However, apart from explaining equilibrium prices in supply-demand relations, microeconomic theory does not show much interest in consumer behaviour.

Namely, when describing consumer behaviour, textbooks explicitly treat value as subjective (Mankiw et al. 2013: 152) and they define value as the sense of worth an individual feels for owning or using a good. The concept of utility is built on the determination of value in the eyes of the consumer. Utility is inherent to an individual and results from the mode of enjoyment (objective technological and economic possibilities for enjoying/exploiting a good) and personal characteristics (personality, value attitudes, etc.). If expressed in monetary terms, the personal utility for an individual may differ significantly from the 'average' market price. The range of differences will depend on the individual and his/her personal reasons and preferences which the theory calls "consumer preferences", while the scale of the difference between the market price and personal utility is called "consumer surplus".

The individualized perception of value/utility has been present in theory for quite a long time. The Austrian School (Wieser 1891) already advocates the view that "the value of commodities is derived wholly from their utility, but the utility they afford is not wholly convertible into value". It should be noted that the term value in the quotation refers to "market value" and not individual value. This is evident from the

[17] The issue of quality has not been mentioned in the paper so far. In this context, quality would have a similar meaning, that is, the impact on behavior, as well as the personally estimated utility.

[18] Since TCT focuses on individual transactions, they will use the term *bargain price* when talking about market relations and *contract price*, when market relations are limited via contracts i.e. if a relation is additionally and autnomously regulated by a mutually expressed will of contracting parties.

continuation of the description: "(...) goods that are not to be had in sufficient quantity acquire a value which as a rule is less than their utility."

Contrary to this orientation towards a socially established measure of utility, more recent interpretations tend to emphasize fragmented behaviour in consumer markets as well. For example, in the field of industrial organization, the individualized approach is explicit in the interpretation of strategic behaviour as individually rational, whereas the theory of the firm, emphasises the specifics of each transaction. Examples are visible in the business strategy management and marketing literature in the guidelines for market segmentation, product differentiation, advertising policies and branding, etc. [19]

Thus, the essential determinants of the contemporary theoretical view of consumer purchasing practice would be related to the following expectations: situations of incomplete information and consequently limited rationality; the existence of opportunities for opportunistic behaviour, which is in fact the core of entrepreneurs' reputational efforts; segmentation of the consumer market created by individualistic recognition of values and the influence of random, unpredictable, non-controllable factors in consumer choices and actions.

All of the above would imply that the purchasing decisions do not guarantee the buyer maximum (economically efficient or optimal) utility levels. This conclusion rests on the premise that a person is not capable to objectively identify measure and compare the value of a product, irrelevantly whether the consumer's buying choice is made on the scale of his/her own preferences, or withing the variety of competitive products offered on the market. From the perspective of the producer, the acceptance of the idea of unpredictability of consumer behaviour will suggest that costs and efforts invested in any form of strategic behaviour will be hard to recover and can, at best, considered questionable.

Personal experience as a starting point for anticipating the value of experience goods

As stated in the Introduction, the fundamental property of economic goods is the possession of value. For some goods, the market prices will come closely to total production costs incurred to place the product on the market. However, there are also goods whose market price can deviate significantly from the producer price. The traditional economic interpretation of these discrepancies is attributed to supply-demand relationships. Namely, the excess of demand in relation to the available supply raises the selling prices, thereby increasing the seller's profits, while the lack of demand in relation to the supply lowers the selling prices, creating a loss for the sellers.

[19] The same topics are encountered in industrial organization, but there are differences in the way of expressing and the degree of formalizing theoretical patterns. Moreover, the already described TCT's premise that values (prices) on the market are determined transactionally, suggests individualized utility.

Strategically oriented literature will expand this basic interpretation by arguing that different groups of goods exhibit different patterns in determining market value. For some commodities, such as those traded on regulated markets (stock exchanges), price formation will be influenced by anticipating future prices. Since the subject of trading is homogeneous, the factors affecting future prices are relatively predictable (weather conditions, geostrategic processes), the buyer selects the product and the manufacturer by comparing the offer. The theory calls these goods "search goods".[20]

Contrary to these, in other markets, the influence of personal judgment will be more significant. The very concept of experience goods was coined for the purpose of obtaining a convincing explanation of why and when the buyer is willing to accept a selling price that is not necessarily based on "objective" production costs. Thus, experience goods are considered in opposition to "value-recognizable" goods.

What characterizes the concept of experience goods is the specific way in which their value is perceived. These are goods whose value can only be defined once the product has been purchased and experienced. (Wikipedia: SEC classification of goods and services). Or, according to Bräuninger and Haucap (2003): "(...) one cannot judge the product's quality without actually consuming it", which may also mean that another sample of the same good, for the same consumer, but on another occasion, may evoke a completely different feeling of satisfaction. Therefore, the personal experience acts as a starting point for anticipating the value of experience goods.

In this context of unpredictability of values, building a reputation becomes a reasonable strategy for an entrepreneur who wants to anticipate the (possible) future experience of customer satisfaction. It is also a metaphor for socially projected value. This socially accepted notion acts as a "signal" and is more significant when it comes to goods where the impossibility of objectively estimating the monetary value of a good is more pronounced. In such situations, the consumer is more likely to upgrade the autonomous process of valuation or to replace it with the suggestion "method".

There is more research that points to the strategic importance of reputation. Allegedly, a significant part of business success today is attributed to reputation and branding.[21] In a paper that analyses the effects of 13 factors (external, related to production and strategic efforts) on the competitiveness of agricultural producers in the post-Soviet countries of Eastern Europe, the (negative) reflection of reputation proved to be the most significant of all. The paper also emphasizes that reputational risk is one of the main challenges that agricultural managers face (Zakharchenko et al. 2019).

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[20] The topic of the classification of goods was discussed in more detail in the article published within the publication Challenges of the Wine Sector in the Republic of Croatia (Kaštelan-Mrak, Kaštelan, 2023).

[21] *According to recent studies, today, about 80% of the value of a brand falls on its* ***intangible assets****. These assets are divided into:* ***reputation****, commitment to employees, identity, customer satisfaction and the propensity of people to recommend the company's products or services (*https://202digitalrep.com/en/reputation-economy/) (April 29, 2024)

Examples of consumer behaviour in wine markets

Below is an overview of several empirical studies that thematise the factors that affect consumer behaviour. Inherent in the previously explained theoretical approaches, research often evaluates consumer responses to wine markets prices.

In the context of understanding the markets where small farmers interact, the papers that emphasize the extreme fragmentation of such market are interesting. Almost every paper stresses the locality, either by looking at how local markets respond to prices or, as is the case with wine markets, at the significance of the geographical origin of wine. Namely, the influence of the recognisability of the region from which the wines originate is confirmed from the earliest to the most recent research (Gene et al., 2024). For this reason alone, wine cannot be considered a homogeneous good.

However, the reason why the positioning of agricultural producers of non-standard goods is additionally difficult is the high uncertainty (volatility) of consumer behaviour. Research also points to significant differences present in consumer behaviour. Namely, wine in many ways belongs to the category of experience goods. It is also worth noting that the concept of hedonic goods in the literature first appeared in a paper on agricultural economics (Schroeter et al., 2011). [22]

Several studies examining the market behaviour of consumers in wine markets are given bellow.

The first study is a research from the United States, specifically California (Buccola and VanderZanden 1997), in which the authors note that the demand for red wines shows inelasticity, wheras the demand for white wines shows elasticity in terms of price. They also confirm the difference in consumer behaviour in relation to wines of different origin (different regions) and of different reputation. [23] In a study conducted in Sweden (Dahlström and Åsberg 2009), when asked how they determine desirability (form preferences on the basis of which consumers decide whether to pay a certain price), the consumers answered that they trust the opinions of experts, i.e. wine critics, recommendations by friends, but there are also those that repeat the purchase of an already familiar wine. Another study by American authors (Schroeter et al., 2011) confirms the theses of the previous work because they confirm the influence of the subject in value assessments.

Schroeter et al. (2011) investigate price determinants in the wine markets of the USA, Canada, France, Germany, Austria and New Zealand. The results mostly confirm the results of previous research, namely that region, reputation, price category[24] and vintage affect market prices. What this research adds to previous ones is the

[22] Hedonic goods, similarly to luxury goods, refer to an already realized personal experience or to an expected experience of pleasure, similar to the concept of experience good.
[23] The original paper useses the term *prestigious*, which is more of a reflection of status signalling.
[24] Here the price plays the role of a value signal, so it works similarly to reputation because it suggests to customers, who are not experts, what kind of experience to expect.

highlighting of the influence of wine ratings as a factor leading to higher prices. The same authors also investigate the perception of quality by consumers and find that there is a tendency that the assessments at the time of the research correspond to previous experiences and a priori attitudes derived from the knowledge on expert ratings. The observation is significant as an indicator of the limited possibilities of recognizing the quality of wine by the majority of consumers. Such a situation is also confirmed by research on the experiences of wine consumers on the domestic market, specifically in Primorsko-gornaska County, Croatia. Vretenar (2023) confirms the influence of demographic factors on consumer preferences, while Katunar et al. (2024) report on the results of a blind wine tasting. This research pointed to different levels of self-confidence of respondents depending on their demographic characteristics, as well as to "mistakes" in discerning whether a wine belongs to a higher or a lower price category.

Moreover, in more recent times and in the immediate vicinity, an Italian study from 2019 stands out (Mauracher et al. 2019). It recognizes the impact of the moment, that is, the current social attitudes,[25] on the consumer's willingness to pay a certain price (willingness to pay - WTP is a frequently used category in surveys on consumer behaviour). Comparing the attitude towards the declared organic characteristics of the wine, it was established that there are significant differences between the socio-demographic groups on the market. In addition, as expected, the impact of the price level on the willingness to buy was confirmed, as well as the fact that the price elasticity of demand for organic wines is less pronounced. Another valuable observation was that consumers who buy wine less often are less price sensitive.

Another interesting study (Donze and Katsumata, 2022) deals with an international comparison of wine imports. It is singled out here as another argument in support of the thesis that the value of wine is more often determined as a result of social influences than for technological reasons and production costs. Similar to previous research, it supports the thesis that differences in consumer behaviour can be explained by socio-economic factors, and that buying wine often carries the meaning of a social act i.e. an individual's social distinction.

What is present in all of the mentioned studies is the factor of limited predictability of consumer behaviour, followed by numerous patterns of price movements as an expression of value. All of the above makes the discernment of the factors that entrepreneurs should incorporate into their own strategies very challenging.

CONCLUSION

The mere fact that business plans often remain unrealized, whereas, at the same time, real events follow their own dynamics, calls for constant additions to the theory. To understand the business success of small entrepreneurs, especially in the agricultural production sector, it is important to familiarize oneself with the theoretical framework behind the factors determining the value of products. The

[25] which could even be considered a fad, therefore unrelated to input prices or any other technical-technological (objective) factor

challenge is equally great for determining strategies in the development of one's own organization, and for the positioning of products in consumer markets.

The number of theories increases by day. Alongside the "resource approach", which nowadays puts intangible resources in a central position, many other approaches, for example those directly aimed at explaining the process of price formation in the markets, tend to emphasize the limited predictability of future events. In its newer modified version, the resource approach follows on the transaction costs theory and the theory of incomplete contracts, which individualize the question of value determination, linking them to individual entrepreneurs operating in specific market and business circumstances. In this perspective, the theory implies that the model of building one's own organization starts from the recognition of the situation in the markets, and results in the selection and structuring of sufficiently reliable mechanisms to control critical transactions and resources.

Today, consumer behaviour is also observed from a similar individualized angle. In principle, in theory, the value for the consumer is proportional to the expected utility. It may be assumed that utility can be quite subjective, but with a caveat that subjective assessment is (medially) connected to external influences: socially encouraged patterns of value (fashion), but also intentional and strategically driven actions taken by entrepreneurs. Like any strategic behaviour, it also aims at projecting and/or changing value attitudes. However, as with all planning efforts, impact on the consumer is not guaranteed. Therefore, the consumer's decision about the actual purchase will always remain quite uncertain, sometimes dependent on whim and sometimes triggered by a random, unpredictable event.

Examples from the sphere of winemaking confirm that the shaping of the experience goods' value can be understood better by studying market price mechanisms. Moreover, considering the likely high fragmentation of the experience goods market, it is desirable to follow the logic of clear (even narrow) specialization/focus when designing the most profitable organizational development models and in shaping market strategies. As authors, we believe that precisely such a differentiated approach could best improve the business of small Croatian agricultural producers.

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EXPLOITING THE POTENTIAL OF SOCIAL NETWORKS BY FAMILY FARMS IN CROATIA

CHAPTER 12

Nina Grgurić Čop *

ABSTRACT

Family farms account for more than half of all registered agricultural entities in Croatia, making them essential not only for rural development but also for the economy. However, there is no unified, free platform for family farms to market their products and connect with consumers, leading to a market gap that social networks can help bridge. This chapter analyzes the Facebook pages of family farms across Croatia to determine the interrelation of the number of social networks the farm is active on and the diversity of posts on Facebook with the number of "likes" and follower engagement (reactions, comments, and shares on the last ten posts). The results indicate that the number of social networks brings about only an increase in the number of "likes", while the diversity in Facebook posts attracts both more "likes" and greater follower engagement. The findings also point to the family farms' underutilization of the social network potential in relation to sharing essential information (location, main activity), brand development and promotion of family farms from specific regions and trades. Family farms should thus put more effort into social networking. They should offer delivery through these channels, increase posting frequency, and collaborate with social media influencers.

Keywords: *family farm, social media, Facebook, follower engagement, influencer marketing*

INTRODUCTION

Family farm is an organizational model in which a farmer, as an individual, independently and continuously engages in agricultural activities and supplementary activities to generate income. According to the Family Farms Act (Zakon o obiteljskom poljoprivrednom gospodarstvu, NN 29/2018), this model is based on utilizing family-owned and/or leased resources and relies on the labor, knowledge, and skills of family members. Data from the 2023 Annual Green Report on Agriculture, based on the Registry of Farmers and Family Farms at the Agency for Agricultural Payments, Fisheries, and Rural Development (APPRRR), shows that Croatia currently has 122,879 registered family farms, representing 74.6% of the total number of registered farmers (Ministarstvo poljoprivrede, šumarstva i ribarstva, 2024). This makes them key players not only in the country's agricultural production but also in its economic development, as they contribute to rural growth through employment and investments.

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Family farms play an essential role in food production, typically producing smaller quantities but in a more sustainable way than large agricultural corporations. Given their dependence on their surrounding environment, family farms employ production and storage methods that help preserve the environment, biodiversity, and the longevity of heirloom varieties (Darnhofer, 2010; Toader & Roman, 2015). While traditional farming methods have allowed family farms to withstand supply chain challenges in agriculture (Aguiar et al., 2018), they can also quickly adapt to market changes, such as shifts in demand and innovations (Darnhofer, 2010). This economic significance underscores the importance of providing family farms with necessary support through incentives, tax relief, infrastructure development, and education for family farm owners and employees, as well as regulatory policies that ease their operations. One way to support family farms is through a unified platform where they could present and distribute their products and services across Croatia. An initiative called "Family farms of Croatia" was launched in 2020 to address this need, yet, four years later, the platform remains inactive. While some similar platforms exist at local levels and with associated fees, family farms lack a unified free platform to promote their products and communicate with consumers. Social networks thus emerge as a solution to bridge this gap, allowing for free product promotion and direct consumer engagement.

Social media has several advantages over traditional advertising. It offers a relatively affordable way to reach consumers compared to traditional promotion channels like television or newspaper ads (Ogidi & Anthony, 2016), making it an ideal tool for small businesses, including family farms (Skaalsveen et al., 2020). Social media facilitates direct communication with current and potential customers, providing insight into consumer desires and needs, allowing businesses to adapt quickly (Heller Baird & Parasnis, 2011). Family farms can also use social media to tell their story, emphasize competitive advantages, and communicate their values, creating unique brand associations over time (Thompson et al., 2018). Furthermore, social networks allow for micro-targeting, ensuring that family farms' messages reach the consumers most interested in their products and services (Dubois et al., 2021). Additionally, social media enables family farms to easily reach geographically distant target audiences without incurring extra costs (Yang et al., 2016). Due to family farms' seasonal offerings, which vary throughout the year, social media offers the simplest way to promote current and upcoming products. In cases where products are perishable, such as fresh produce, meat, or eggs, social media enables efficient dissemination of delivery schedules to minimize waste. Social media also allows for organizing events (virtual or live) and contests, fostering loyalty and a sense of connection with the business. Moreover, social media makes it easier to find business partners for synergistic opportunities (e.g., agrotourism) or improve current practices. It can also educate the broader community about sustainability in food production, storage, and preservation, as well as connect family farms with experts who can help improve their operations through innovative production methods, administrative assistance, and promotional strategies.

Despite the evident benefits of using social media in business, there is limited research on how family farms in Croatia use social media. Thus, the purpose of this chapter is to investigate how Croatian family farms use social networks: the

channels they employ, the content they share, and their effectiveness in attracting and engaging their audiences. The chapter analyzes Facebook pages of 103 family farms from various regions in Croatia. Based on the analysis of social media channels, content posted, and its relationship with follower engagement, recommendations are provided to help family farms in Croatia better leverage the potential of social media.

THE IMPORTANCE OF SOCIAL MEDIA FOR FAMILY FARMS

Previous research on digital marketing usage by small agricultural producers, known as family farms, highlights the frequent use of social networks like Facebook, WhatsApp, and YouTube among farmers to promote their products and communicate with consumers. These platforms allow small farmers to reach a broader audience and provide timely information about their products and services (Meena et al., 2022). For instance, a case study on Cedar Park Farmers Market demonstrates how a Facebook page can serve as an effective marketing platform by sharing information about available products and upcoming events, thereby attracting and retaining customers (Cui, 2014). Social media also serves as a valuable market information source, enabling farmers to monitor trends and consumer preferences. Platforms like Facebook and Twitter facilitate the exchange of market information among farmers, which enhances their decision-making abilities (Phillips et al., 2021). However, achieving positive outcomes from social media requires digital literacy, emphasizing the need for targeted interventions to improve farmers' digital skills (Mokhtar et al., 2022).

Social networks can also help family farms build trust with consumers. For example, blogs are often used to raise awareness and build trust with consumers, addressing challenges such as food safety and urbanization (Zhang et al., 2016). Platforms like Twitter promote knowledge-sharing among farmers, fostering virtual networks that support sustainable farming practices. These networks allow farmers to share experiences and learn from one another, fostering a sense of community (Mills et al. 2019). This sense of community contributes to the development of innovative, effectively targeted, and creative business models that positively impact farm operations (Ge & Li 2023). Drejerska et al. (2019) point out that social media can strengthen relationships with consumers and establish short supply chains, even when consumer interactions remain limited to offline settings.

Collaborating with social media influencers to promote agricultural products also brings many benefits, primarily due to influencers' ability to effectively reach and engage diverse audiences. A recent report based on data from marketing agencies and brand managers projects that the influencer marketing industry will reach a value of approximately $24 billion by the end of 2024, with a quarter of respondents planning to allocate nearly half of their marketing budgets to influencer campaigns on social networks (Geyser, 2024). Influencers' credibility enhances the perceived quality of the information they share (Kim et al., 2024; Fransiska et al., 2024), allowing them to effectively bridge consumer trust and purchase intentions, making them valuable resources for promoting agricultural products (Chen, 2023). Social media influencers skillfully create content that attracts audience attention, thereby

increasing the reach and impact of promotional messages. Their ability to create engaging, innovative, and trustworthy content fosters emotional connections and improves information quality, which is essential for effective advertising (Zhang & Choi, 2022). Community structure and social media influence play crucial roles in information dissemination. Selecting influencers with strong community connections allows businesses to maximize the effectiveness of their promotional activities (Wang & Wei, 2024).

Influencers can identify and engage specific communities interested in agricultural products, such as those focused on organic or sustainable products. This targeted approach helps reach potential consumers more likely to appreciate specific product attributes (Soares et al., 2024; Yekimov et al., 2021). Strategic collaboration with influencers with high content customization and subtle brand promotions can significantly boost engagement metrics, including reactions, comments, and shares (Matous, 2023; Wies et al., 2023). Moreover, by engaging influencers, businesses fulfill audience needs for entertainment, information, and connection with others (Zhang & Choi, 2022).

Using social networks by small agricultural producers significantly enhances product promotion and consumer interaction. When applied effectively, social networks enable family farms to reach broader audiences, foster trust, and ensure access to timely information. The following section presents an empirical study analyzing how Croatian family farms utilize social networks in their business operations.

EMPIRICAL RESEARCH

Methodology and Sample

The study analyzed Facebook pages of family farms, selecting Facebook because it is a common choice for social media promotion among farmers (Meena et al., 2022). The sample included family farms from the first 11 pages of Google search results using the keywords "OPG" (Croatian abbreviation for family farms) and "Facebook." The search was conducted in Google Chrome's incognito mode to avoid personalization of results based on previous searches on the same computer. This method ensured that Google ranked results according to their relevance to the keywords, the quality and relevance of page content, and ease of access across devices (Google, 2024). The sample excluded duplicate results and those unrelated to individual family farm Facebook pages, as defined by Article 5, Paragraph 1.a of the Family Farms Act (Zakon o obiteljskom poljoprivrednom gospodarstvu, NN 29/2018). For instance, the Facebook group “OPG Hrvatska” was excluded since it is not an individual family farm. After filtering, the final sample comprised 103 Facebook pages from family farms across various regions of Croatia.

For each of the 103 family farms in the sample, the following details were analyzed: basic information (location and offered products), number of Google recommendations, mentions, check-ins, overall Google rating, number of Facebook followers, recommendation count and percentage on Facebook, region (Central

Croatia, Northern Croatian Coast, Dalmatia, Gorski Kotar and Lika, and Eastern Croatia), follower engagement as operationalized by reactions, comments, and shares on the last ten posts, and content diversity. Content diversity was analyzed in mid-September to capture posts related to the harvest and delivery of fruits and vegetables, which starts earlier due to weather changes (Gugić, 2023). Content diversity was coded as follows:

- *Process videos*: Videos related to production, delivery, product preparation, and other stages in the production, processing, and/or delivery process displayed on the family farm's Facebook page.
- *Product ideas*: Posts where farmers, beyond showcasing their products, share ways to use them, such as recipes featuring produced items, arrangement ideas, planting tips, or ambiance photos for those offering hospitality or tourism services.
- *Personal content*: Posts where farmers share photos or videos not directly related to their work, such as family moments, pets, or personal challenges in their business and private lives.
- *Contests*: Posts announcing contest rules and/or winners on the family farm's Facebook page.
- *Delivery information*: Posts indicating whether the family farm offers delivery and details on how it is organized. For egg and milk producers, distribution information (e.g., store locations) was included since these products are perishable, especially in summer months, and may not be feasible to deliver daily to multiple addresses.

Each family farm was coded from 0 to 4, depending on the variety of content types in the last ten posts. The collected and coded data were analyzed using JASP software (JASP Team, 2024). Most family farms in the sample (52%) were from Central Croatia, followed by Dalmatia (23%), Eastern Croatia (15%), and the Northern Croatian Coast (10%). None of the family farms in the sample were registered in Gorski Kotar and Lika (see Figure 1).

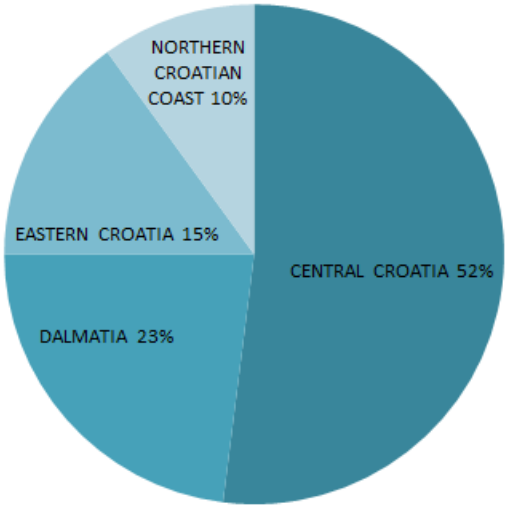

Figure 1 Geographic distribution of sampled family farms
Source: Author's work.

The analyzed family farms primarily engaged in the production and sale of vegetables and vegetable products (seedlings, preserves), representing one-quarter of the sample (see Figure 2).

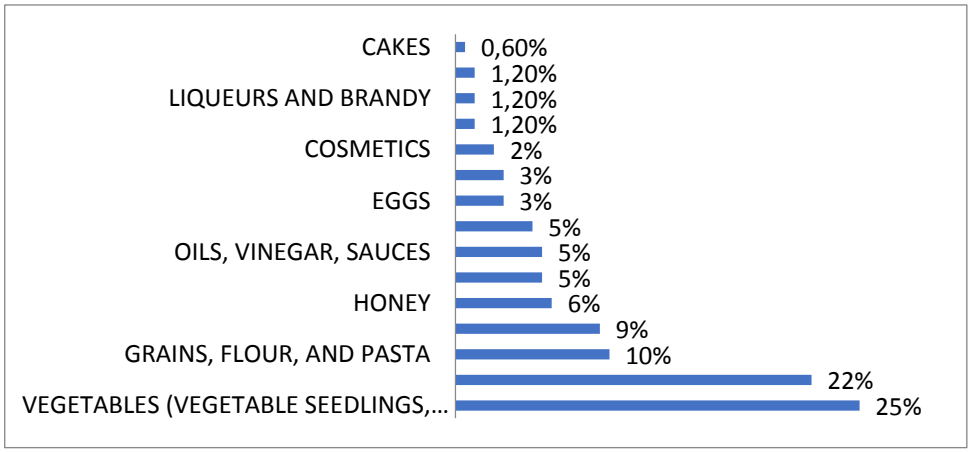

Figure 2 Distribution by product category of analyzed family farms
Source: Author's work.

The average rating of the analyzed family farms on Google is 4.8 (with an average of 51 reviews per family farm), while 24 family farms are not rated there. More than half of the family farms in the sample have no mentions or recorded visits on Google (Table 1). Fruit production and sales (juices, jams) and nuts comprised 22%, followed by grains, flours, and pasta (10%), flowers and seedlings (9%), honey (6%), hospitality and tourism, oils, vinegars, sauces, and meat (fresh and processed) each at 5%. Less than 5% of the sample produced and sold eggs, spices, essential oils, cosmetics, dairy products, liqueurs, spirits, wines, and baked goods. It is important

to note that most family farms engaged in multiple types of products or services, meaning one family farm might appear in several categories (e.g., fruit production, honey, and hospitality services).

The average Google rating for the analyzed family farms was 4.8 (with an average of 51 reviews per family farm), and 24 family farms were not rated on Google. More than half of the family farms lacked mentions or recorded check-ins on Google (see Table 1).

	Google				Facebook			
	Rating	**Number of reviews**	**Mentions**	**Check-ins**	**Likes**	**Followers**	**Number of recommendations**	**Percentage of recommendations**
	4.8	51.2	102.6	78.5	3736	3866	31	97
No data (%)	23%	23%	64%	72%	12%	0%	54%	54%

Table 1 Average follower count, ratings, and recommendations on Google and Facebook
Source: Author's work.

On Facebook, the average number of "likes" was 3,736, and the average number of followers per page was 3,866. Recommendations on Facebook appear only if more than five followers leave feedback; thus, data was missing for 54% of the sample. For the remaining sample, the average number of recommendations was 31, with 97% being positive.

Social Media Channels and Content Analysis of family farms

Since the analysis focused on Facebook pages, all family farms in the sample have a profile on this platform. Additionally, a Google search verified their presence on other social media networks, including Instagram, YouTube, blogs, TikTok, and X (formerly Twitter). Searches used the full name of the family farm, e.g., "OPG Firstname Lastname" along with the platform name. Separate Google searches were performed for each platform, and if profiles existed without the "OPG" prefix, they were excluded. Figure 3 shows the percentage of family farms in the sample with profiles on other social networks besides Facebook. More than half of the sample also has an Instagram profile, though many profiles on Facebook and Instagram show limited activity, often restricted to posts shared by individuals associated with the family farm. Significantly fewer family farms use YouTube (9%), maintain a blog (7%), or have TikTok (5%) or X (%).

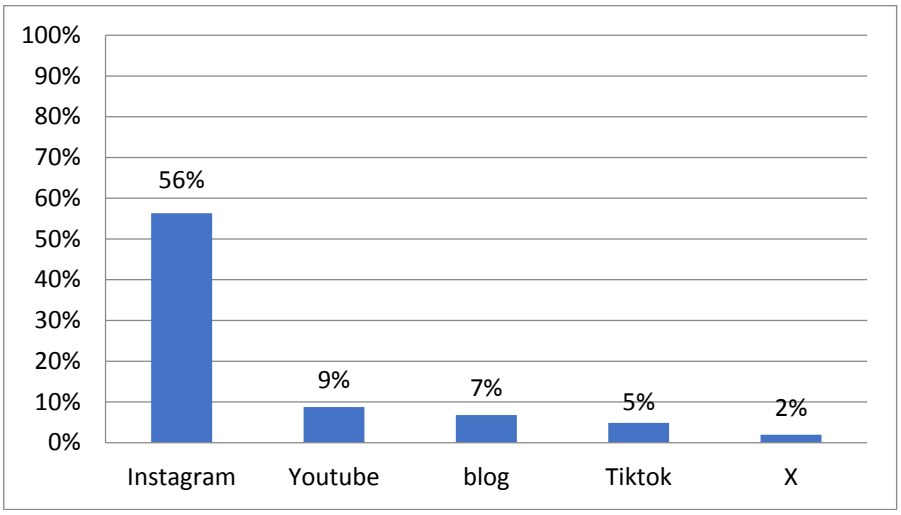

Figure 3 Family farm social media channels besides Facebook
Source: Author's work.

Given the increasing use of geolocation services for shopping and leisure activities, providing an accessible and accurate location is essential for attracting new customers and visitors. However, basic information on the Facebook pages of many family farms, including location and product/service descriptions, is often incomplete. The location, a basic detail, is not clearly listed on 17% of the pages. In some cases, the location is too general (e.g., "Hvar") or too specific (e.g., street name only). Sometimes, multiple locations are listed, or the location is ambiguous (e.g., "Kastela, North Maluku, Indonesia, Split").

Similarly, 19% of pages lack a clear description of the family farm's primary activities or the products and/or services they offer. Often, only a general description such as "local business" is provided, which does little to distinguish the family farm. Incomplete descriptions can mean that followers miss out on the full range of products or services offered. In two cases, page descriptions were provided in both Croatian and English, aligning with tourism trends that show most tourists in Croatia are international (DZS, 2024).

Although family farms have the option to sell directly from their premises, followers often expect delivery services to be available in urban areas. Information about delivery (when and where it will occur) was provided on just over half of the family farm pages (54%) in the last ten posts. Instead of delivery details, many pages feature calls to action like "Visit us!" or "Contact us!".

The diversity of posts on the Facebook pages of observed family farms (see Figure 4) reflects the types of content, including contests, personal updates, videos, product ideas, or delivery information.

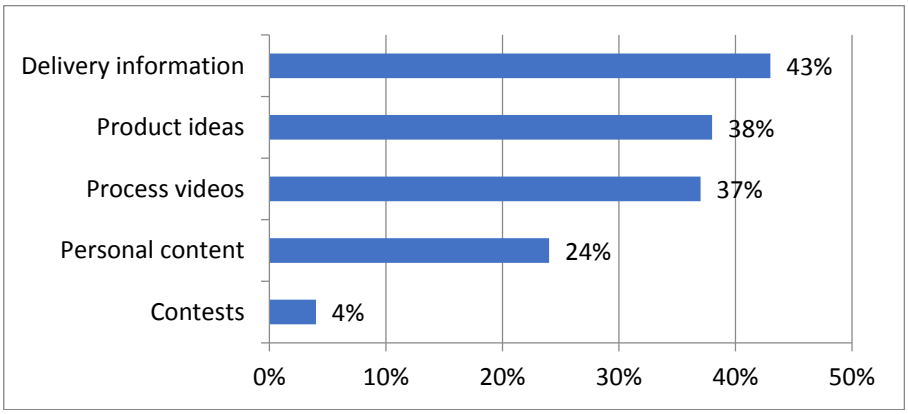

Figure 4 Content diversity of family farm Facebook pages
Source: Author's work.

The analysis results show that family farms frequently share delivery information (47%), followed by product ideas (38%) and videos (37%). Personal content is shared by a quarter of the sample (24%), while only 4% of family farms organize contests.

Using Social Media for Audience Reach and Engagement

One major advantage of social media is the vast reach it provides (Cui, 2014). To determine the relationship between content diversity, the number of social media channels, and the number of "likes" on family farm pages, as well as follower engagement, a one-way ANOVA was conducted. Tukey HSD post-hoc tests were used for content diversity analysis, while Games-Howell tests (Ruxton & Beauchamp, 2008) were applied for differences in the number of channels due to significant group size variation.

Table 2 shows that family farms with more diverse content receive more "likes" ($F_{(4,89)} = 3.806$; $p < 0.05$). Post-hoc testing (see Table 3) revealed statistically significant differences in "likes" between family farms with minimal content variety and those with high content diversity.

Cases	Sum of Squares	df	Mean Square	F	p
CONTENT DIVERSITY	4.082 ×10+8	4	1.020×10+8	3.805	0.007
Residuals	2.386×10+9	89	2.681×10+7		

Table 2 Relationship between content diversity and "likes"
Source: Author's work.

			95% CI for Mean Difference				
		Mean Difference	Lower	Upper	SE	t	p
0	1	-417.243	-4.607	3.773	1.504	-0.277	0.999
	2	-2.683	-7.147	1.780	1.603	-1.674	0.455
	3	-3.142	-9.617	3.332	2.325	-1.351	0.660
	4	**-9.689**	**-17.702**	**-1.676**	**2.877**	**-3.367**	**0.010**
1	2	-2.266	-5.875	1.343	1.296	-1.748	0.410
	3	-2.725	-8.643	3.193	2.125	-1.282	0.703
	4	**-9.272**	**-16.842**	**-1.702**	**2.718**	**-3.411**	**0.008**
2	3	-459	-6.574	5.656	2.196	-0.209	1.000
	4	-7.005	-14.730	718	2.774	-2.525	0.094
3	4	-6.546	-15.584	2.490	3.245	-2.017	0.266

Table 3 Post-hoc comparison for content diversity and number of "likes"
Source: Author's work.

Having more than one social media channel besides Facebook ($F_{(2,91)} = 3.127$; $p < 0.05$) is also associated with a higher number of "likes" (see Tables 4 and 5).

Cases	Sum of Squares	df	Mean Square	F	p
NUMBER OF CHANNELS	1.797×10+8	2	8.984×10+7	3.127	0.049
Residuals	2.615×10+9	91	2.874×10+7		

Table 4 Relationship between number of channels and "likes"
Source: Author's work.

		95% CI for Mean Difference					
Comparison	Mean Difference	Lower	Upper	SE	t	df	p
1-2	**-2.523**	**-4.938**	**-108**	**1.007**	**-2.504**	**67.502**	**0.039**
1-3	-4.044	-10.263	2.175	2.147	-1.883	7.526	0.209
2-3	-1.520	-7.843	4.802	2.302	-0.661	9.883	0.791

Table 5 Post-hoc comparison of number of channels and "likes"
Source: Author's work.

Despite the reach social media provides, audience engagement (reactions, comments, shares) is crucial. Engagement indicates audience interest and willingness to interact, which builds follower loyalty (Helme-Guizon & Magnoni, 2019) and purchase intent (Onofrei et al., 2022). Social media algorithms also prioritize posts with high engagement, amplifying visibility over time (Lee et al., 2018).

Follower engagement analysis (see Table 6) shows a significant link between engagement and content diversity ($F_{(4,98)} = 3.598$; $p < 0.05$). Family farms that diversify posts - showcasing product uses, sharing videos, personal moments, contests, and delivery details - enjoy higher engagement levels (see Table 7).

Cases	Sum of Squares	df	Mean Square	F	p
CONTENT DIVERSITY	5.748×10+6	4	1.437×10+6	3.598	**0.009**
Residuals	3.915×10+7	98	399469182		

Table 6 Relationship between content diversity and follower engagement
Source: Author's work.

			95% CI for Mean Difference				
		Mean Difference	Lower	Upper	SE	t	p
0	1	235,05	-275.46	745.56	183.69	1280	0.704
	2	-327.35	-857.47	202.78	190.75	-1.716	0.429
	3	112.5	-567.21	792.21	244.57	0.460	0.991
	4	-164.81	-1.058.46	728.84	321.55	-0.513	0.986
1	**2**	**-562.40**	**-985.07**	**-139.73**	**152.08**	**-3.698**	**0.003**
	3	-122.55	-722.23	477.13	215.77	-0.568	0.979
	4	-399.86	-1.234.26	434.54	300.23	-1.332	0.672
2	3	439.85	-176.63	1.056.32	221.82	1983	0.282
	4	162.54	-684.01	1.009.08	304.6	0.534	0.984
3	4	-277.31	-1.224.73	670.11	340.9	-0.813	0.926

Table 7 Post-hoc comparison for content diversity and follower engagement
Source: Author's work.

Finally, the number of social media channels an family farm uses ($F_{(2,100)} = 0.664$; $p = 0.517$) did not correlate with higher follower engagement (see Table 8).

Cases	Sum of Squares	df	Mean Square	F	p
NUMBER OF CHANNELS	588.662.695	2	294331348	0.664	0.517
Residuals	4.431×10+7	100	443077483		

Table 8 Relationship between number of channels and follower engagement
Source: Author's work.

During the analysis of family farm social media pages, special attention was given to collaborations with influencers. Out of the 103 family farms in the sample, only three had visible partnerships with influencers. Since there is no standardized way to identify such collaborations, it is possible that other family farms work with influencers as well, but these partnerships are not sufficiently transparent to appear in searches when reviewing family farm social media activity. However, the fact that no other partnerships surfaced when searching for family farm names in combination with various social media channels, or within the last ten posts (which, in some cases, span several months), suggests that family farms rarely collaborate with influencers, or that such collaborations are not well-labeled and connected to the family farm's own social media profiles.

Improving Social Media Management for family farms

The analysis of social media use by family farms in Croatia revealed significant potential for improving existing practices. First, given the popularity and reach of social media, family farms are underutilizing opportunities to represent themselves on the Facebook platform, even in a basic form—by providing a location and description of their products/services. Almost a quarter of the analyzed Facebook pages lacked these basic details or only included a generic description such as "local business," suggesting that many family farm owners have not yet recognized the importance and full potential of social media as an effective tool for reaching new customers. Second, in most cases, family farms are missing the opportunity to use social media to create a brand identity separate from the individuals behind it. Very often, the family farm's name includes the personal name of the family farm owner, which is often generic or simply indicates the general area in which they are located. Such family farm names do not communicate the business's activities. Additionally, family farm owners frequently post content on social media from their personal profiles and tag the family farm's profile, which is not beneficial for building a distinct identity for the family farm. Third, the sampling of family farms revealed a lack of family farms from the Lika and Gorski Kotar regions, which is surprising given the long tradition of agricultural and cured meat production associated with these areas. Also, very few family farms from the first ten pages of Google search results are engaged in wine and oil production, products often linked to Croatia's identity. Thus, there are product categories and geographic locations where family farms are not managing their Facebook pages effectively, meaning Google does not recognize them as relevant search results. Fourth, given the general trend of increasing delivery services (Gupta et al., 2024), family farms should strive to offer delivery options instead of merely inviting the audience to visit them during hours that often overlap with the usual working hours of most people (until 4 or 5 pm). Fifth, although not separately addressed in the analysis, data collection revealed that some family farms post surprisingly infrequently. For example, one family farm in the sample had only made eight posts in the four years since its profile was created.

According to the results of the analysis, family farms should develop content diversity on their Facebook pages, as greater content variety is associated with a higher number of followers and greater follower engagement in terms of reactions, comments, and shares. Figure 5 shows how family farms can enrich their page content.

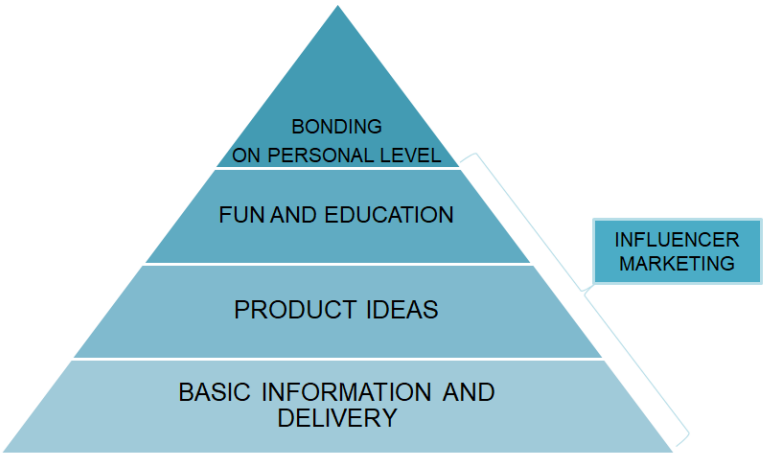

Figure 5 Enriching family farm Facebook post content to increase followers and engagement
Source: Author's work.

First and foremost, family farms should provide clear, easily accessible information about their exact location, the availability of their products and services, and updated delivery times and locations. Page content can then be enhanced by moving beyond the usual product photos to show specific product uses, such as sharing recipes, gift packages, or showcasing the setting and highlighting its purpose, e.g., agrotourism suitable for organizing children's birthdays. A further step involves posts on the family farm's page that share entertaining or educational content. For example, a video clip showing the planting process, educating about fertilizer use, or demonstrating the creativity of family farm employees and humorous situations they encounter during deliveries. Finally, building close relationships with the audience by sharing personal content, such as family moments, adventures with pets, or sharing situations that bring particular joy (e.g., receiving awards) or sadness (e.g., natural disasters), is crucial for maximizing the potential of social media, which enables connection with the audience. Influencers should also ideally be included in the first three levels. Influencers use their credibility, community connections, and content creation skills to increase consumer trust and drive purchasing decisions. This approach is particularly useful in the context of agricultural products, which often require a marketing strategy that highlights their unique advantages and sustainable aspects.

CONCLUSION

Social media provides a way for family farms in Croatia to promote their products and communicate directly with customers with very little investment. This chapter analyzed social media usage by 103 family farms from various parts of Croatia. The

results show that the number and engagement of followers are linked to the number of social media networks used by family farms and the diversity of posts they publish. To encourage engagement from a larger number of followers, family farms should invest in social media by posting timely, accurate information about their location, the products and services they offer, and delivery times and locations. In addition, social media provides the opportunity to build a family farm brand by sharing product-related content and ideas for using the product, sharing video clips of the production process, and sharing personal moments like family moments, pet-related content, or emotional moments with followers.

The sampling revealed a lack of family farms from the Gorski Kotar and Lika regions and of family farms involved in wine and olive oil production. This shows that family farms from these areas need to engage more in terms of more frequent posting of relevant content and attracting more people, so that the social media presence of these family farms is better ranked in Facebook page searches. Among the family farms in the sample, there is room for improvement in terms of the number of social media networks and the diversity of content they publish. Most family farms have Facebook, half have both Facebook and Instagram, while a very small percentage have open profiles on other social networks or blogs. It would be desirable for family farms to expand to other social networks for several reasons. First, due to the demographic diversity of the audience: while Facebook is mainly used by older generations, Instagram and TikTok reach a younger audience. Second, each social network is specific to a certain type of content, so on YouTube, for example, a detailed, documented video of the production or storage process can be shared, which is not suitable for Facebook or Instagram, while urgent announcements like delivery location and time can be posted on X (formerly Twitter). Third, using multiple social networks reduces the risk that changes in a social network's algorithm will result in a reduced reach of a family farm page. Fourth, profiles on different social networks help keep a family farm page higher in search rankings. In addition, it is important to emphasize the largely untapped potential of family farms to collaborate with influencers, who are an increasingly popular means of promoting products and services on social media due to the positive results they bring, from greater audience reach and engagement to increased product awareness and purchase intention.

Although social media offers numerous benefits for family farms, more attention needs to be paid to increasing digital literacy and encouraging family farms to invest in social media to enrich their in-person interactions with existing customers and attract new ones. Through regional and local government units and local action groups, family farm employees should be educated about the importance of social media and how to use it effectively. Additionally, efforts should be made to identify and promptly dispel prejudices against influencer marketing, given its high potential for promoting food products and agrotourism services. Ultimately, long-term investment in digital literacy and the integration of social media into the operations of family farms can contribute not only to greater recognition in the local market but also to opening up opportunities for expansion into international markets, which can further enhance the sustainability and competitiveness of family farms.

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FINANCING EUROPEAN AGRICULTURE: CURRENT STATE AND CHALLENGES

CHAPTER 13

Marko Tomljanović *

ABSTRACT

Agriculture is one of the most important sectors that has marked the development of European integration so far. Given its characteristics, limitations and sensitivity to global trends, European agriculture continuously adapts to new challenges in the global business environment. Therefore, EU assistance through funds and other available financial instruments is imposed as a necessity. The chapter analyzes the trends in financing European agriculture and presents the most important funds and financial instruments, with special emphasis on the European Agricultural Guarantee Fund and the European Agricultural Fund for Rural Development. Although there are significant resources, there are still limitations in their utilization, which, along with the priorities of the new cohesion policy and the necessity of achieving sustainable development, will represent the most important challenges of European agriculture in the current financial perspective.

Keywords: *EU, agriculture, funds, financial instruments*

INTRODUCTION

The European agricultural policy represents one of the fundamental policies of development of modern European integration, which, since its beginnings in the 60's of the 20th century, has always been exposed to significant pressures from the European and global environment, which required thorough changes. The basic idea of the European agricultural policy was to achieve the goals of safe and accessible food for the European population and to ensure the income of farmers. Furthermore, over time, the goals were extended to the areas of competitiveness, sustainability, and most recently to the respect of environmental protection standards, energy efficiency, while contributing to the goals of digital transformation (Kandžija and Cvečić, 2010). The complexity of this sector, which still includes a significant part of the European budget and overall legislation, emerges from all of the above mentioned. Also, with changes in goals and priorities, the structure and methods of financing were also changed. In doing so, a transition from the initial support for production, which resulted in the creation of large surpluses of agricultural products, to an approach based on two pillars, i.e. direct payments and rural development was achieved. Although it is characterized by a continuous decrease in

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Tomljanović, M. (2025). Financing European Agriculture: Current State and Challenges, in book Katunar, J., Vretenar, N., Jardas Antonić, J. (eds), Agriculture Through Sustainability Perspectives, University of Rijeka, Faculty of Economics and Business, Croatia.

employment and other negative economic and social trends, agriculture still remains one of the key factors for the survival of modern European integration and as such requires constant modernization and adaptation to modern business concepts. The researches dealt with in this chapter, which concern the analysis of the agricultural sector in the EU, represent a kind of continuation of the research of the wine sector (Katunar, Vretenar, 2023), and their goal is to identify key problems and challenges through the conducted analyses and to propose potential solutions that will contribute to the development of the sustainability of the agricultural sector.

The research subject in this chapter are funds and other financial instruments intended for the financing of European agriculture. The conducted research aims to analyse trends in the financing of European agriculture and the most important sources of financing, as well to define scientifically based challenges and perspectives of development and financing of European agriculture.

The research is presented through five interconnected chapters, which begin with introductory considerations and presentation of key elements of the research and its structure. In the continuation of the chapter, trends in the financing of European agriculture are analysed, with special emphasis on changes in financing approaches, which arose as a result of changes in the global business environment. The central part of this chapter is the systematization of the most important instruments for financing European agriculture. The considerations in this part of the chapter indicate the wide possibilities for achieving goals and priorities of European agriculture using available funds and other financial instruments. The knowledge presented in previous chapters created foundations for defining the key challenges and perspectives for encouraging the competitiveness and development of European agriculture, with a special emphasis on the sustainable development goals and the framework of the new European cohesion policy. The research ends with a conclusion, which represents a synthesis of the key findings that were reached during this research.

TRENDS IN FINANCING OF EUROPEAN AGRICULTURE

European agriculture, like other economic sectors, is faced with major challenges of globalization, which require significant changes and adaptation to modern business conditions. In such a situation, European agriculture is continuously changing and adapting its processes to the requirements of the fourth industrial revolution, characterized by automation, robotization and the increasing application of technological solutions in agricultural production processes. Also, in the context of the tertiarization of the entire economy, agriculture is becoming less and less attractive, especially for the young population, which results in the abandonment of villages and the deterioration of rural areas. The above is shown in Figure 1, which shows the employment trend in EU agriculture.

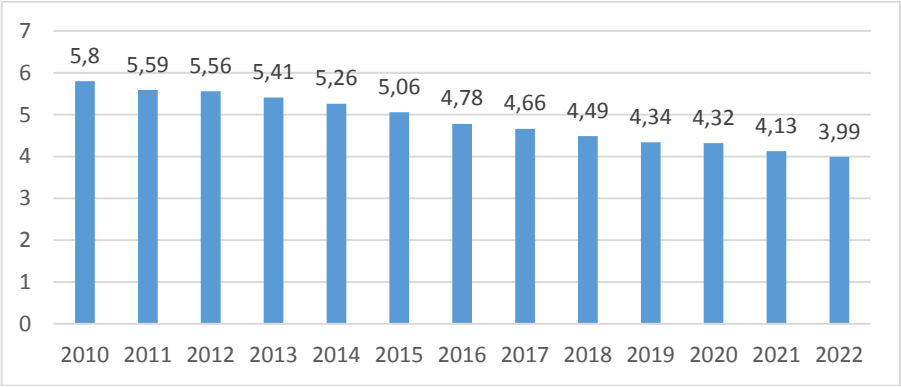

Figure 1 Employment in EU agriculture in period 2010-2022 (% of total employment)
Source: developed by author based on World Bank (1) (2024)

According to the available data, it is possible to conclude that employment in European agriculture is continuously decreasing. Namely, in 2022, 3.99% of employment was realized in agriculture, which represents a significant decrease compared to 2010, when employment in agriculture amounted to 5.8%.

Furthermore, the value added of agriculture during the observed period achieved oscillating trends, whereby in 2022 it contributed to the achievement of 1.7% of the EU's GDP, while the lowest value was achieved in 2016, when agricultural activities achieved 1, 59% of EU GDP (Figure 2).

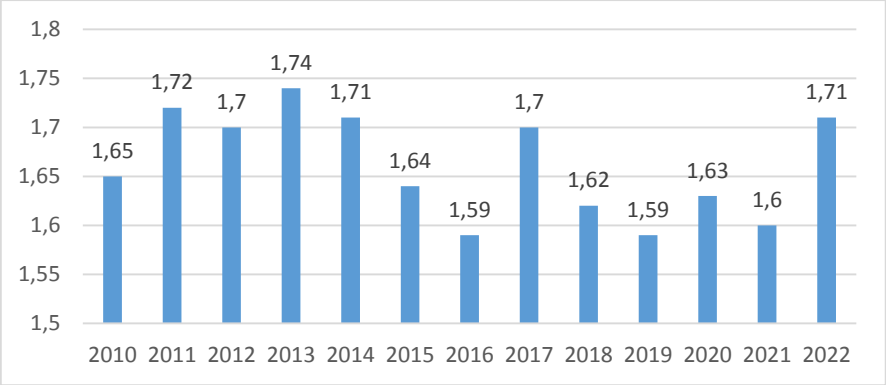

Figure 2 Value added of EU agriculture in period 2010-2022 (% of GDP)
Source: developed by author based on World Bank (2) (2024)

Despite the decreasing trends in key indicators, European agriculture still represents one of the key drivers of the European economy, primarily considering its role in providing food for the European population and generating income for the agricultural population. Nevertheless, contemporary considerations of agriculture indicate a transition from its traditionality toward synergy with other aspects of economic activity. Simply stated, agriculture is no longer a sector that is entirely oriented to the efforts of the individual, but represents an area of activity largely connected to other determinants of the economy. The financing of agriculture at the EU level is also moving in this direction, which is shown in Image 1.

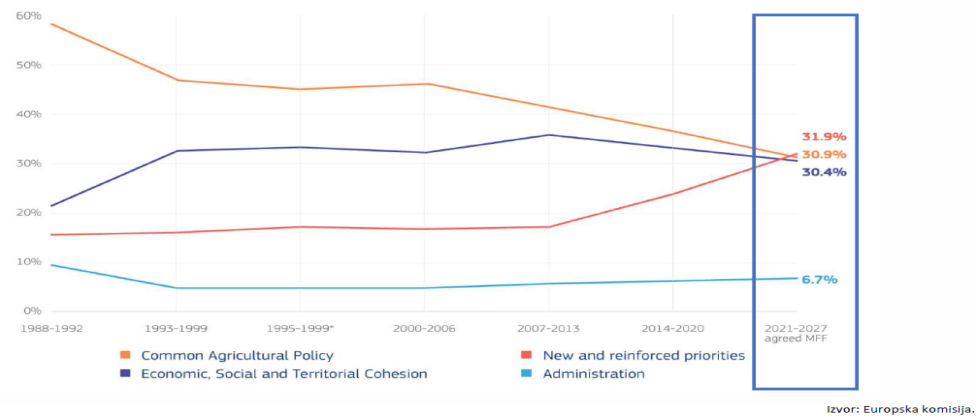

Figure 3 Trends in financing of EU agriculture
Source: European Commission (6), 2024

Figure 3 indicates that the share of agriculture in the European budget has almost halved in the last 40 years, and in the current financial perspective it occupies 30.9% of entire budget. On the other hand, there is a visible increase in share of budget intended for achieving economic, social and territorial cohesion, especially through available financial instruments and EU funds, and a significant increase in funds intended for the so-called new policies and priorities, which mostly imply the achievement of the goals of environmental protection, sustainable development and the implementation of "smart" and other concepts based on modern sources of economic growth and competitiveness. All of the above points to the intertwining of agriculture with other economic activities, which is evident when analysing EU budget expenditures in the period 2021-2027 (Figure 4).

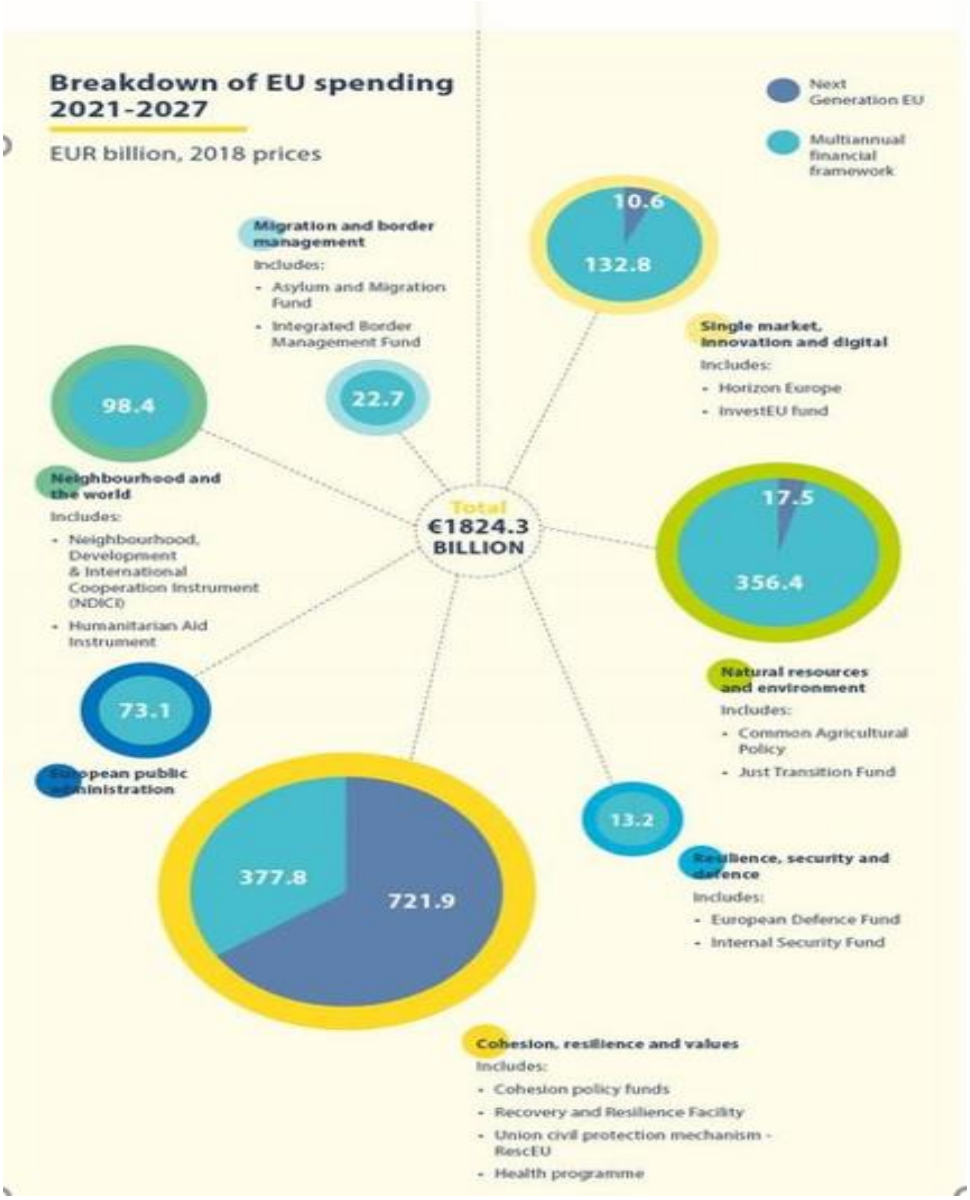

Figure 4 Structure of EU Budget in period 2021 – 2027
Source: Council of the EU (2024)

The data indicates that agriculture in the context of the current European budget is represented to the greatest extent in the thematic area Natural resources and the environment, for whose realization EUR 356 billion (+ EUR 17.5 billion from the NextGeneration EU program) is intended. Also, agriculture, bearing in mind its structural limitations and economic and social challenges, is largely represented in the thematic area of Cohesion, resilience and values, where through available funds and financial instruments, the achievement of the sustainability of agriculture and the achievement of its competitiveness is sought. In addition to the biggest budget

topics, agriculture also finds its place in other thematic areas, in accordance with the present contemporary challenges in the European and global business environment.

The simplified structure of the EU budget is presented in Table 1.

Theme	MFO	NGEU	Total
Single market, innovation and digitalization	149,5	11,5	161
Cohesion, resilience and values	426,7	776,5	1203,2
Natural resources and environment	401	18,9	419,9
Migration and border management	25,7	-	25,7
Security and defence	14,9	-	14,9
Neighbourhood and the world	110,6	-	110,6
European public administration	82,5	-	82,5
Total	1210,9	806,9	2017,8
Total (in 2018 prices)	1074,3	750	1824,3

Table 1 EU Budget expenditure in period 2021-2027 (billion of euros)
Source: developed by author based on European Commission (7) (2024)

Data from Table 1 indicate that more than 1,600 billion euros of the total value of the budget in the period 2021-2027 are intended for thematic areas in which EU agriculture can directly or indirectly "find" its opportunity. At the same time, funds are available to European farmers from available financial instruments and funds, which can be realized through various forms of direct payments, market measures and measures intended to encourage rural development. The available financial instruments intended for the field of agriculture are presented and analysed in more detail in the continuation of this chapter.

MEASURES AND INSTRUMENTS OF FINANCING EUROPEAN AGRICULTURE

For the financing of the CAP in the framework of the 2021-2027 financial perspective 386.6 billion of euros has been earmarked. The total distribution of funds is done in accordance with the strategic plans of the member countries. Within the framework of the 2021-2027 financial perspective, 28 strategic plans from 27 member states were approved. At the same time, all member countries defined one strategic plan, while Belgium was the only one to define two strategic plans, i.e. one for Wallonia and Flanders (European Commission (1), 2024). Strategic plans require compliance with the objectives of the European Green Deal and "From Field to Fork" strategy, whose key objective is to ensure healthier and more sustainable food in the EU.

Management of financial resources intended for the common agricultural policy is carried out in two ways i.e. direct management by the European Commission and shared management. At the same time, the majority of funds (99.3%) are distributed through shared management, where *"tasks related to the execution of the budget are transferred to EU member states that take all necessary measures to protect the financial interests of the Union"*. On the other hand, the European Commission directly manages 0.7% of the budget funds intended for agriculture, which are mostly aimed at providing administrative and technical support, information and financing of marketing activities. In general, in the process of distributing agricultural financial resources, European Commission *"has a supervisory role and ensures the compliance of mechanisms within the management and control system by checking the effectiveness of the functioning of that system and, if necessary, implementing financial corrections"* (European Union (1), 2024).

Creation of specific strategic plans resulted in the definition of nine specific/special objectives for the development of agriculture in the period 2021-2027 (European Union (1), 2024):
"1st special objective: Support for sustainable agricultural incomes and resilience in the Union for food security.
2nd special goal: Strengthening market orientation and increasing competitiveness.
3 special objective: Improving the position of farmers in the value chain.
4th special objective: Contribution to the mitigation of climate change and adaptation to these changes and the development of sustainable energy.
5th special objective: Encouraging sustainable development and effective management of natural resources, such as water, soil and air.
6th special goal: Contribution to the protection of biodiversity, improvement of ecosystem services and preservation of habitats and landscapes.
7th special objective: Attracting young farmers and facilitating the development of enterprises in rural areas.
8th specific objective: Promotion of employment, growth, social inclusion and local development in rural areas, including bioeconomy and sustainable forestry.
Specific objective 9: Improving the response of EU agriculture to societal demands on food and health, including safe, nutritious and sustainable food and animal welfare.

Cross-sectoral goal: it is aimed at encouraging knowledge, innovation and digitization in agriculture".

The EU's common agricultural policy is financed by two funds, the European Agricultural Guarantee Fund and the European Agricultural Fund for Rural Development.

Activities of the 1st pillar (direct support and market measures) are financed through the activities of the **European Agricultural Guarantee Fund (EAGF)**. Within the current financial perspective, 291.1 billion of euros has been earmarked for this Fund, most of which will be directed to activities supporting the income of farmers. On the other hand, the resources of the **European Agricultural Fund for Rural Development (EAFRD),** supplemented by the resources of the Next Generation EU program, are amount to 95.5 billion of euros (European Union (1), 2024).

Total planned distribution of agricultural resources in the period 2021-2027 is shown in Table 2.

Budget of the CAP	**(A) Year of 2021**	**(B) MFO 2021–2027**	**% (B)**
1. First pillar – direct payments and market measures	40 368,0	290 534,0	76,8%
2. Second pillar			
2a. Measures for rural development	15 345,0	87 998,3	23,2%
2b. additional rural development measures ithin NGEU	2 387,7	8 070,5	-
3. Total CAP for 2021-2027 (1+2.a)	55 713,0	378 532,3	100%
4. Total EU obligations	168 496,0	1 221 719,5	-
5. % CAP (3/4)	33,1%	31%	-
6. CAP total: MFO 2021 – 2027 + NGEU 2021 – 2022 (1+2a + 2b)	58 100,7	386 602,8	-
7. MFO 2021 – 2027 + NGEU 2021–2027	333 108,9	1 642 788,7	-
8. % CAP (5/6)	17,4%	23,5%	-

Table 2 Distribution of CAP's resources in the period 2021-2027
Source: developed by author based on European parliament (1), 2024

The data indicate that 76.8% of the total funds are intended for the activities of the 1st pillar (direct payments and market measures) while 23.2% is directed to the 2nd pillar (rural development).

Direct payments consist of **production related and non-production related direct payments**. At the same time, non-production-related payments consist of *"basic income support for sustainability, additionally redistributed income support for sustainability, additional income support for young farmers and programs for climate, environment and animal welfare"*. Production-related payments *"include production-related income support and a special payment for cotton"*. Also, within the framework of the 1st pillar, certain market/sectoral measures are financed, which are implemented in accordance with the accepted strategic plans. Interventions are foreseen in the areas of fruit and vegetables, beekeeping, winemaking, for hops, olive oil and table olives and other sectors (European Parliament (1), 2024).

Data from Table 3 indicate that the largest part of direct payments are non production related direct payments, in which more than half of the funds go to basic

income for sustainability, followed by eco-schemes and additional redistributed income support for sustainability. Production related direct payments represent 12.18% of total direct payments.

Type of intervention	**EU contribution (in billion of euros)**	**% in total direct payments**
Basic income support for sustainability – basic income for sustainability	96,69	51,12%
Production related income support	23,03	12,18%
Additional income support for young farmers	3,4	1,80%
Additional redistributed income support for sustainability	20,09	10,62%
Eco schemes – schemes for the environment, climate and animal welfare	44,71	23,64%
Special cotton payments	1,23	0,65%
Total direct payments	189,15	100%

Table 3 Structure of direct payments in agriculture in the period 2023-2027
Source: developed by author based on European parliament (2), 2024

Table 4 shows distribution of the total allocated funds by EU member states in 2021 according to individual pillars.

Member state	**(a) Direct support (1st pillar - EAGF)**	**(b) Total (1st pillar - EAGF) (including (a)**	**(c) Total EAFRD (2nd pillar)**	**(b + c)% of EU total amount**
Belgium	498,8	557,3	83,2	1,17%
Bulgaria	843,2	867,9	354,6	2,25%
Republic of Croatia	347,4	360,7	382,1	1,36%
Czech	852,3	869,4	357,1	2,25%
Denmark	798,5	808,2	116,7	1,7%
Germany	4 615,1	4 739,8	1 354,0	11,2%
Estonia	165,4	167,1	91,6	0,47%
Greece	1 990,9	2 232,6	635,8	5,3%
Spain	5 055,0	5 666,3	1 149,3	12,5%
France	5 807,7	7 372,2	1 913,1	17,1%
Ireland	1 180,7	1 190,6	343,3	2,8%
Italy	3 552,3	4 241,7	1 470,8	10,5%

Cyprus	47,3	52,71	22,2	0,14%
Lithuania	294,7	297,1	124,0	0,77%
Latvia	510,2	514,7	188,9	1,3%
Luxembourg	34,3	34,9	15,41	0,1%
Hungary	1 276,6	1 310,4	576,5	3,5%
Malta	5,1	5,2	14,9	0,04%
Netherlands	651,3	703,1	163,1	1,6%
Austria	683,3	707,3	580,7	2,37%
Poland	3 319,7	3 351,3	1419	8,8%
Portugal	756,4	860,9	393,7	2,3%
Romania	1 882,2	1 953,0	1 215,1	5,8%
Slovenia	132,5	139,5	119,1	0,5%
Slovakia	384,7	395,8	138,9	1,0%
Finland	517,3	526,0	388,3	1,7%
Sweden	673,0	683,3	319,7	1,85%
EU	0,0	164,2	0,0	0,3%
EU - 27	37 878,8	40 776,5	14566,4	-

Table 4 Distribution of CAP sources by EU member states in 2021
Source: developed by author based on European parliament (1), 2024

Distribution of CAP financial resources in 2021 indicates the dominance of countries that are considered as leaders of the European economy. In general, the largest part of the planned funds for agricultural activities in 2021 is directed to France, Spain, Germany and Italy, while significant values were also achieved by Poland. As for the activities of the 1st pillar, again the largest share goes to France, Spain, Germany, and the position of Italy, Poland and Greece should also be highlighted. A similar situation is present in the 2nd pillar, where again the largest share is taken by France, followed by Italy, Poland, Germany and Romania.

The European Agricultural Fund for Rural Development (EAFRD) is oriented towards the achievement of three long-term strategic goals of European agriculture (European Union (1), 2024):
1) competitiveness of agriculture and forestry
2) sustainable management of natural resources and facing with climate change
3) balanced development of rural economies and communities.

EAFRD funds are directed in accordance with rural development programs, whose creation is co-financed by national funds of EU member states. At the same time, rural development programs must be aligned with the key priorities of the EAFRD. The European Commission (2) (2024) points out that the EAFRD represents *"a source of loans, microcredits, guarantees and equity capital, which are available to users in agriculture, forestry and rural areas that initiate financially sustainable projects that contribute to the priorities of the EAFRD".* Investments in the climate and environment, financial instruments, smart villages and assistance to local initiatives were mentioned as the most important features of the rural development program.

The European Commission (2) (2024) points out following key priorities of the EAFRD:
1) encouraging the transfer of knowledge and innovations in agriculture, forestry and rural areas
2) improving the profitability and competitiveness of all types of agriculture and promoting innovative agricultural technologies and sustainable forest management
3) promoting the organization of the food chain and animal welfare and risk management in agriculture
4) promoting resource efficiency and encouraging the transition to a low-carbon economy resistant to climate change in the agricultural, food and forestry sectors
5) restoring, preserving and improving ecosystems related to agriculture and forestry
6) promoting social inclusion, reducing poverty and encouraging economic development in rural areas.

Furthermore, each priority is divided into so-called **focal areas**, i.e. specific areas of each priority. The current structure of the EAFRD includes **18 focal areas** (European Network for Rural Development (n.d.)):

„1) Priority 1: Transfer of knowledge and innovation
1A: Encouraging innovation, cooperation and knowledge development in rural areas
1B: Strengthening the links between agriculture, food production and forestry and research and innovation
1C: Encouraging lifelong learning and vocational training in the agriculture and forestry sector.

2) Priority 2: Farm sustainability and competitiveness
2A: Improving the economic performance of all agricultural holdings and facilitating the restructuring and modernization of agricultural holdings
2B: Facilitating the entry of farmers with appropriate qualifications into the agricultural sector and generational renewal

3) Priority 3: Food chain organization and risk management
3A: Improving the competitiveness of primary producers through better integration into the agri-food chain
3B: Support for prevention and risk management on farms.

4) Priority 4: Restoration, preservation and improvement of the ecosystem
4A: Restoration, conservation and enhancement of biodiversity
4B: Improving water management
4C: Preventing soil erosion and improving soil management.

5) Priority 5: A resource-efficient economy resistant to climate change
5A: Increasing the efficiency of water use in agriculture
5B: Increasing the efficiency of energy use in agriculture and food processing
5C: Facilitating the supply and use of renewable energy sources
5D: Reduction of greenhouse gas and ammonia emissions from agriculture
5E: Encouraging carbon conservation and sequestration in agriculture and forestry.

6) Priority 6: Social inclusion and economic development
6A: Facilitating diversification, creation and development of small businesses, as well as job creation
6B: Encouraging local development in rural areas
6C: Improving the availability, use and quality of information and communication technologies (ICT) in rural areas".

In addition to the aforementioned focal areas, the realization of EAFRD priorities is also determined by the implementation of prescribed measures. Currently, there are **20 policy measures** that can be implemented in national strategic plans, with the purpose of achieving EAFRD priorities.

Rural development masures include (European Commission (3), 2024):
1. transfer of knowledge and information
2. advisory services, farm management and support services
3. quality frameworks for agricultural and food products
4. investments in physical assets
5. natural disasters: restoration of production potential and prevention of damage
6. development of farms and business environment
7. basic services and reconstruction of villages in rural areas
8. investments in the development of forest areas and ensuring the sustainability of forests
9. establishment of producers' groups and organizations
10. agriculture-environment-climate
11. organic production
12. Natura 2000 and direct payments within the water framework
13. direct payments to areas facing natural and other specific problems
14. animal welfare
15. forest-ecological and climate services and forest conservation
16. cooperation
17. risk management
18. additional direct payments for the Republic of Croatia
19. support for LEADER initiative
20. technical support

During financial perspective 2014-2020, EAFRD funds were mostly focused on encouraging the competitiveness of small and medium-sized enterprises, environmental protection, and dealing with climate changes and energy challenges, as shown in Figure 5.

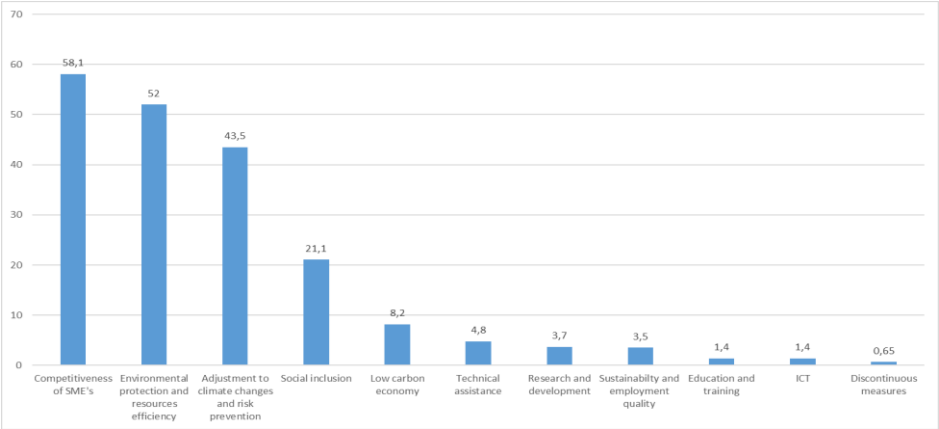

Figure 5 Priorities of EAFRD in period 2014-2020 (in billion of euros)
Source: developed by author based on European Commission (1), 2024

Likewise, the data from Figure 6 indicate that the largest part of the funds was intended for Italy, France, Germany and Poland.

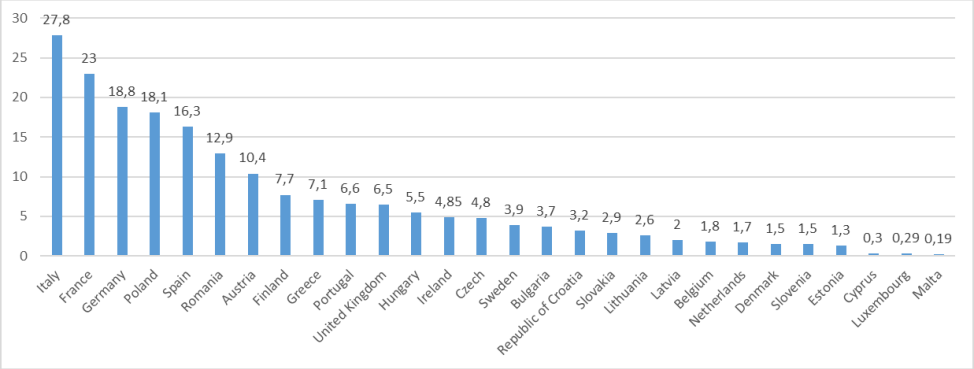

Figure 6 Distribution of EAFRD funds according EU member states in the period 2014-2020 (in billion of euros)
Source: Developed by author based on European Commission (1), 2024

The level of utilization of available funds increased during the period, and in 2023 a level of 82% was recorded, which is shown in Figure 7.

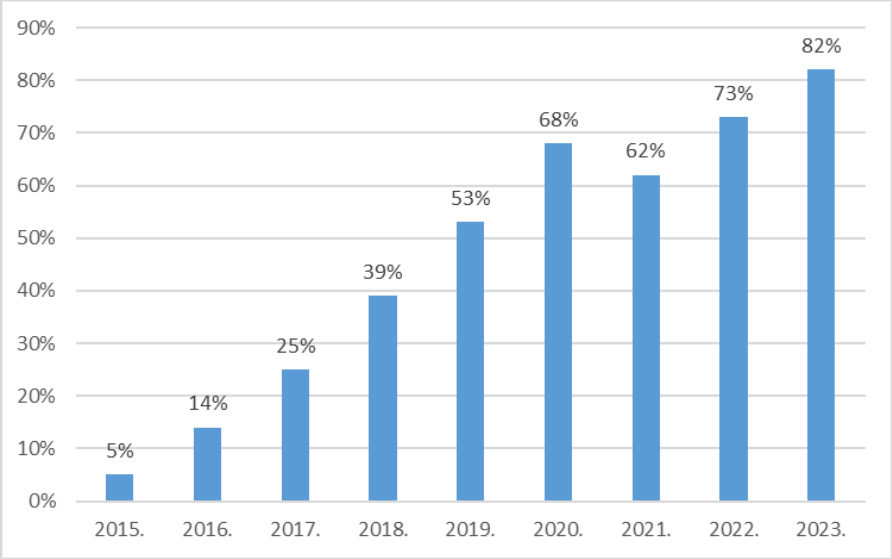

Figure 7 Utilization of EAFRD funds in the period 2015-2023 (%)
Source: developed by author based on European Commission (1), 2024

When analysing total utilization of funds by EU member states, the data point to the leading position of the United Kingdom, which has since left the EU, followed by Luxembourg, Hungary, the Czech Republic and Austria (Figure 8).

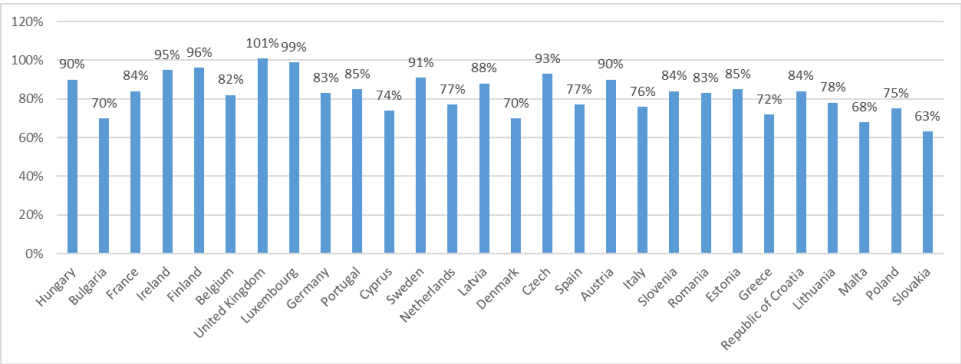

Figure 8 Utilization of EAFRD funds in EU member states within 2014-2020 financial perspective
Source: developed by author based on European Commission (1), 2024

The European Commission (2) (2024) also emphasizes the importance of the European Network for Rural Development, LEADER approach and the European Partnership for Innovation in Agriculture in the process of achieving the prescribed goals and priorities.
The European Network for Rural Development is *"a hub for information on how policies, programmes, projects and other initiatives for rural development work in practice and how they can be improved to become more effective. Its goal is to gather everyone who wants and can contribute to rural development in Europe".*

LEADER represents a "bottom-up" approach in which farmers, rural enterprises, local organizations, public bodies and individuals from various sectors join together in local action groups (LAGs), which draw up their own local development strategies and manage their own budgets.
The **European Partnership for Innovation in Agriculture** *"supports rural development objectives by fostering innovation in agriculture and rural communities".*

In addition to the listed and presented most important sources of funding for European agriculture, it is necessary to mention other sources that contribute to its sustainability and competitiveness. As previously stated, modern European agriculture is characterized by its connection with other sectors and branches of the economy, and its functioning cannot be seen in one dimension. At the same time, its significant connection with small and medium-sized enterprises and determination by the rules of market competition is present. Therefore, the available EU programs intended to encourage small and medium-sized enterprises also play a significant role in achieving the goals and priorities of European agriculture. Furthermore, according to Tomljanović and Murić (2023), in the context of financing European agriculture, it is possible to engage funds available through the most important funds, i.e. European Fund for Regional Development, European Social Fund, Cohesion Fund and other financial instruments (LIFE, OBZOR 2020, etc.), mainly in the areas of infrastructure development, encouraging research and the transition to a knowledge society, and encouraging the digital and green transition, as well as for education, training and improvement of existing and creating new jobs.

Of course, the use of European funds and other financial instruments should be carried out in accordance with the key principles of European cohesion policy, namely the principle of financial solidarity, principle of programming, principle of partnership, principle of concentration and principle of co-financing.

CHALLENGES IN FINANCING OF EUROPEAN AGRICULTURE

In the next period, European agriculture will be faced with many challenges, which will largely determine its future movements. As the most important challenge, it is necessary to identify the necessity of adaptation to the most important priorities of the European cohesion policy in the period 2021 - 2027. Bearing in mind that the area of cohesion represents the largest and most generous element of the current European budget, European agriculture, in planning future development directions, should continue to focus on continuous smart specialization, modernization, digitalization and "greening", while respecting social needs and getting closer to citizens . Image 3 shows the most important priorities of the European cohesion policy in the period 2021-2027.

Figure 9 Priorities of EU Cohesion policy in the period 2021-2027 Prioriteti kohezijske politike EU-a u razdoblju 2021. – 2027. godine
Source: European Commision, 2018

Furthermore, European agriculture should place in the center of its activities the necessity of achieving the goals of sustainable development, which is a concept affirmed in economic science at the beginning of the 70's of the 20th century. Although the term is comprehensive and ubiquitous, there is still no consensus among economists about its unique theoretical definition. In doing so, it is necessary to single out the views of Pavić-Rogošić (2010), who defines sustainable development as *"a process of change in which the utilization of resources, direction of investments, orientation of technical development and institutional changes are in harmony with each other and enable the fulfillment of the needs and expectations of current and future generations"* and Kandžije and Cvečić (2008), who define sustainable development *"as the simultaneous and comparative realization of the three most important goals, i.e. achieving economic competitiveness, increasing employment and environmental protection and risk prevention".* Furthermore, Črnjar and Črnjar (2009) analyse three key conceptions of sustainable development, i.e. the development conception, the conception of needs and the conception of future generations.

EU focused on the achievement of global goals of sustainable development defined by the United Nations in 2015, which *"determine the direction of sustainable development with the obligation to create a better future for people and the planet"* and foresee the achievement of seventeen global goals of sustainable development and 169 sub-goals, which is shown in Image 4 (Laboratorij održivog razvoja (n. d.).

Figure 10 UN global sustainable goals
Source: Laboratorij održivog razvoja (n. d.)

Furthermore, it is necessary to highlight the fact that, although there are significant available funds that can be used to improve the capacity and performance of European agriculture, they are not realized automatically, i.e. countries and regions need to create foundations for ensuring their effective use. This places significant emphasis on the development of absorption capacities for receiving and using EU financial resources. In general, absorption capacity can be defined as the ability of a country/region to attract and utilize available financial resources, whereby emphasis must be placed on three key dimensions, i.e. administrative capacity, financial capacity and macroeconomic capacity (PJR Consulting, 2022). All of the above places emphasis on the further development of human resources, through education, training and strengthening of individual competencies.

EU represents a complex administrative system determined by a large number of laws, rules and other legal acts, which require clear and precise application in specific areas of activity. The above mentioned is especially relevant for areas related to the use of EU financial instruments. Respecting the opinions of direct users, the system needs to be continuously improved, key deficiencies corrected, and thus brought closer to potential users, while respecting principle of transparency in the areas of management and execution. All before mentioned will certainly increase the level of utilization of available funds with the increasing satisfaction of potential users.

CONCLUSION

This chapter analyzes trends and financing instruments of European agriculture. The European agricultural policy represents one of the largest and oldest European policies, and on which rests the entire development of modern European integration. As such, it faces numerous and continuous challenges, which require the provision of significant financial resources. In modern business conditions,

agriculture is no longer an isolated sector, but its connection with other sectors is present, with the necessity of meeting modern priorities, above all competitiveness and the transition to a green and digital economy. The largest part of budget funds in the field of agriculture is directed through the European Agricultural Guarantee Fund and the European Agricultural Fund for Rural Development, primarily for direct payments, market measures and rural development measures. Also, bearing in mind the modern approach to agriculture, this sector is directly or indirectly present in other funds and financial instruments, primarily for encouraging innovation, employment, education and training and other key priority areas. Contemporary European agriculture faces numerous challenges, where it is necessary to single out the further development of absorption capacities, priorities of the new European cohesion policy and the necessity of implementing the concept of sustainable development. Of course, ensuring the transparency of execution, management and supervision remains a priority. This research has created the basis for future research on this topic, which should mostly be oriented towards the quantification of the effects of the use of available financial resources on the economic and social performance of European agriculture.

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SHORT FOOD SUPPLY CHAINS – CONSUMER PREFERENCES

CHAPTER 14.

Petra Adelajda Zaninović [*], Helga Pavlić Skender [**]

ABSTRACT

Short food supply chains play an important role in connecting local producers with consumers, promoting sustainability, supporting local economies and providing access to fresh, high-quality produce. However, their market is still underdeveloped due to the mismatch between consumer demand and producer supply. The aim of this research is to explore the concept of short food supply chains, examine consumer preferences for purchasing fruit and vegetables and their product within short food supply chains and assess the impact of respondents' characteristics on their attitudes towards short food supply chains. The research is divided into two parts. In the first part of the research, a structured online survey was conducted among a sample of 286 respondents in Primorje-Gorski Kotar County in April 2024. In the second part of the research, an ordinal logistic regression was conducted to assess the impact of respondents' characteristics on their preference for purchasing products in short food supply chains. The results of the research contribute to the existing literature in the field of short supply chain management and food and agricultural supply chains. The insights gained can help business entities in making decisions about distribution channels and in the design of their own supply chains to meet market demands, taking into account consumer characteristics and preferences.

Keywords: *short food supply chains, agriculture products, consumer preferences*

INTRODUCTION

In the past decade, especially since the outbreak of the COVID-19 pandemic and the disruptions in the global food market, interest in short food supply chain (SFSC) research has increased. Short food supply chains, i.e. the localization of food production, can have a positive impact on health, the environment and sustainable local development (Mikulić, Lovrinčević and Keček, 2023). There is a growing awareness of the unsustainability of the current global food system (Sonnino, 2013; Willett et al., 2019; Gajdić, Manečić and Pavić, 2021; Cirone et al., 2023) with short food supply chains being seen as a contribution to sustainable development and a perspective for the future of the food system (Bisoffi et al., 2021). Many international institutions have recognized the importance of short food supply chains and have incorporated them into their long-term development strategies. In the European

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Zaninović, P. A., Pavlić Skender, P. (2025). Short Food Supply Chains – Consumer Preferences, in book Katunar, J., Vretenar, N., Jardas Antonić, J. (eds), Agriculture Through Sustainability Perspectives, University of Rijeka, Faculty of Economics and Business, Croatia.

Union, for example, short food supply chains are an important pillar of the „Farm to Fork Strategy“, which promotes the transition to a sustainable food system and the recovery of rural economies (European Commission, 2020; Evola et al., 2022). Short supply chains have also been recognized by the United Nations and are considered to contribute to the achievement of several UN Sustainable Development Goals (SDGs) (Djekic et al., 2021). However, despite their recognized importance, short supply chains have not yet reached their full potential, as the coordination and matching of producer supply and consumer demand in short food supply chains is challenging in terms of economic, managerial and organizational factors (Cirone et al., 2023).

The objective of this research is to analyze the concept of short food supply chains, to investigate consumer preferences when purchasing fruit and vegetables and their processed products within short food supply chains, and to assess the impact of respondents' characteristics on their attitudes towards short food supply chains. Food produced within short food supply chains complements the existing global food system, mostly sold in supermarkets. Understanding consumer preferences when buying food is important to match supply and demand in short food supply chains. In theory, preferences are usually represented as "an ordered set of two alternatives, among which the subject has a strong or weak preference for one of the alternatives, or is indifferent between them" (Vretenar, 2023:89). The results of this research can be useful for all stakeholders in short food supply chains and contribute to a better understanding of consumer preferences for short food supply chains and the matching of food supply and demand.

This chapter consists of five interconnected parts. The Introduction sets out the motivation and objectives of the research. Following the Introduction, the second part of the chapter reviews the literature on short food supply chains. The third part of the chapter describes the data used for the analysis and the research methodology. The results of the research are presented in the fourth part of the chapter, while the fifth part of the chapter discusses the research findings and presents the concluding considerations of the research.

LITERATURE OVERVIEW

The liberalization of international trade also facilitated the development of global food supply chains. Food products from all over the world became available on all markets at any time and in any quantity. Global food supply chains are organized in such a way that producers are “separated” from consumers (Kneafsey et al., 2013). Such a food system has led to negative consequences for small local producers who are not price competitive in the market, to asymmetric information in terms of ignorance of the origin of products or unethical behavior and profit distribution between stakeholders in the supply chain, excessive food waste (Pavlić Skender and Zaninović, 2022) and ultimately negative health consequences due to the lower quality of food produced in large quantities (Schrobback et al., 2023) and transported over long distances, which increases the risk of product spoilage (Pavlić Skender 2023). The current global food system has also led to a decline in biodiversity because many farmers have turned to the production of more profitable

products that generate a higher profit instead of producing local fruit and vegetables (Carbone, 2017).

However, Mikulić, Lovrinčević and Keček (2023) note that the global food system is moving towards the local food system, especially after recent events such as the COVID-19 pandemic and the war in Ukraine, which have had a significant negative impact on the global food market. Short food supply chains (hereinafter: SFSC) represent a model in which food products reach the customer directly from the producer and/or with a maximum of one intermediary, e.g. a retail shop (Evola et al., 2022). In this case, as the name suggests, there is a short distance between the producer and the customer, which characterizes local production (Gajdić, 2019). The exact distance between producers and customers is not defined in the literature, but it usually includes the local or regional level. This type of business model enables social interaction between the producer and the customer and a better awareness of customers about the products they buy (Renting et al., 2003). According to Marsden et al. (2000), the definition of the SFSC concept does not specify the distance and/or the number of intermediaries between the producer and the customer, but states that SFSC characterizes the customer's awareness of the origin of the product and the production process that may have been used. Therefore, locally produced food is characterized not only by the physical proximity between the producer and the customer, but also by the possibility of direct communication and interaction between the producer and the customer, face-to-face or digitally, as well as by the transparency of information about the production method and the origin, quality and possible certification of the product. Within SFSC, producers connect with consumers and local areas through various forms of organization such as direct sales on the producer's farm, sales at markets and stalls, direct sales from the producer to retailers and through social networks and digital platforms (UNIDO 2020). The development of online commerce and digital platforms has also enabled a socio-territorial direct link between the producer and the customer (Elghannam, Sánchez and Díaz, 2017) and even the possibility of tasting products so that customers can participate in the production of certain products (Zaninović, 2023).

SFSCs have many economic and social benefits, such as the distribution of higher-quality and more nutritious food, greater transparency within the supply chain, "fair trade" and the promotion of the development of local economies (Niemi and Pekkanen, 2016; Todorović et al., 2018; Cerrada-Serra et al., 2018). An essential component of this type of food system is the high quality of food and economic growth and development (Mattas et al. 2022). SFSCs are extremely important for the survival and revitalization of family farms as well as for supporting sustainable agricultural production and the revitalization of local rural communities (Bokan, 2021). They bring local producers together with customers, promote sustainability, support the local economy, and provide access to fresh, high-quality produce (Sonnino 2013; Jarzebowski, Bourlakis, and Bezat-Jarzebowska 2020). A return to local production in the SFSC can promote the protection of the environment and traditional crops and develop local food distribution (Deller, Lamie and Stickel 2017). Considering the importance of agricultural producers not only for maintaining a constant supply of products, but also for preserving the population (and cultural traditions) of rural areas, the development of sustainable farms is a matter of public interest (Katunar, Kaštelan Mrak, Zaninović, 2022).

Despite the recognized benefits, SFSCs have not yet reached their full potential and face challenges such as matching producer supply and customer demand (UNIDO 2020; Cirone et al., 2023). One of the reasons for this is the fact that this topic is relatively new and there is not much research addressing the issue of consumer preferences within short food supply chains. Existing research suggests that customers have an interest in buying products in short food supply chains (González-Azcárate, Luis Cruz Maceín and Bardají, 2021; Guiné et al., 2021) for reasons of healthy eating, environmental protection and greater transparency regarding the origin and production method of products. However, there is still a barrier for customers in the form of higher food prices in short food supply chains compared to the prices of food in, e.g., supermarkets (Annunziata and Mariani, 2018). Research by Cirone et al. (2023) also shows that customers are aware of the benefits of short food supply chains; however, the authors note that customer characteristics should be taken into account when creating an offer. Therefore, this research focuses precisely on customer characteristics such as the economic and social environment in which customers live and work.

METHODOLOGY

Questionnaire and data collection

A structured questionnaire was used to collect data for research purposes. The survey was conducted online in April 2024. The sample comprised 286 respondents residing in the Primorje-Gorski Kotar County. The questionnaire analyzed the attitudes and preferences of consumers regarding the purchase of fruit, vegetables and their products such as dried fruit, nuts, jams, honey, oil, etc. The questionnaire consists of two parts. The first part of the questionnaire mainly covers the characteristics of the respondents, including sex, age, education level, monthly household income, number of household members and number of children in the household. The second part of the questionnaire contains questions about consumer preferences regarding the purchase of fruit, vegetables and their products. Table 1 below shows the characteristics of the respondents. The research is dominated by women, 73% of female respondents compared to 27% of male respondents. The research is also dominated by respondents with high levels of education (university degree and PhD), which may influence sample bias, as there is a significant correlation between the education level and the decision to shop through SFSC (Evola et al., 2022). The majority of households earn more than EUR 3,000.00 per month and three-person households dominate. In addition, most households have a child aged 0 to 12 or 13 to 18 years. Of the 286 respondents, 54% were aware of the term short food supply chains prior to this research, while 46% of respondents were not aware of the term short food supply chains.

VARIABLE	N	(%)
SEX		
MALE	76	27%
FEMALE	210	73
OTHER	0	0%
AGE		
18 – 24	16	5,6%
25 – 34	43	15,03%
35 – 44	90	31,47%
45 – 54	86	30,06%
55 – 64	29	10,14%
> 65	22	7,69%
EDUCATION LEVEL		
ELEMENTARY SCHOOL	2	0,7%
SECONDARY EDUCATION	71	23,83%
UNDERGRADUATE STUDY	44	15,38%
GRADUATE STUDY/MBA	129	45,1%
POSTGRADUATE DOCTORAL STUDY	40	13,99%
HOUSEHOLD INCOME		
<500 EUR	9	3,15%
500 – 1000 EUR	21	7,34%
1001 – 1500 EUR	49	17,13%
1501 – 2000 EUR	47	16,43%
2001 – 2500 EUR	47	16,43%
2501 – 3000 EUR	45	15,73%
> 3000 EUR	68	23,78%
HOUSEHOLD SIZE		
1	37	12,94%
2	74	25,87%
3	81	28,32%
4	76	26,57%
> 4	18	6,29%
NUMBER OF CHILDREN IN THE HOUSEHOLD AGED 0-12		
0	185	64,69%
1	68	23,78%
2	25	8,74%
3 AND MORE	8	2,80%
NUMBER OF CHILDREN IN THE HOUSEHOLD AGED 13-18		
0		
1	225	78.67%
2	48	16,78%
3 AND MORE	10	3,5%
	3	1,05%
NUMBER OF CHILDREN IN THE HOUSEHOLD AGED 19 AND MORE	238	83,22%
0	33	11,54%
1	14	4,90%
2	1	0,35%
3 AND MORE		

Table 1 Characteristics of the respondents
Source: Edited by the authors

The majority of respondents, as many as 69%, prefer to buy fresh fruit and vegetables from supermarkets, while 57% of respondents prefer to buy processed

fruit and vegetables, such as oil, honey and jam, from supermarkets. After supermarkets, 16% of respondents prefer to buy fresh fruit and vegetables at the market, but 32% of respondents prefer to buy processed fruit and vegetables directly from the producer on the farm. The fewest respondents, 7%, prefer to shop in a gourmet shop.

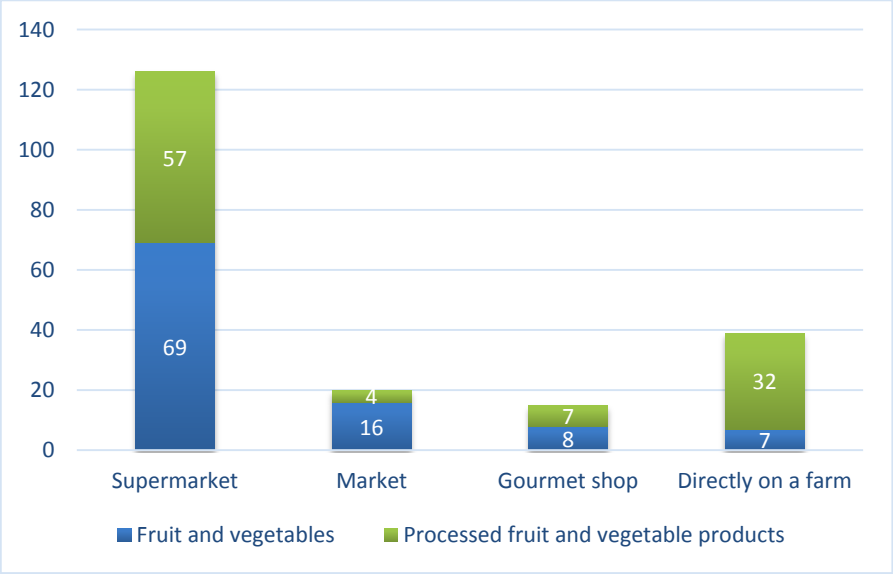

Figure 1 Preferences for the location where fruit and vegetables and their products are purchased,%
Source: Edited by the authors

Respondents cited local production as the main criterion when buying fresh fruit and vegetables and their products. Namely, 56% of respondents consider local, domestic production as the main criterion when buying fresh fruit and vegetables, i.e., 60% of respondents consider local, domestic production as the main criterion when buying processed fruit and vegetables. The next criterion when buying fruit and vegetables and processed products is price, and in the last place, at 5% and 6%, is the possession of an ecological certificate (Figure 2).

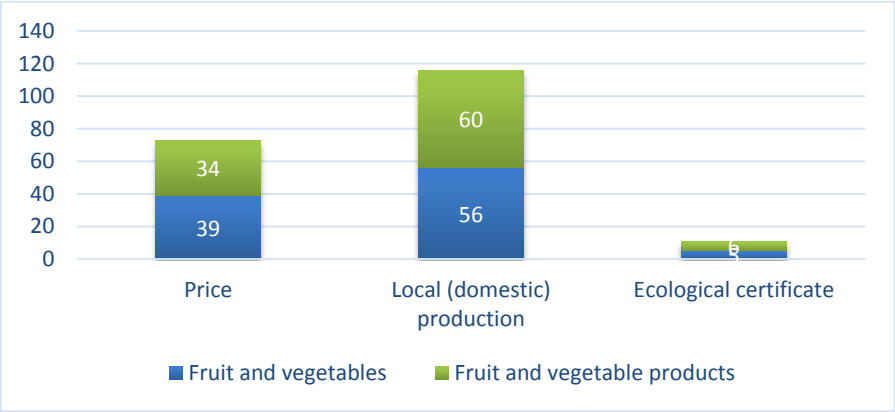

Figure 2 The main criterion for buying fruit and vegetables and their products,%
Source: Edited by the authors

Figure 3 shows the respondents' answers to the question about their preferred distribution channels for fruit and vegetables and their products. The distribution range (distribution channels) indicates the number of alternative channels available for product distribution (Katunar, Kaštelan Mrak, Sokolić, 2020). Most respondents, 28%, prefer to sell fruit and vegetables and their products in shopping centers and/or organic markets and stalls. Distribution to local shops follows with 26%. Respondents in Primorje-Gorski Kotar County least favor the collection of fruit and vegetables and processed products from collection points (16%) and home delivery (18%), which also means that they do not tend to order fruit and vegetables online.

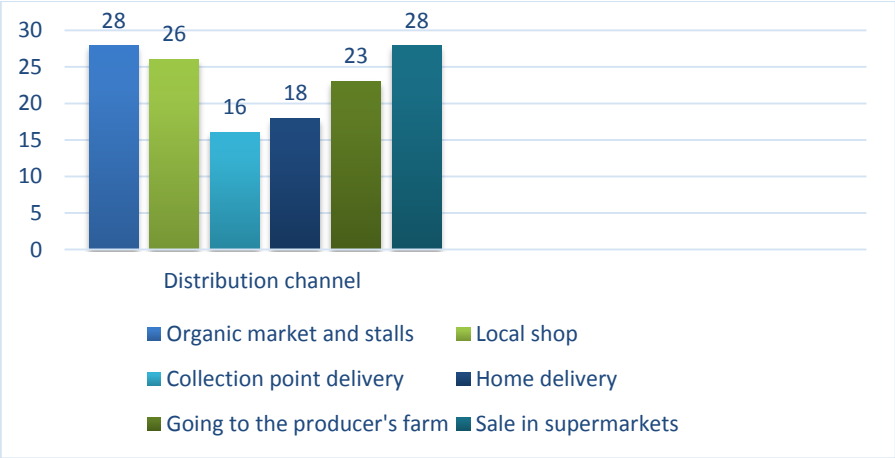

Figure 3 Preferred distribution channel for fruit and vegetables and their products,%
Source: Edited by the authors

Figures 4 and 5 show the respondents' attitudes to certain statements, which were rated on a Likert scale from 1 (disagree) to 5 (strongly agree).

In Figure 4, the *Price* column refers to the statement "I am willing to pay a higher price for a local product." Respondents generally strongly agree with this statement, with 45.5% of the respondents giving a rating of 5, and 30.8% of the respondents a

rating of 4.

The *Local Producers* column refers to the statement "I prefer to buy from local producers", and 44.4% of respondents strongly agree with this statement, while only 2.1% of respondents disagree with this statement, i.e. they do not prefer to buy fruit and vegetables and their products from local producers. The *Family Farm* column refers to the statement "I prefer to buy from family farms"; 37.4% of respondents prefer to buy at family farms, while 2.8% of respondents do not prefer to buy from family farms at all. The *Support to the local economy* column refers to the statement "It is important to me to support local producers and the local economy". As many as 41.6% of the respondents strongly agree with this statement, i.e. gave it a rating of 5, 30.1% of respondents gave it a rating of 4, while 2.8% of respondents gave this statement a rating of 1. The column *Sustainability of agriculture* refers to the statement "The sustainability of agricultural production is important to me"; 42% of respondents strongly agree with the statement, while 2.4% of respondents strongly disagree with this statement. The column *Quality products* refers to the statement "It is important to me that the products I consume are of high quality and high nutritional value". The majority, i.e. 62.9% of respondents, consider it extremely important to consume high-quality fruit and vegetables with high nutritional value, while, e.g., an ecological fruit and vegetable certificate means much less to them, i.e., only 20.6% of respondents strongly agree with the statement that it is important to them that the products they consume have an ecological certificate.

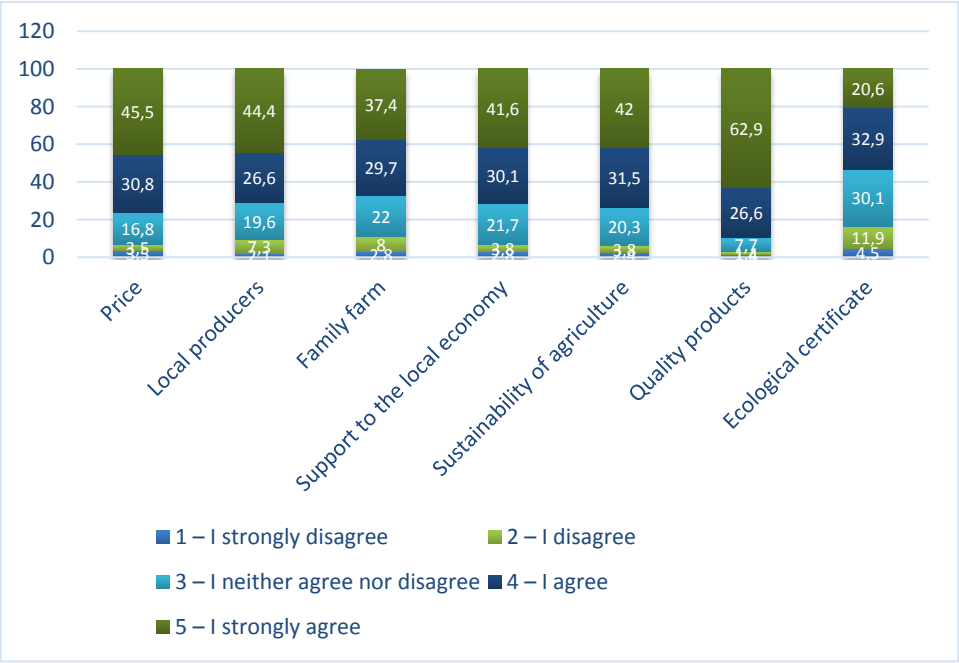

Figure 4 Attitudes of the respondents,%
Source: Edited by the authors

In Figure 5, the *Location* column refers to the statement "It is important to me that fruit and vegetables can be bought near my home or the place where I commute",

and 52.4% of respondents strongly agree with this statement, while 4.5% of respondents strongly disagree with this statement.
The *Time* column, i.e. the agreement with the statement that when buying fruit and vegetables it is important to be able to buy fruit and vegetables at any time, was rated as very important by 28% of the respondents, i.e. they strongly agree with it, while the majority consider this statement to be important, but not extremely important.
The *Online ordering* column shows that only 9.8% of participants fully prefer to buy fruit and vegetables online, while the majority of respondents do not prefer to buy online, which is also in line with the responses in Figure 3.
Respondents are equally likely to plan shopping in advance and/or not plan it.
Regarding the other variables, i.e. the statements that respondents are *well aware of local fruit and vegetable producers, outlets for local "homemade" products, prices for local "homemade" products,* and *prices for products with ecological certification*, the majority of respondents gave a rating of 2 or 3, which is presented in columns 6 – 9 of Figure 5.

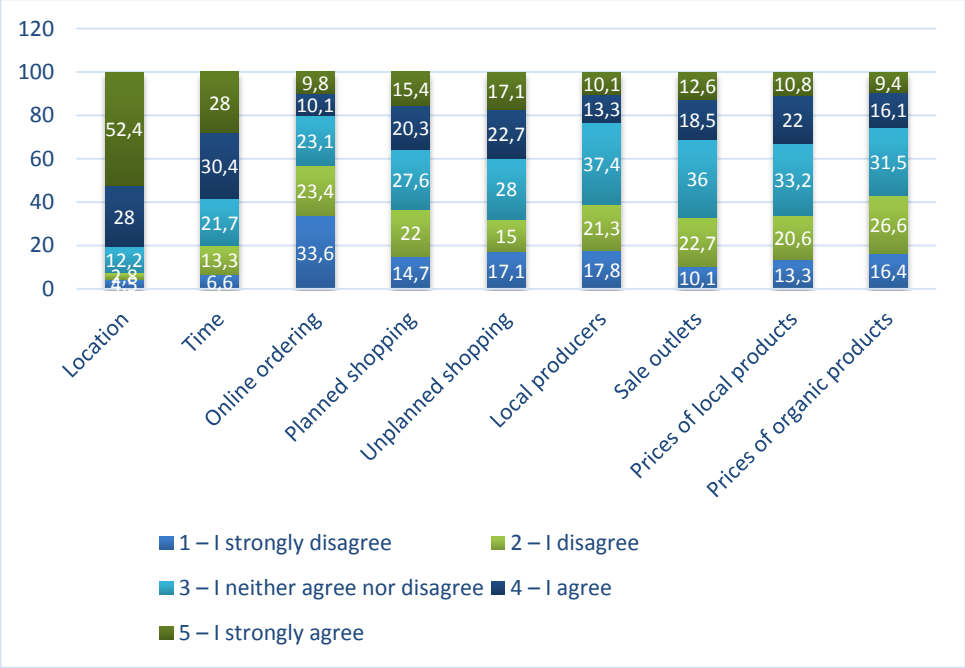

Figure 5 Attitudes of the respondents,%
Source: Edited by the authors

Ordinal Logistic Regression

Ordinal logistic regression (OLR) has been used in this research. OLR, also known as ordinal regression or proportional odds model, is a type of regression analysis used to predict an ordinal dependent variable based on one or more independent variables. The independent variables can be continuous, ordinal or nominal. The logistic regression model assumes that the relationship between each pair of

outcome groups is the same. This means that the odds ratios are constant at all threshold values of the outcome variable. A logit link function is used to model the cumulative probabilities of an ordinal outcome.

This method is particularly useful when the dependent variable has a natural order but the distances between the levels are unknown or assumed to be equal (Liu 2016), such as when analyzing the levels of agreement with certain statements (strongly disagree, disagree, neither agree nor disagree, agree, strongly agree).

The ordinal logistic model has the following form:

$ln(y_j^*) = logit\ [\pi(x)] = ln(\pi_j\ [x)/1-\pi_j(x)] = \alpha_j - \beta_1 x_1 - \beta_2 x_2 - \ldots - \beta_p x_p$ [1];

where y is the probability of being in or below category j given a set of p predictors (logit coefficients and independent variables). The symbol π stands for threshold values, and each logit has its threshold value. Ordinal logistic regression is often used in the social sciences, where ordinal data are common. For example, it can be used to model student satisfaction levels (Arbula Blecich and Zaninović, 2019) or customer feedback ratings (Lu, Wang, Li 2021). In our case, we want to analyze consumer preferences when buying fresh fruit and vegetables and processed products, and preferences are expressed by rating the statement on a Likert scale (1 – I strongly disagree, 2 – I disagree, 3 – I neither agree nor disagree, 4 – I agree, 5 – I strongly agree) based on the consumer's sex, consumer's age, consumer's education level and income. Using ordinal logistic regression, we can assess how, for example, sex or education level affect the likelihood of the respondent falling into a higher satisfaction category.

The logistic regression model in this research has the following form:

$price_j^* = \alpha_j - \beta_1 age - \beta_2 sex - \beta_3 education - \beta_4 income - \beta_5 size - \beta_6 location$ [2],

$local_j^* = \alpha_j - \beta_1 age - \beta_2 sex - \beta_3 education - \beta_4 income - \beta_5 size - \beta_6\ location$ [3],

$family\ farm_j^* = \alpha_j - \beta_1 age - \beta_2 sex - \beta_3 education - \beta_4 income - \beta_5 size - \beta_6 location$ [4],

$quality_j^* = \alpha_j - \beta_1 age - \beta_2 sex - \beta_3 education - \beta_4 income - \beta_5 size - \beta_6 location$ [5],

$organic_j^* = \alpha_j - \beta_1 age - \beta_2 sex - \beta_3 education - \beta_4 income - \beta_5 size - \beta_6 location$ [6].

The dependent ordinal variables are the respondents' ratings on a scale of 1 to 5, where 1 means 'strongly disagree' and 5 means 'strongly agree':
price – "I am willing to pay a higher price for a local product."
local – "I prefer to buy from local producers."
family farm - "I prefer to buy from family farms."
quality – "It is important to me that the products I consume are of high quality and

high nutritional value."
organic –"It is important to me that the products I consume have an ecological certificate."

The independent variables age represents the age of the respondent, sex is a binary variable that indicates 0 – male; 1 – female, education represents the level of education, size refers to the household size and location is a binary variable that has the value 0 – if the respondent does not live in Primorje-Gorski Kotar County or 1 – if the respondent lives in Primorje-Gorski Kotar County.

RESEARCH RESULTS AND DISCUSSION

The results of the ordinal logistic regression are presented in Table 2. It can be seen from the table that the *age* variable has a significant positive impact on quality, i.e., the older the respondents, the more likely they are to strongly agree with the statement that it is important to the respondents that the products they consume are of high quality and high nutritional value. As far as the *sex* variable is concerned, it has a significant positive impact on the variables price, local, family farm, and quality. It follows that a female respondent is more likely to strongly agree with the statements that she is willing to pay a higher price for a local product, that she prefers to buy from a local producer and/or family farms, and that it is important to her that the products she buys are of good quality. The *education* variable is not significant in this case, which is contrary to expectations, as highly educated respondents are expected to be more inclined to buy more expensive and better-quality products from local producers; however, as we have already mentioned earlier in the chapter, the sample is dominated by highly educated respondents, which may influence the estimated results. The *income* variable is also in line with expectations, as, the higher a household's income, the more likely they are to be willing to pay a higher price for a quality product produced by local producers or family farms. The *household size* variable has significant negative effects on price, i.e., the larger the number of household members, the greater the likelihood that respondents are not willing to pay a higher price for a local quality product, which is again in line with our expectations, as the larger the household, the lower the income per household. The results of the logistic regression are consistent with previous research such as research by Evola et al. (2022) and Cirone et al. (2023).

Independent variables	(2)	(3)	(4)	(5)	(6)
	Price	**Local**	**Family farm**	**Quality**	**Organic**
age	-0,0186	0,0486	-0,0196	**0,239****	0,134
	(0,0897)	(0,0905)	(0,0890)	(0,100)	(0,0873)
sex	**0,509****	**0,483***	**0,414***	**0,665****	0,203
	(0,252)	(0,254)	(0,247)	(0,271)	(0,249)
education	0,0109	-0,0144	-0,0820	0,0251	-0,179
	(0,120)	(0,121)	(0,121)	(0,135)	(0,117)
income	**0,312*****	**0,279*****	**0,215****	**0,179***	-0,0394
	(0,0882)	(0,0856)	(0,0838)	(0,0940)	(0,0814)
size	**-0,213***	-0,115	-0,0646	0,0501	0,110
	(0,109)	(0,106)	(0,106)	(0,119)	(0,103)
location	-0,197	-0,211	0,0340	-0,230	-0,121
	(0,226)	(0,224)	(0,219)	(0,249)	(0,217)

/cut1	-3,002***	-3,266***	-3,151***	-2,925***	-2,808***
	(0,544)	(0,600)	(0,564)	(0,681)	(0,514)
/cut2	-2,264***	-1,662***	-1,693***	-2,214***	-1,369***
	(0,496)	(0,482)	(0,478)	(0,583)	(0,462)
/cut3	-0,796*	-0,256	-0,274	-0,791	0,157
	(0,460)	(0,463)	(0,459)	(0,504)	(0,454)
/cut4	0,631	0,909*	0,981**	0,884*	1,671***
	(0,459)	(0,466)	(0,460)	(0,497)	(0,463)
Number of observations	286	286	286	286	286
Pseudo R^2	0,0287	0,0213	0,0121	0,0274	0,0102

Standard errors in parentheses. *** p < 0,01, ** p < 0,05, * p < 0,1

Table 2 OLR Results
Source: Edited by the authors

CONCLUSION

The objective of this research was to explore the concept of short food supply chains, to investigate consumer preferences regarding the purchase of fruit and vegetables and their products within short food supply chains, and to assess the impact of respondents' characteristics on their attitudes towards short food supply chains. The research consisted of two parts. In the first part of the research, a structured online survey was conducted on a sample of 286 respondents in Primorje-Gorski Kotar County in April 2024, and in the second part of the research, an ordinal logistic regression was conducted to assess the impact of respondents' characteristics on their preference for purchasing products in short food supply chains. The results of the research show that women are more willing to pay a higher price for a quality product and that they are more likely to buy products from a local producer or a family farm. The regression results also show that the older the people, the greater the likelihood that it is more important to them that the product is of high quality and nutritional value. The regression analysis results also show that household income has a significant positive impact on the willingness to buy higher quality, possibly more expensive products from local producers or family farms. By contrast, the larger the household, the more negative the effect of household income on the willingness to buy a homemade but more expensive product. This research also has certain limitations, as it only focuses on a single county, Primorje-Gorski Kotar County, and many of the respondents have a high level of education, which may influence the bias of the sample. Future research should therefore focus on covering the entire Republic of Croatia or beyond to examine if there are differences in respondents' preferences taking into account the place of residence. The insights gained from this research can help business entities make decisions about distribution channels and design their supply chains to meet market demand by taking into account consumer characteristics and preferences.

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SYNERGY OF AGRICULTURE AND TOURISM – CONVERGENCE OF SEASONAL CYCLES IN CROATIA AND THE EU

CHAPTER 15.

Alen Host *

ABSTRACT

This chapter analyzes the concept of seasonality in tourism and agriculture. Seasonality is a challenge for policyholders in both sectors. Pressures on the labor market, community services and environmental objectives mean that a range of measures need to be taken to ultimately enable sustainable development. At the same time, there is an increasing focus on the local community to define targets, implement measures and take responsibility for their implementation. In the relevant literature, seasonality is often seen as a problem for the tourism sector. As a solution to this problem, the development of selective forms of tourism is called for, which can increase the attractiveness of the destination even in the low season. Many selective forms of tourism are linked to agriculture, which has a very similar seasonal cycle. In addition, agriculture and tourism often use the same inputs and require them at the same time of the year. For this reason, it is not justified to consider tourism and agriculture as completely complementary activities, as they compete with each other in terms of space, labor and water requirements.

Keywords: *seasonality, selective forms of tourism*

INTRODUCTION

For many years, an increase in the number of tourist arrivals and overnight stays has been synonymous with the development of tourism. However, the capacities of many tourist attractions are utilised beyond acceptable levels during the season. As a result, tourists are unable to experience these attractions in their entirety, which also raises the question of the sustainability of an ecosystem overburdened by visitors. Agriculture and tourism can be a new opportunity for the sustainable development of tourism in Croatia by presenting autochthonous products, products of protected geographical origin that cannot be mass-produced, to tourists in an appropriate way and creating new motives for visiting outside the main tourist season. The further development of different motives for tourist arrivals outside the peak tourist season contributes to more stable income from tourism and enables long-term, sustainable growth through the indirect inclusion of traditionally agricultural areas in tourism.

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SEASONALITY OF TOURISM

Seasonality is defined as "a temporal imbalance in the phenomenon of tourism, i.e. an imbalance in elements such as the number of visitors, the consumption of visitors, traffic on highways and other means of transportation, employment and the number of visitors to attractions" (Butler, 2001, p. 5).

In general, destinations exhibit a seasonal pattern of tourist visits, with natural, mostly climatic conditions (e.g. sun and sea, snow) playing an important role (Higham and Hinch, 2002; Jang 2004) or they are a combination of climatic and anthropogenic conditions (government or school vacations) (Cooper et al., 2005).

The natural causes of seasonality lie in the cyclical and regular weather fluctuations in nature, which largely correspond to those in tourism and agriculture. They are mostly related to the climate and the different seasons (Butler, 2001). Factors such as temperature, rain, snow and periods of sunshine dominate. Seasonal fluctuations resulting from natural conditions are not particularly pronounced at the equator, but they are in the zone between the tropics and the poles, where most travel takes place, and in the main agricultural areas. This leads to a seasonality of tourism demand (Baum and Lundtorp, 2001).

Institutional causes associated with anthropology make their own specific contribution to seasonality (Butler, 2001). The main causes are public holidays, school vacations or seasonal shutdowns in certain industries. Traditionally, tourism demand increases in the summer or during the Christmas vacations (Koenig-Lewis, Bischoff, 2005).

Both institutional and natural causes of seasonality can vary. Koenig-Lewis and Bischoff (2005) point out that national holidays can vary from year to year, which has different effects on tourism demand. In addition, some public holidays vary between states or regions within the same state (Rantsi et al., 2023).

It is well known that seasonality in tourism can lead to serious economic and social problems, such as an unstable labor market (Sokolić, 2023) caused by temporary employment at the destination (Goeldner and Ritchie, 2003). However, some studies have also found positive effects of seasonality on the destination (Butler, 1994; Alshuqaiqi, Omar, 2019).

INFLUENCE OF CLIMATIC PARAMETERS ON TOURISM IN CROATIA

The most commonly used method for measuring the influence of climate parameters on tourism is the Tourism Climate Index (TCI) (Mieczkowski, 1985). This indicator was developed with the aim of showing the climatic suitability of the destination for "average" tourists who want to undertake light outdoor physical activities (e.g. sightseeing, shopping). The TCI can also be used to monitor the global or regional impact of climate change on tourism according to projected scenarios of future climate conditions.

The TCI was developed by Mieczkowski (1985) based on previous research on monitoring climate change variables and their impact on tourism and human biometeorology. For the TCI indicators, the monthly average values of seven climate variables relevant to tourism are integrated into five sub-indices, which are listed in Table 2: Daily Comfort Index (CId), Daily Comfort Index (CIa), Precipitation (R), Solar Radiation (S) and Wind (W). They are all rated on a scale from 0 (unfavourable) to 5 (optimal), while the sub-indices for thermal comfort (CId and CIa) are rated from -3 to 5. With different weights and a combination of all sub-index weights, the overall TKI is calculated as follows:

$$TCI\ 2 * (4 * CId + CIa + 2 * R + 2 * S + W).$$

Sub-index	**Monthly average**	**Impact on TCI**	**Ponder**
Daily comfort index	Highest daily temperature (^{0}C) and minimum relative humidity	It represents the thermal comfort at maximum tourist activity (normally between 12 and 4 pm)	40%
Daily comfort index (CIa)	Average daily temperature, average relative humidity (%)	It represents the thermal comfort during the entire 24-hour period	10%
Precipitation (R)	Total amount of precipitation (mm)	Negative impact on outdoor activities and climate comfort	20%
Sunshine (S)	Duration of exposure to sunlight (hours)	Positive effect	20%
Wind (W)	Wind speed (m/s)	Variable effect depending on its value and the maximum temperature	10%

Table 1 Formation of indicators of the tourist climate index (TCI)
Source: Jong et al. (2023)

All the sub-indices listed have the highest possible score of 5, which is why Mieczkowski (1985) developed a TCI scoring system with a maximum total score of 100. Results for the presence of tourism above 40 are acceptable, while climatic conditions are considered good if the score is above 60. Scores above 80 are considered excellent (Table 2).

TCI	Description
90 – 100	Ideally
80 – 89	Excellent
70 – 79	Very good
60 – 69	Good
50 – 59	Acceptable

40 – 49	Slightly acceptable
30 – 39	Unfavorable
20 – 29	Very unfavorable
10 – 19	Extremely unfavorable
< 10	Impossible

Table 2 Ranking according to the Tourism Climate Index (TCI)
Source: Kovács, Unger (2014)

Seasonality is a phenomenon that strongly influences the tourism sector, but also the society in which tourism takes place. The mismatch in the intensity of activities limits economic expansion, with natural and institutional causes being recognized as the main causes of seasonality. The effects of seasonality can be positive and negative. For many investors in the tourism sector, the low season means a great loss of potential and underutilization of facilities, while the high season is characterized by excessive pressure on resources, which calls into question the sustainability of these forms of tourism.

The pressure on the municipal system is a clear consequence of the seasonality of tourism. However, two basic components must be distinguished:

- growing pressure on fixed resources (accommodation, transport infrastructure) due to seasonality
- increasing pressure on resources whose availability decreases due to seasonality (water and space).

The limits to the growth of tourism in Croatia are related to the available resources. Unlike labor or some other goods that can be obtained from other markets, water is a limited resource that has a limiting effect on the development of tourism (Ricart et al., 2023). In addition, water is also an essential resource for agricultural production.

Agriculture and tourism are seen as complementary activities, with agriculture providing important inputs for the development of a whole range of selective forms of tourism (wine tourism, gastrotourism, rural tourism). The consumption of agricultural products produced in the immediate vicinity of tourist destinations shortens the supply chain and thus contributes to the sustainability and visibility of the destination. In this sense, agriculture and tourism complement each other, but they also compete for the limited resource of water.

In terms of space, tourism and economic development generally affect the conversion of land; usually from agricultural or forestry purposes to the construction of various facilities, irrevocably losing the space for agriculture. The reduction of very limited agricultural land in the Mediterranean part of Croatia reduces the possibility of developing a whole range of selective forms of tourism and contributes to an even more pronounced seasonal cycle.

Figure 1 shows the seasonal component in Croatian tourism.

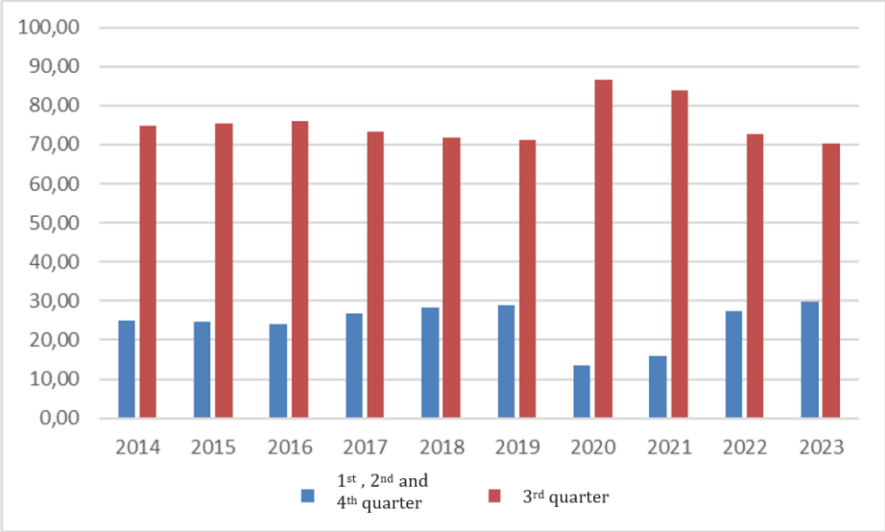

Figure 1 Seasonal component in Croatian tourism
Source: DZS, Dolasci i noćenja domaćih i stranih turista, Hrvatska, mjesečno. Link: https://web.dzs.hr/PXWeb/Selection.aspx?px_path=Turizam__Dolasci%20i%20no%c4%87enja%20turista%20u%20komercijalnim%20smje%c5%a1tajnim%20objektima&px_tableid=BS_TU11.px&px_language=hr&px_db=Turizam&rxid=b2d0fceb-4150-4f9c-8b29-271dbf2dedab

The seasonal component is of great importance in Croatia due to the focus on so-called 3S tourism (sun, sea, sand).

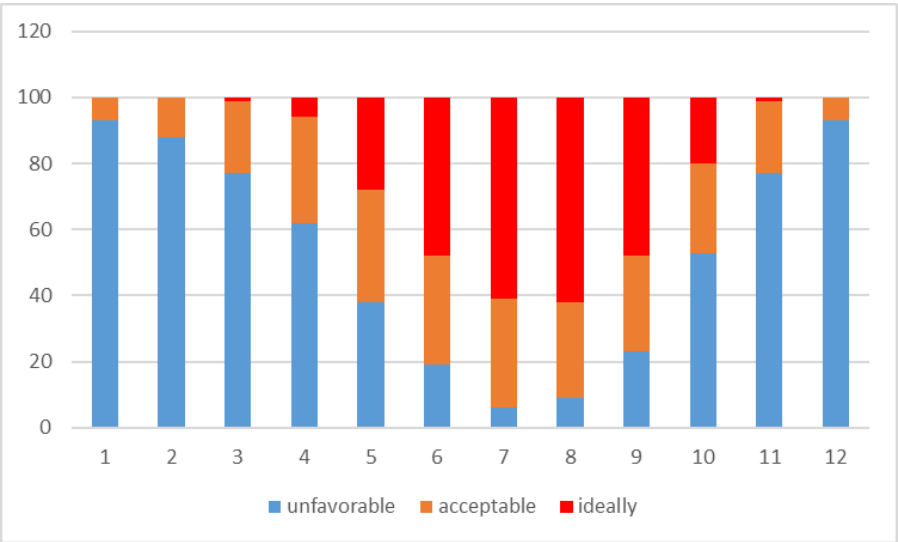

Figure 2 TCI for 3S (*sun, sea, sand*)
Source: Prepared by the author according to Srnec, L., Magjarević, V. (2022).

However, certain selective forms of tourism have completely different seasonal cycles that do not coincide with the prevailing cycle resulting from 3S. For example,

the ideal period for rural tourism is spring and autumn, whereby rural tourism works to reduce the seasonal component in tourism, i.e. to achieve a more balanced capacity utilisation in tourism.

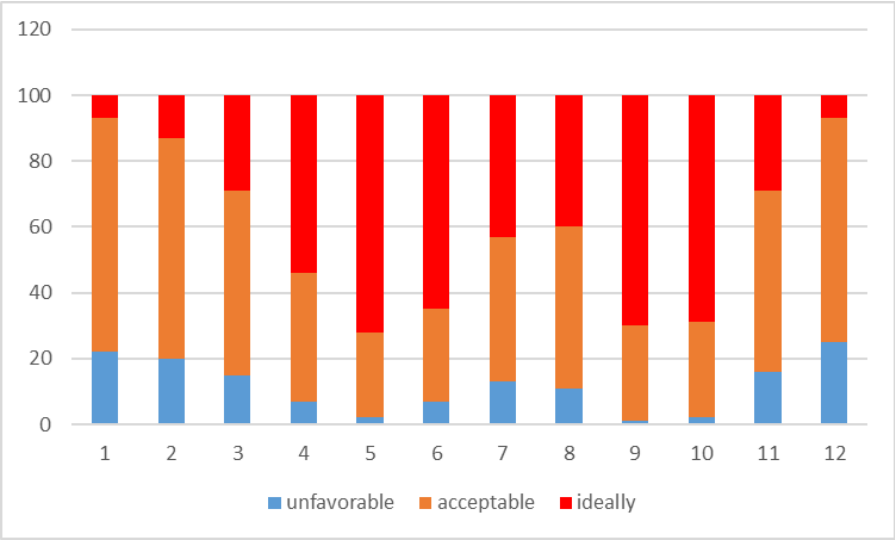

Figure 3 TCI in culture
Source: Prepared by the author according to Srnec, L., Magjarević, V. (2022).

The seasonal component is very pronounced in Croatia. On a quarterly basis, more than 70% of overnight stays by foreign guests occur in the third quarter (July, August, September). This is also recognized in the Strategy for the Development of Sustainable Tourism in Croatia until 2030, which identifies the need to "mitigate the seasonality of tourism activities" as the first development need.

The relationship between tourism and rural areas is one of the ways to overcome seasonal fluctuations in the demand for tourism services and the shift away from 3S tourism, as can be seen in Figures 2 and 3.

The Government of the Republic of Croatia has adopted the Decision on the classification of local and regional self-government units according to the level of development (Official Gazette 3/2024). As can be seen in Figure 4, there is a noticeable concentration of developed municipalities and towns in the coastal region, where income is mainly derived from tourism, and in northwestern Croatia. Areas of the Republic of Croatia where agriculture is an important economic activity have a significantly lower development index.

The group of local self-government units that are in the highest development category in Croatia according to the value of the index consists of the following local self-government units: Bakar, Bale – Valle, Baška, Biograd na Moru, Bol, Buzet, Cres, Čakovec, Čavle, Dobrinj, Dubrovnik, Dugo Selo, Dugopolje, Fažana – Fasana, Funtana – Fontane, Grad Zagreb, Hvar, Kanfanar, Kastav, Kaštelir-Labinci – Castelliere-S. Domenica, Kolan, Konavle, Koprivnica, Kostrena, Krk, Kršan, Ližnjan – Lisignano, Makarska, Mali Lošinj, Malinska – Dubašnica, Marčana, Matulji, Medulin, Nin,

Novalja, Novigrad – Cittanova, Omišalj, Opatija, Pazin, Pićan, Podstrana, Poreč – Parenzo, Pula – Pola, Punat, Rijeka, Rovinj – Rovigno, Samobor, Solin, Stubičke Toplice, Stupnik, Sutivan, Sveta Nedelja (Zagrebačka županija), Sveti Petar u Šumi, Šenkovec, Tar-Vabriga – Torre-Abrega, Tinjan, Umag – Umago, Varaždin, Velika Gorica, Viškovo, Vižinada – Visinada, Vrbnik, Vrsar – Orsera, Zabok, Zadar, Zaprešić, Žminj, Župa Dubrovačka.

Of the total of 68 units in this group, only 12 are local self-governing units from continental districts, which underlines the influence of tourism on economic development.

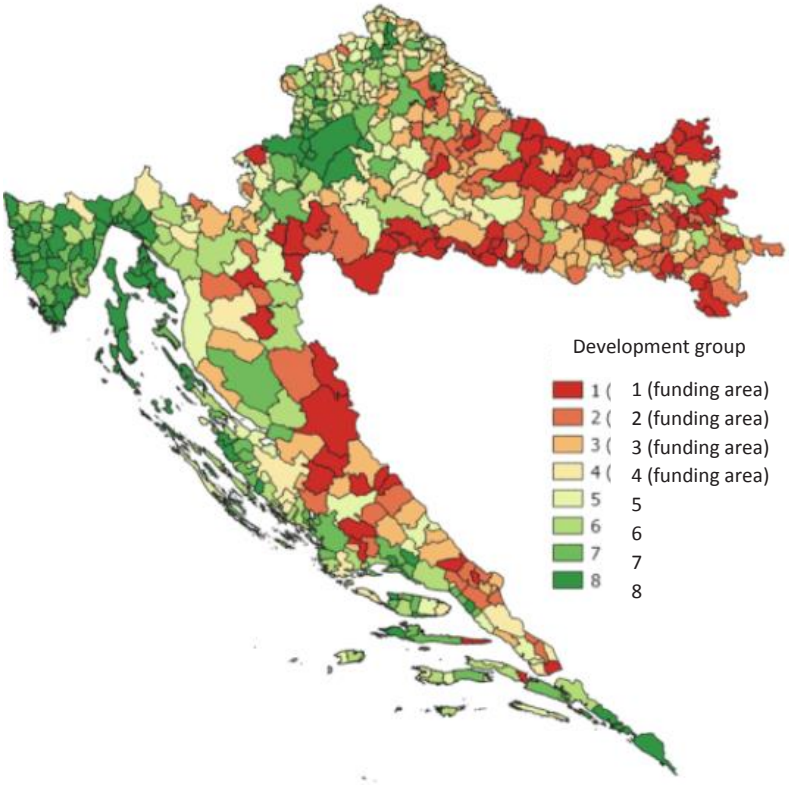

Figure 4 Municipalities and cities of the Republic of Croatia by development groups of the development index in 2024
Source: Prepared by Odluka o razvrstavanju jedinica lokalne i područne (regionalne) samouprave prema stupnju razvijenosti (NN 3/2024).

The development of tourism in Croatia is primarily linked to the narrow coastal strip of the Adriatic. According to the categorization of the Institute of Tourism, Figure 5 shows the local self-government units of categories I and II of tourism development. There is a high correlation between the development index and the tourism development index in Croatia. There are coastal areas along the Adriatic Sea and specific destinations (attractions) inland (Plitvička jezera, City of Zagreb, Baranja, etc.).

Tourism contributes significantly to Croatia's GDP. According to the Ministry of

Tourism, the share of tourism in GDP is almost 20%, with the exception of the years of the COVID-19 crisis. However, the ratio of tourism revenue resulting from the balance of payments in relation to GDP cannot be equated with the actual share of tourism in GDP, even though the Croatian Ministry of Tourism regularly applies the above methodology.

	2017	2018	2019	2020	2021	2022
GDP (billion EUR)	48.462	51.527	53.983	49.070	58.207	67.390
Revenues from tourism (billions of EUR)	9.493	10.096	10.539	4.346	9.134	13.114
Share of tourism in GDP	19.6	19.6	19.5	8.9	15.7	19.5

Table 3 Share of tourism in the Croatian economy according to the Ministry of Tourism
Source: Ministry of tourism of the Croatia, Turizam u brojkama 2022., Ministry of tourism of the Croatia, Turizam u brojkama 2020., Ministry of tourism of the Croatia, Turizam u brojkama 2018.

The tourism satellite account serves precisely to evaluate the direct economic contribution of tourism to the national economy. Tourism is not an activity in itself, but is defined by the characteristics of the consumers, depending on whether these consumers are also tourists or not.

According to the methodology of the Tourism Satellite Account (TSA), the total contribution of tourism to the Croatian economy (total contribution of tourism to the gross domestic product of Croatia) is 16.9%, while the direct contribution of tourism to the gross domestic product is 11.4%.

According to other sources (https://www.gidb.org/tourism-current-global-tourism), the share of tourism revenue in GDP in 2022 was highest among EU Member States in Croatia (19.3%), Cyprus (9.9%), Malta (8.8%), Portugal (8.7%) and Greece (8.6%). This reflects the importance of tourism for the economies of these countries, but also their vulnerability due to the procyclical nature of tourism as an economic sector.

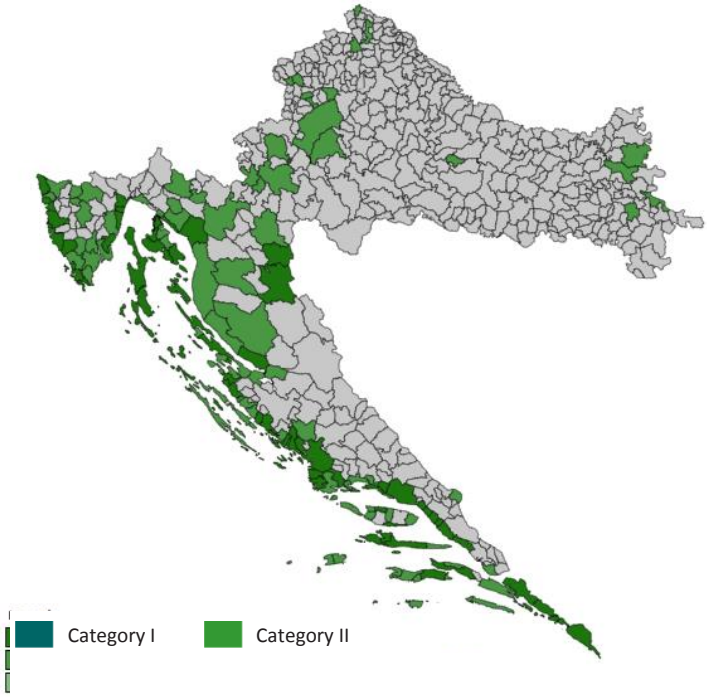

Figure 5 Tourism development index for 2022 by LGU in Croatia, categories I and II
Source: Institute for Tourism, https://www.iztzg.hr/hr/itr/

The development of selective forms of tourism is primarily intended to offset the burden on destinations. One of the solutions is the development of selective forms of tourism, i.e. the combination of tourism and agriculture. However, the insistence on maximising the production of generic agricultural products leads to the need to compete with mass agricultural production. However, the size of farms, regional differences and climatic characteristics in Croatia, as well as the already relatively large number of products with protected geographical indications or protected designations of origin, can represent an ideal development opportunity for Croatian agriculture, which is ideally combined with the need to mitigate the seasonal component in tourism.

SYNERGY EFFECTS BETWEEN TOURISM AND AGRICULTURE

The strong dependence of Croatian GDP on tourism is a problem, but it also opens up the possibility of developing complementary sectors. Considering the fact that tourism is largely dependent on personal experiences, agriculture, i.e. agricultural products, imposes itself. A distinction must be made between mass agricultural production, which is based on price competitiveness, and specific local products, which are unique in their qualitative characteristics. Protected geographical indications and protected designations of origin play a key role in linking agriculture and tourism and create the conditions for a new quality leap in Croatian tourism.

From an economic and social point of view, interest in Protected Geographical Indications is growing due to increasing international competition for agricultural products and the need for qualitative product differentiation. This emphasizes the uniqueness of the product and the need to compete on the market solely on price. From the producers' point of view, it is therefore a beneficial development from markets with perfect competition to market organizations with imperfect competition.

Consequently, a larger number of suppliers implement the requirements at local level and fulfill the required quality elements. Protected geographical indications eliminate global competition and represent one of the most interesting instruments that can be managed at local level to achieve the goal of developing highly profitable agricultural production, refining the tourist offer and making it more competitive at the same time. The possible synergies are not limited to the agricultural and tourism sectors, but also to the preservation of traditional knowledge and cultural heritage, as well as the creation of an ecosystem that allows the development of a sustainable rural economy. This also helps to reduce development disparities between Croatian regions (Figure 1).

This potential stems from the strong connection of these products to the place where they are produced, as well as the specificity of the local human and material resources used in the production process, which give these products unique quality characteristics. In addition, consumers are interested in experiencing a destination in a variety of ways, and locally produced and/or processed food has a special place, whether it is the need for identity, safety and quality of food or the protection of the environment through the shortest possible supply chain and the reduction of CO2 emissions. In view of this, the protection of geographical origin has a positive impact on rural development, not only in economic terms, but also in social, cultural and environmental terms.

Products with protected geographical designations of origin are precisely identified on the market by the aforementioned fact. According to Vandecandelaere et al. (2009), there are three key dimensions that define products with protected geographical indications:

- the specificity of the local resources used in the production process
- the history of the product, the tradition of its production and consumption
- the social dimension, including the presence of shared knowledge about production and consumption at the local level.

This strong link with the local community in a limited area represents a potential for rural development that is not limited to the economic impact, but also to the general development of the local community at a social, cultural and environmental level.

The analysis of possible impacts of protected geographical indications (Belletti et al., 2017) can be carried out using the following main categories:

- Impact on the structure of the protected geographical indications - this excludes some companies that do not fall within the scope or do not have the capacity according to the specifications. However, these rules on geographical origin can have a positive effect on the relocation of economic

activities and the creation of higher value-added production by local producers, which in turn ensures a positive effect on employment and income in the local economy or region.

- Impact on the economic efficiency of the protected geographical indication system - the main effect is the increase in income, but the negative effect on businesses that cannot use protected geographical indications must also be taken into account. The level of prices as an indicator is not the only measure of the success of GI protection, because higher prices do not necessarily lead to an increase in the income of individual companies and the entire production system due to the costs of introducing and maintaining the GI system. Production costs may increase not only due to higher costs of monitoring the use of protected geographical indications, but also due to the adaptation of the production process to new requirements, the introduction of certification systems (acquisition of new skills, change of administrative routines), administrative costs (time for filling in forms) and compulsory participation in institutions managing protected geographical indications.
- The new system of protected geographical indications – opens up new markets and the possibility of exporting, which means greater diversification and a reduction in risk. When analysing the benefits, it must also be taken into account that the system of protected geographical indications can be used more easily by large companies than by small producers.
- Impact on consumers and markets – the effect of protected geographical indications is related to the ability to control the misuse and counterfeiting of these indications, especially if the product is well known and there is a possibility of counterfeiting. Protected geographical indications can increase the willingness of consumers to pay a higher price because they perceive the quality of the product. The specification of a product with a protected geographical indication can change the quality and identity of the product, as a higher level of quality of the raw material and/or the final product can be identified, making traceability systems necessary. At the same time, the product specification rules can lead to a standardization of the product, resulting in the loss of specific product characteristics.
- Economic impact of protected geographical indications outside the production system: The registration of a geographical indication and its effective use by companies can bring benefits that go beyond the narrow circle of the production system itself. Local entrepreneurs can use a product with a protected geographical indication, its perception by the consumer and the specific resources associated with it (local gastronomy, tradition, landscape, etc.) as tools to improve the competitiveness of the entire local economy and society by taking advantage of the product's ability to attract customers and tourists to the production area. As a result, other economic activities such as hotels, restaurants, museums, etc. can be developed using protected geographical indications.
- Impact on other elements of territorial capital – GI systems are often closely linked to numerous local resources that are an integral part of the local (land, landscapes, etc.) but also of the social (culture, customs). The limited resources that can be used for the production of products with protected

geographical indications must take into account sustainability (effect on the soil, water table), but also the relationship between the geographical origin of the product and other local tangible or intangible resources (e.g. local traditions, fairs, specific habitats).

CONCLUSION

Given Croatia's resources and, above all, its geographical and climatic conditions, tourism is one of the most important economic sectors. The seasonality of tourism in Croatia is higher than the seasonality of tourism in the Mediterranean, which is why measures are needed to achieve a more seasonally balanced demand for tourism services in Croatia. This contributes to the goals of sustainable development of tourism as defined in the key strategic documents of the line ministry. The link between agriculture and tourism is not only specific to Croatia, but other EU countries also use the synergy effects of these two sectors to achieve the goals of balanced regional development.

Agricultural products are closely linked to the tradition and natural conditions of a given area. This means that traditional agricultural products are generally produced according to the principle of sustainability, using almost exclusively local inputs with very short supply chains. Products with geographical designations of origin and authenticity markings offer all customers, including tourists, certainty about their origin and production methods. On the other hand, the producers of such products are given the opportunity to participate in the market with incomplete competition and higher prices than usual. Tourism becomes a link between producers and consumers and contributes to the balanced development of rural areas through selective forms of tourism.

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IMPROVING RURAL EDUCATION THROUGH SMART VILLAGE STRATEGIES: A multidisciplinary approach to technological integration

CHAPTER 16

Zoran Ježić *

ABSTRACT

Rural areas around the world face many challenges, including limited access to education, inadequate infrastructure and economic hardship. The concept of smart villages offers an innovative approach that uses advanced technologies and integrated strategies to improve the quality of life in rural communities. This chapter explores how smart villages can be used to improve education in rural areas, focusing on a multidisciplinary approach to technology integration. Through an overview of the existing studies, practical examples and analyses of key success factors, the chapter aims to provide a comprehensive overview of methods and strategies that enable the sustainable development and progress of education in rural communities.

Based on a case study method, concrete examples of the implementation of smart technologies in rural communities were analyzed in detail. The aim of this chapter is to identify and present the best practices that can serve as models for improving education in rural areas using smart technologies and innovative approaches. The focus is on the importance of local community engagement, digital technologies and innovative approaches that can jointly transform the education system and create the basis for long-term economic and social prosperity. The case study methodology allows for a deeper understanding of the specific challenges and successes of individual projects and provides practical insights that can be transferred to similar initiatives in other rural areas.

Keywords: *smart villages, rural education, sustainable development, socioeconomic progress, case study method*

INTRODUCTION

Rural areas around the world face many challenges, including limited access to education, insufficient infrastructure and economic hardship. However, the concept of smart villages represents an innovative approach that uses advanced technologies and integrated strategies to improve the quality of life in rural communities. This chapter explores how smart villages can be used to improve education in rural areas, highlighting a multidisciplinary approach to technology integration. Through a review of existing studies, examples from practice and analysis of key success factors, the chapter aims to provide a comprehensive insight into methods and strategies that can enable sustainable development and educational progress in

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rural communities. This certainly contributes to the development of the economy of those areas, to the improvement of the economic structure, and thus to the reduction of income inequality.

In this chapter, the case study method is used to analyze in detail concrete examples of the implementation of smart technologies in rural communities. The aim of the chapter is to identify and present the best practices that can serve as a model for improving education in rural areas using smart technologies and innovative approaches. Special focus is placed on the importance of the local community, digital technologies and innovative approaches that together can transform the education system and create the foundations for long-term economic and social prosperity. The case study method used in this chapter provides a deeper understanding of the specific challenges and successes of individual projects, providing practical insights that can be applied to similar initiatives in other rural areas.

DEFINING SMART VILLAGES

Smart villages are rural communities that use innovative solutions and new technologies to improve the quality of life, economic growth and sustainable development. (Geri et al. 2022) The goal of the existence of rural villages is to improve infrastructure, access to services, agricultural productivity, education and health care of the population that lives in them. Unlike smart cities, which use digital technologies to focus on the transformation and improvement of their functions, smart villages emphasize the importance of the local community, which is entrusted with the strategic planning of development with the use of digital technologies. Acquiring the status of a "smart" village is a complex process that includes connecting different policies, such as energy efficiency, mobility, waste disposal, application of information and communication technologies, data availability for all citizens, and testing of new business and financial models. In some European villages, locals have joined forces to implement various digital solutions and local services such as e-commerce or e-administration. (aem.hr, visited on March 17, 2024)

In 2016, the Cork 2.0 Declaration defined a new vision for the future of Europe's rural areas. On the basis of that document, and at the initiative of the Slovenian representative Franc Bogovič and the Hungarian representative Tibor Szanyi, the European Commission and the European Parliament adopted the Action Plan for Smart Villages in 2017 (Kurfürst, 2021). The concept of smart villages began to gain attention in the EU in 2017, when the need for balanced development of rural areas was recognized. The European Commission and other institutions have developed strategies and programs to support the transformation of villages through digitization, innovation and participatory management. The concept of smart villages was first discussed at a conference in Cork in 1996, with special emphasis on the need for innovative rural development policies. This conference laid the foundations for thinking about the future of rural areas in Europe, emphasizing the importance of adapting new technologies and methods to improve the quality of life and economic opportunities in these areas (Ježić et al., 2021).

The EU's Smart Villages initiative, launched in 2017 by EU commissioners, represents an important step towards the revitalization of rural areas. This initiative aims to apply smart solutions in sectors such as health, mobility and agriculture. Using advanced technologies and innovative approaches, the initiative aims to ensure the sustainable development of rural communities, improve the quality of life of their residents and create new economic opportunities.

The Bled Declaration from 2018 further developed and expanded the concept of smart villages, presenting new strategic goals and guidelines for rural development through digital solutions. This declaration highlighted the importance of digital platforms for e-learning, e-health and economic activities as key tools for improving rural development. Digital platforms provide access to education, health services and business opportunities that are often unavailable in remote rural areas, thereby improving the quality of life and opening up new opportunities for growth and development (Kurfürst, 2021).

Through all these initiatives and conferences, it is clear that the future of rural areas is closely linked to the application of smart, innovative solutions that can respond to the specific challenges faced by these communities. Smart villages represent a model of sustainable development that uses technology and innovation to create growing, connected and economically viable rural communities in Europe.

Figure 1 Smart villages in Europe
Source: Villages – Smart Rural Areas, 2020, accessed 05/07/2024

Smart Villages in Europe is an initiative that supports rural communities in the development and implementation of smart village strategies. The Smart Rural 21 project, launched in 2020, works with pre-selected villages to encourage innovation and sustainable development. Some of the villages included in this project are: Alsunga (Latvia), Babina Greda (Croatia), Kythera (Greece), Penela (Portugal) and Stanz (Austria). These villages develop various projects aimed at improving the quality of life through the use of new technologies and sustainable practices.

In the following text, the key prerequisites and models for the transformation of rural areas into smart villages are presented and defined.

Smart village development methodology

Key prerequisites for the development of smart villages include a motivated local community that is ready to take an active role in the transformation process. In addition, a clear vision of development is necessary, which can be focused on various aspects such as ecological principles, sustainable development or digitization. Such a vision helps direct efforts and resources towards achieving specific goals that can significantly improve the quality of life in rural areas.

The involvement of all stakeholders, such as local governments, investors and non-governmental organizations, is essential for the success of this process. These stakeholders bring different perspectives, resources and expertise, which is vital to the implementation of complex projects and initiatives. For example, local governments can provide the necessary infrastructure and regulatory support, investors can provide financial resources, while non-governmental organizations can contribute through education and community support (Ježić et al., 2021).

Although the use of digital technologies can significantly contribute to the transformation of a village into a "smart village", it is not strictly mandatory. The village can also be considered smart through the application of other innovative solutions that do not include digitization. The key is to use available resources and technologies in a way that best suits the specific needs and conditions of the local community. Smart villages can therefore vary in approach and focus on different aspects of sustainability, from organic farming to smart resource and energy management.

In the following text, the key elements of establishing a smart village and the stages of its development are presented and defined.

Figure 2. Stages of development of smart villages
Source: author's work according to Ježić et al., 2021.

The involvement of the local community and all stakeholders is key to initiating change and ensuring the success of any development project. Community commitment and active participation are the foundation of any successful venture. Effective vision and planning require identifying long-term development goals based on local priorities, such as increasing food quality, reducing social exclusion or improving connectivity. At the same time, it is necessary to conduct a risk assessment to identify potential risks and resources within the area, thereby ensuring preparation for sustainable development. It is important to analyze and select development clusters, considering whether independent development or cooperative effort in the villages is a better way to achieve the desired results.

The participation of all stakeholders is essential for the development of strategies and solutions that meet the specific needs of the local community. Assessing the suitability of smart technologies and innovative practices for local implementation further ensures that the most effective solutions are used. Portfolio development involves building a framework that supports the implementation of development strategies, including project activities and funding mechanisms. Scaling and marketing local products and services are key to expanding their reach beyond local borders and attracting investment. Finally, constant monitoring and evaluation of the impact and outcomes of implemented strategies ensure sustainable and efficient development, adapting to changing needs and challenges.

The ultimate goal is to create smart villages that are adaptable and respond to the specific needs of the local community, using a bottom-up approach that promotes government efficiency, improves the quality of public services, and revitalizes rural areas through innovative and sustainable solutions (Ježić et al., 2021).

This approach emphasizes the importance of a flexible community-led model that adapts to local characteristics and long-term development requirements, with a strong emphasis on local leadership and multi-stakeholder partnerships. However, it often happens that local communities cannot realize their full potential and then "rural development trap".

Rural development and the "rural development trap"

Rural development refers to the process of improving the quality of life and economic well-being of people living in relatively isolated and sparsely populated areas. The goal of rural development is to improve the living conditions of rural communities, making them more sustainable and developed. Development strategies should include improving agricultural activities, promoting local manufacturing industries, increasing educational opportunities, and improving health and transportation services for people living in the area. The development of smart villages is one such approach, with an emphasis on the use of digital technologies and innovations to encourage rural development and closer connection of rural areas with urban regions.

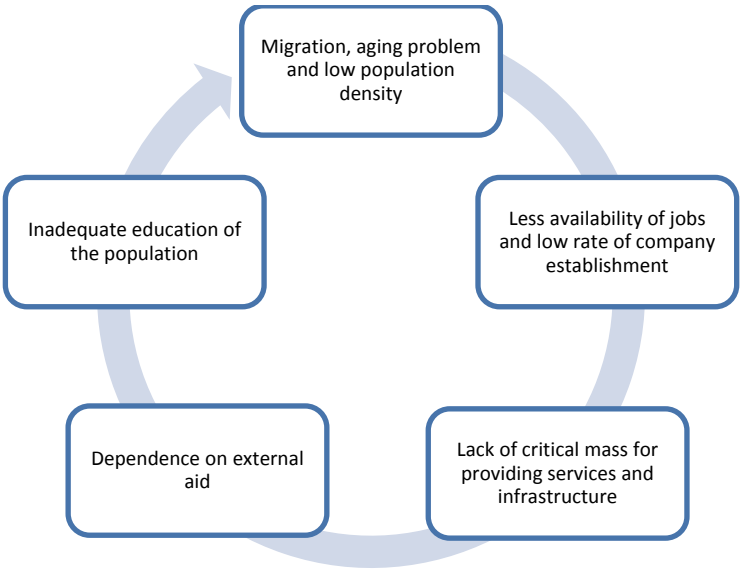

Figure 3 Trap of rural development
Source: author's creation according to Ježić, Z. and colleagues, 2022.

Rural development, although necessary for reducing poverty and improving the quality of life in rural areas, can be accompanied by numerous challenges and pitfalls that can threaten long-term development goals. The concept of the "rural development trap" refers to a situation in which rural areas cannot realize their full development potential due to a combination of socioeconomic challenges. These challenges often act to reinforce each other, creating a cycle that is difficult to break.

One of the biggest obstacles to successful rural development is the lack of basic infrastructure, including roads, water systems, electricity and telecommunications networks. Without adequate infrastructure, access to education, health services and markets remains limited, making sustainable development difficult. Also, rural development often depends on external assistance from governments, non-governmental organizations or international agencies. This dependence can create long-term non-independence of communities and undermine local initiatives. It is crucial to ensure that development programs are accompanied by measures for local capacity building and sustainability.

Migration and aging of the population represent significant challenges for rural development. These processes have long-term social, economic and demographic consequences that can significantly affect the sustainability and prosperity of rural communities. One of the most obvious effects of migration is the depopulation of rural areas. Young people often migrate to urban areas in search of better educational and work opportunities. This results in a decrease in the population, which can lead to the closure of schools, health facilities and other important services due to lack of users. Migration of the working-age population reduces the available labor force in rural areas, which can negatively affect local economies, especially in sectors such as agriculture and small businesses. Labor shortages can lead to reduced production and economic growth. The departure of young people

results in an increase in the average age of the remaining population. This change in the demographic structure can further burden the social and health systems, as the aging population requires more medical care and social support. An aging population has greater health needs, which increases health care costs in rural areas. In addition, older people often have chronic diseases that require continuous care, which further burdens health care systems.

The education of the population plays a key role in the economic, social and cultural development of rural areas and the development of smart villages. A high level of education of the population contributes to many aspects of sustainable development, and its benefits are manifested on a personal, joint and social level. Educated workers have greater skills and knowledge, which increases their productivity. Better education enables more efficient use of technology and innovation, which can significantly increase the production capacity and economic output of rural communities. Also, education enables people to engage in different types of work and have different occupations, which helps diversify the economy of rural areas.

Therefore, the importance of education for the development of smart villages is defined below.

EDUCATION - THE KEY TO THE DEVELOPMENT OF THE 21ST CENTURY

Education represents the power of economic growth and development of society. The increased level of education of the individual and society enables an increase in utility values in society, an increase in national income and an increase in the purchasing power of the population.

With regard to the ever faster obsolescence of existing knowledge and the need to apply new ones, the permanent education of human resources becomes essential. Continuous training for the development, application and use of new technologies enables technological progress. The development, application and spread of new technological achievements are becoming necessary preconditions for competitiveness in developed societies, and thus for the economic growth of the country.

The knowledge economy is predominantly an electronic economy based on information, knowledge and new skills (Godin, 2010: 261). With regard to the ever faster obsolescence of existing knowledge and the need to apply new ones, the permanent education of human resources becomes essential. Continuous training for the development, application and use of new technologies enables technological progress. The development, application and spread of new technological achievements are becoming necessary preconditions for competitiveness in developed societies, and thus for the economic growth of the country. In the last ten years, the trend of increasing high technology in world exchange has been accelerating. This leads to the promotion of creativity and innovation, the encouragement of an interdisciplinary and multidisciplinary research approach, the change of organizational structures in order to increase effectiveness, the connection of science and the economy through faster commercialization of results, the

gathering of scientific and financial resources through (transnational) megaprojects, the development of research and educational capacities, and the increase of investments in research. These processes include the organized and permanent collection of knowledge, the creation of knowledge bases, the rapid and organized creation of new knowledge, increasing the ability to absorb knowledge, improving the communication infrastructure for more effective access to knowledge and its exchange using computer networks, finding effective organizational models for the application of acquired knowledge (the so-called " learning company"), the development of new scientific branches (such as biomedicine and genetics, biotechnology, nanotechnology) and the emergence of new materials and forms of energy. The aforementioned encourages the socio-cultural transition from an industrial society to a knowledge society, and traditional economies to knowledge-based economies. Likewise, there is significant development of smart cities and smart villages.

At the current level of development of science, technique and technology, as well as human society, investing in the education of human resources becomes essential for modern progress. Proof of this is the fact that only approximately 15% of the countries in the world are highly developed, and their share in the world's wealth is approximately 80% (World Bank Report 2023). In the global economy, the importance of volume is losing importance. The new challenges for the entry of new companies into the knowledge economy do not lie in volume, but in the production of high value and quality. The knowledge economy is based on specialized knowledge, especially the ability to recognize and solve problems. The quality of employees who possess such skills includes multiple education, independent initiative, creativity, communication, sense of responsibility, cooperation and understanding of technologies and the environment. Innovation and creativity become the key capabilities of managers in order to act strategically, create alliances and encourage development and change.

Constant changes demand from individuals and organizations in the knowledge economy the need for greater creative ability, which can be observed through the following determinants (Seltzer and Bentley, 1999):

- Work will increasingly require a high knowledge component and high skill levels; even marginal and low-paid jobs will require a greater ability to manage information, apply knowledge and skills in work.
- Accelerating market competition and the application of new technologies require businesses to innovate faster. Innovative pressure is applied to new products and services, in communication and management, and in employment practices.
- Combining disciplines and knowledge bases, for example combining artistic and technical skills or professional knowledge and interpersonal personality, will be increasingly important for maximizing the value of intellectual capital.
- People will increasingly have to rely on themselves in managing, organizing and balancing their personal and business lives. Changing patterns and demands of the labor market will require new forms of personal and communication skills.

Education has an important function in every society. It is generally considered that education is a lifelong process of transferring knowledge, skills and competences. Education becomes the basis of human emancipation, a functional instrument through which an individual's identity, social reputation, authority and power are realized. Although knowledge is acquired individually, it becomes the wealth of all members of the community, so it is considered that education is the only individual trait that becomes a common value and benefit of the entire community.

The modern formal education system began to take shape in the West at the beginning of the 19th century, and the modern idea of lifelong learning takes shape more distinctly since the 70s of the last century. At the same time as lifelong learning, there are descriptions of a learning society, and that is why these two terms are connected to theoretical discussions. Sometimes they are used as synonyms, sometimes lifelong learning is a way of building a learning society, and sometimes it is an integral part of it. Regardless of the differences, theoretical debates in the early 1970s spoke of the need for the entire society to be determined differently according to learning. Education has a significant social, social and economic function. Humanistically oriented goals refer to the development of human personality. Economic goals refer to the stimulation of economic growth, that is, the development of the productive forces of a given society, while socially oriented goals refer to the improvement of the social position of the individual, the homogenization of society, and the strengthening and development of dominant social relations. According to contemporary functionalists, education is a bridge between the family and society as a whole. It represents the equality of opportunities that opens up the possibility of changing the position that individuals acquire by birth or inheritance, and therefore education becomes the basis of human emancipation and a very functional instrument through which the identity of the individual is realized, but also the overall development of society. They believe that, although knowledge is acquired individually, it becomes the wealth of all members of the community, and therefore education is a common value of the entire society.

The basic functions of the education system in society are concentrated in political, social (selective) and economic functions. (Zoričić, 1996) The political function of the education system has a double goal. On the one hand, society wants to ensure the stability of the existing social order through the educational process. On the other hand, the education system serves as a tool for clearly defining the goals of the social policy of an individual state. This concept is often called the "state system of education". At the national level, this system includes various institutional forms intended for formal education.

The social function of the education system encompasses various aspects of its social role. The basic purpose of education from the perspective of social policy is to ensure equality of opportunity. In other words, the goal is to provide each individual with an equal chance to realize their innate abilities. Sociologists of education often emphasize the importance of ensuring equal access to education in order to achieve this equality.

The interconnection of the educational and economic subsystems plays a key role in society. The educational system produces informational output that the economic

subsystem uses to meet its needs in production. According to the concept of the economic function of education, the educational system regulates the needs of the workforce, ensuring the quantity and quality of human abilities in accordance with technological conditions. This connection directly affects the education of human potential, both quantitatively and qualitatively. Also, permanent education of employees and assessment of the effectiveness of education are key to success in technologically developed societies. Trained human potential enables technological progress, and the development, application and mastering of new technologies are necessary prerequisites for economic success.

Knowledge, the fundamental productive force in human society, is the main prerequisite for the success of the economy. Globalization trends connect the world into entities where equal standards and value systems are applied. Differences in knowledge and its application become the main factors that divide developed from underdeveloped countries, rich from poor. The main trend of education in the XXI. In the 20th century, the focus is on the quality acquisition of a small amount of permanent knowledge that is actively acquired and is suitable as a permanent basis for further permanent learning throughout life.

With the development of the concept of lifelong education, all forms of education become important for the overall education. Due to the rapid development and transfer of information, formal education cannot meet the needs of the labor market, and it needs to be constantly supplemented. An important role in this process is played by non-formal and informal education, which is constantly being developed and upgraded in accordance with the needs of the market.

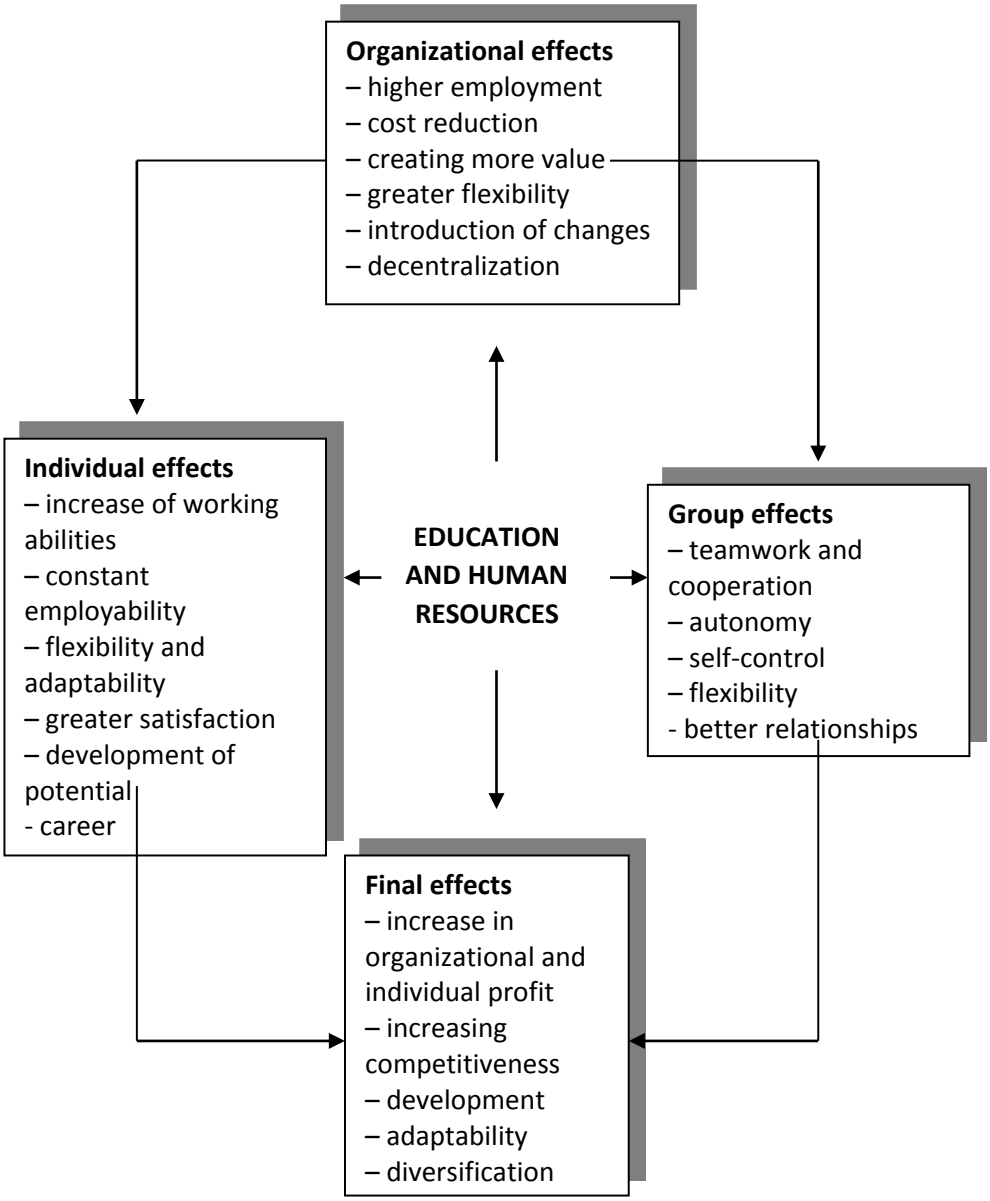

Figure 4 Individual, organizational, group and final effects of education
Source: Karaman Aksentijević et al. (2012)

There are three basic requirements that the education system must meet in order to enable economic development (Karaman Aksentijević, 2012: 115):

- to ensure the fulfillment of quantitative and qualitative requirements in terms of ability for specific work
- constantly follow the changes in the modern economy
- to organize education in a way that enables rapid adaptation to economic needs, primarily to the needs expressed in the labor market. The goals to be

achieved by the educational policy are: facilitating the acceptance of new knowledge and skills, a tighter connection between education and the economy, and the fight against exclusion.

Creating an adequately trained, adaptable and mobile workforce employable throughout Europe is extremely important for European economic development. The Lisbon process enabled greater competitiveness of Europeans, but also better integration of institutions and communities. Jean Monnet himself stated at the end of his life that if he were to start his initiative again, he would integrate Europe through education (Jean Monnet House, 2023).

In recent decades, we have noticed an accelerated growth in investment in research and development and an increase in the capacity of educational institutions. In addition, scientific and financial resources are increasingly linked by transnational megaprojects, and this dynamic has a significant impact on the economy. (Karaman Aksentijević, N. Ježić, Z. and Adelajda Zaninović, P., 2021) The industry is changing its organizational models to increase efficiency. Interdisciplinary and multidisciplinary approaches are becoming more and more important, and cooperation between science and business encourages innovation. Connecting science and business enables faster commercialization of research results. Products that contain a high proportion of knowledge and information become more competitive on the market. Innovations are increasingly spreading to rural areas, not only in urban areas. The concept of smart villages involves the application of technology and knowledge to improve the quality of life, agricultural practices and the local economy. Smart villages use information technologies, sustainable resources and innovative business models

Education and smart villages - a meta-analysis

Smart villages represent the integration of advanced technologies and innovative approaches to improve the quality of life in rural areas, with a special emphasis on education. There are several key studies that explore this topic and provide valuable insights into the ways in which technology can improve educational outcomes and reduce poverty. The main findings of these studies are summarized below.

	TITLE	KEY CONCLUSIONS
1	Sukri, Sukri., May, Valzon., Salamun, Salamun., Muhammad, Yazid., Kenepri, Kenepri., Siti, Juariah. (2022). Information technology education in the smart village concept in Sei Lembu Makmur Village, Kampar Regency. Jurnal Pengabdian Masyarakat Multidisciplin, 5(3), p. 155 - 164.	It focuses on information technology education within the concept of a smart village, showing data on the impact of technology education.

2	Ani, Faujiah. (2017). Building the "Smart Village" Through the Implementation of the Non-Formal Education to Improve English Language Skills in the Village of Geluran Taman Sidoarjo". 2(1), p. 113 - 124.	It describes the use of non-formal education to improve English language skills in a smart village, providing data on improving language skills.
3	KB, Singh., N., P., S., Sengar., Debanjan, Das., Subhas, C., Misra. (2022). Village 5.0: Enabling Technologies and its Applications in Development of Smart Village. p. 556 - 561.	Discusses technological applications enabled by smart villages, including educational technologies.
4	Subhojoy, Dey., Amab, Bagchi., Soumyamoy, Bose., Vaibhav, Tulsiyan., Soumya, Chakraborti., Ankita, Choudhury., Arpan, Dutta., Vivek, Kumar, Tiwari., Subham, Manav, Shree., T ., K., Rana. (2017). Green energy powered smart village school. p. 266 - 268.	It provides data on the integration of green energy technologies into smart rural schools, highlighting the effects on educational environments.

Table 1 Meta-analysis - overview of key studies linking education and smart villages
Source: creation of the author

All four studies emphasize the key role of technology in improving educational opportunities in rural areas. While the first study focuses on digital literacy, the second one shows the concrete results of language learning through non-formal educational programs. The third study broadens the perspective to the wider application of technology, including the Internet of Things (IoT) and digital infrastructure, while the fourth adds a dimension of sustainability through the use of green energy. Integrating technology into smart village education systems not only improves educational outcomes but also leads to poverty reduction and sustainable development. Technological solutions enable better access to information, increase employability and reduce costs, creating the foundations for long-term socioeconomic stability in rural communities.

In the rest of the chapter, the technologies that enabled the development of smart villages are analyzed in more detail using the case study method. These technologies primarily serve to increase the education of the population in order to achieve the positive effects mentioned in the previous chapter.

Integration of digital technology in smart villages in the function of population education development - case studies

Smart villages represent an innovative approach that uses technology to improve the quality of life in rural areas, especially through education. This chapter analyzes five key case studies that explore different aspects of smart village development and how they can improve educational outcomes, reduce poverty and promote sustainable development:

1. **Case study: Sei Lembu Makmur, Indonesia** – a case study focused on the integration of information technology education in the village of Sei Lembu

Makmur to improve digital literacy and access to education (Entang et al. 2023). The example shows how education and digital tools have improved educational outcomes and how they can be a model for similar rural areas. This study investigates the impact of information technology education within the concept of a smart village in Sei Lembu Makmur, Indonesia. The goal was to increase digital literacy among residents through training programs and the use of digital tools. The results show significant improvements in access to information, communication and employment opportunities. Educational outcomes have improved , which has had a direct impact on the reduction of socioeconomic inequalities. This model can serve as an example for similar rural areas that want to improve education through technology.

2. **Case study: Geluran Taman, Sidoarjo, Indonesia** - this village implements non-formal education programs to improve English language skills, using smart technologies. The example shows how the applied methodologies, community involvement and influence on language skills affects the employment opportunities of residents and poverty reduction. This study focuses on Geluran Taman, Sidoarjo, Indonesia, where non-formal educational programs to improve English language skills using technology have been implemented (Entang et al. 2023). The use of smart technologies has provided residents with access to language learning resources, resulting in significant improvements in language skills. These programs have increased professional opportunities for residents, allowing them to better integrate into the global labor market. The study highlights the importance of adapting educational programs to local needs and capacities.
3. **Case Study: Smart Schools in Malawi -** An example shows the importance of technology - applying solar-powered tablets and internet-connected classrooms in rural schools. The example provides insight into the challenges and successes of integrating renewable energy and digital tools into education. This study analyzes the application of solar-powered tablets and internet-connected classrooms in rural schools in Malawi (Sharra 2023). The project aimed to provide digital educational tools in areas with limited resources. Research shows that solar panels have enabled sustainable energy support for technology in education, while internet-connected classrooms have enabled access to global educational resources. Despite challenges such as technical support and teacher training, the project demonstrated significant improvements in educational outcomes and students' digital literacy.
4. **Case Study: Rajasthan, India's Smart Villages** – initiatives in the villages of Rajasthan, India, include e-learning centers and digital literacy programs (Hanif 2022). The study focuses on the scalability of these projects and their impact on the quality of education in areas with extremely limited resources. E-learning enabled students to access quality educational content, while digital literacy programs increased their skills and employability. These projects have shown that it is possible to significantly improve education even in the most challenging environments through the targeted application of technology. Initiatives like e-learning centers and digital literacy programs implemented in several villages. The case study

shows the scalability of such projects affects the quality of education in environments with extremely limited resources.

5. **Case study: Rural areas in Finland** - study shows how broadband internet has been introduced in remote areas to facilitate distance learning, especially during the COVID-19 pandemic. The example highlights the key role of strong infrastructure in supporting continuing education. Finland has implemented broadband internet in remote areas to facilitate distance learning, especially during the COVID-19 pandemic. This study highlights the critical role of robust infrastructure in supporting continuing education. Broadband internet has enabled students in rural areas to access online educational resources, virtual classrooms and teaching materials, which has reduced educational disparities between rural and urban areas. Finnish experiences can serve as a model for other countries that strive to improve education through infrastructure investments.

All the case studies in this chapter highlight the key role of technology in improving educational opportunities in rural areas. While the study from Sei Lembu Makmur emphasizes digital literacy, Geluran Taman shows concrete results of language learning through non-formal educational programs. The Malawi study expands the perspective on the application of solar energy in education, while projects in Rajasthan and Finland demonstrate how digital infrastructure can reduce educational inequalities and improve the quality of education. Integrating technology into smart village education systems not only improves educational outcomes but also leads to poverty reduction and sustainable development. Technological solutions enable better access to information, increase employability and reduce costs, creating the foundations for long-term socioeconomic stability in rural communities. Therefore, it is necessary to provide an overview of technological integrations that can significantly increase the education of the population as a function of the development of smart villages.

OVERVIEW OF TECHNOLOGICAL INTEGRATIONS IN SMART VILLAGES WITH SUGGESTIONS FOR IMPROVEMENT

Smart villages use advanced technologies to improve the quality of life, with a special focus on education. The introduction of digital platforms, mobile applications, satellite communication, artificial intelligence (AI), Internet of Things (IoT) and green energy is transforming educational systems in rural areas, enabling better access to education and contributing to sustainable development. Below is an overview of the key technologies used in smart villages.

Digital learning platforms enable access to educational resources using the Internet, thereby overcoming geographical barriers and enabling learning in remote areas. These platforms offer a wide range of tools and materials, including video lessons, e-books, interactive tasks and discussion forums. Examples include platforms like *Coursera,* a platform that provides quality educational content free or at affordable prices. In smart villages, digital learning platforms can be key to providing continuing education, especially for people who do not have access to

traditional schools.

Mobile applications play a key role in education in smart villages. They allow access to educational materials using smartphones, which is especially useful in rural areas where access to computers is limited. Apps like *Duolingo* for language learning, *Photomath* for math help and *Google Classroom* for lesson organization are used to improve educational outcomes. Mobile applications allow students and teachers flexibility, enabling learning and teaching on the go.

Satellite communication provides Internet access in remote and rural areas where traditional infrastructure is not available. By using satellite internet, schools in smart villages can access global educational resources, virtual classrooms and online learning platforms. This technology is especially important in areas where telecommunication networks are poorly developed. Satellite communication makes it possible to connect even the most isolated villages, thereby reducing the digital divide and enabling equal access to education. The most famous example is *Starlink* satellite communication.

Artificial intelligence (AI) is transforming education through personalized learning methods, analytics and automation. AI is used to adapt teaching content to the needs of each student, analyze learning data to identify weak points and provide support through virtual assistants. Examples of AI tools include *AI tutors* that can provide personalized lessons and real-time feedback. These tools enable more effective learning and help teachers monitor student progress and adjust lesson plans.

The Internet of Things (IoT) connects various devices and sensors on the Internet, enabling the collection and exchange of data. In an educational context, IoT can improve school security, optimize energy consumption, and improve learning conditions. Examples of IoT applications in schools include smart thermostats for temperature control, air quality sensors in classrooms, and smart systems for monitoring student attendance. These systems help create a safer and more enjoyable learning environment. In addition, IoT systems and technology significantly develop agriculture in rural areas and thereby increase the employability of the population (Katunar and Vretenar, 2023: 138).

The use **of green energy** in smart villages contributes to sustainable development and the reduction of energy costs. Solar panels, wind turbines and other renewable energies can provide reliable and environmentally friendly energy for schools and other educational institutions. Integrating green energy reduces electricity costs and allows financial resources to be diverted into educational resources. In addition, the use of renewable energy has educational value because it teaches students about the importance of sustainability and environmental protection.

Technological integrations in smart villages significantly improve educational opportunities and contribute to sustainable development. Digital learning platforms, mobile applications, satellite communication, artificial intelligence, the Internet of Things and green energy together create the foundations for modern, efficient and environmentally responsible education. These technologies not only improve access to education but also help reduce poverty and create sustainable communities.

CONCLUSION

Smart villages use advanced technologies and innovative approaches to improve the lives of their residents, including educational aspects. By integrating digital tools and resources, education in rural areas becomes more accessible and of higher quality, which contributes to the overall development of the community.

The use of digital learning platforms, mobile applications and satellite communication enables students and teachers to access a wide range of educational materials and resources. Mobile applications further enhance education by allowing students to access content using smartphones. Connecting schools via satellite internet enables access to global educational resources and online learning platforms, thus reducing the digital divide and enabling equal access to education.

In addition to improving education, this approach plays a key role in reducing poverty. Education is the basis for creating better job opportunities, which directly leads to the economic progress of individuals and entire communities. Through the acquisition of new knowledge and skills, residents of smart villages become more competitive on the labor market, which results in increased employability and reduced poverty.

Smart villages represent an important model for sustainable development that harmonizes technological innovation with educational and social improvements. The use of technologies such as artificial intelligence (AI) and the Internet of Things (IoT) further improves educational systems and living conditions in rural areas. AI can provide personalized lessons and real-time feedback, while IoT connects devices and sensors to optimize learning conditions and resource management.

For the further improvement of smart villages and education in rural areas, future research is needed, which must be focused on several key aspects:

1) **Evaluating the effectiveness of technological tools in education:** it is necessary to evaluate in detail how specific technologies such as AI tutors, mobile applications and online platforms affect educational outcomes in rural areas. Particular emphasis should be placed on comparing traditional and modern educational practices to identify the best methods for improving learning.

2) **Adapting educational content to local needs:** explore how locally relevant educational programs can increase engagement and success in learning, especially in the context of local cultures and industries. This adaptation can help create educational programs that are directly applicable and beneficial to the communities in which they are implemented.

3) **The impact of digital literacy on the rural population:** to investigate how improving digital literacy can affect the personal and professional development of rural residents and how it contributes to their socioeconomic mobility. Improved digital literacy can open up new

opportunities for learning, employment and entrepreneurship, which are key to long-term socioeconomic development.

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PART THREE

The third part of the book contains a detailed analysis of the various agricultural crops and their specific characteristics in terms of sustainability, innovation and market strategies. Twelve chapters analyse the various opportunities, challenges and specificities related to wine, prosciutto, honey, tomatoes as well as fisheries management and traditional practices such as sheep farming. It also examines how local specialties contribute or can contribute to the development of competitive advantages.

Chapter 17 analyses the hydroponic technology of growing tomato cultivation under protected conditions in Croatia and discusses the technological risks, market dynamics and competitive strategies that producers can adopt to ensure sustainable industry growth. Chapter 18 analyses sustainable fisheries management through experimental economic simulations and focuses on how to achieve long-term sustainability of fish through strategic resource management. Chapter 19 examines the communication strategies of traditional sheep farming on the island of Cres and analyses the integration of sustainable development and cultural heritage into modern marketing approaches.

Chapter 20 is dedicated to prosciutto as an experiential product and provides insights into the importance and impact of traditional production methods and geographical indications on market positioning, whereas Chapter 21 provides an overview of the state and challenges of Croatian beekeeping. It shows how climate change and unfair competition affect honey production and what adjustments are needed to foster long-term sustainability in this industry.

The remaining chapters are dedicated to wine production and viticulture. Chapter 22 focuses on wine tourism and analyses the motivations of wine tourists and the factors influencing their choice of wine regions with an emphasis on the importance of the local wine and gastronomic offer. To better understand consumer perceptions, Chapter 23 analyses the label designs of wine bottles on the example of the variety *Žlahtina* by means of a text linguistic analysis. Chapter 24 analyses sustainability trends in wine development and labelling, with a particular focus on organic and sustainable wines and respective consumer perceptions. The following chapter, Chapter 25, uses the example of Kvarner winemakers to analyse how strategic alliances enable small producers to achieve better results through joint marketing activities. Chapter 26, on the other hand, presents the Slovak experience regarding the preservation of autochthonous wine varieties, emphasising the importance of vineyard restructuring and market adaptation through the cultivation of high quality and locally specific varieties. The legal perspective of viticulture in the context of innovations in the protection of wines with geographical indications is presented in Chapter 27. The final chapter of this book, Chapter 28, looks to the future of agronomy and is dedicated to innovations in viticulture and winemaking, focusing on the development of new grape varieties that are more resistant to diseases and

pests and the ways in which these innovations contribute to the sustainable development of viticulture.

FRESH TOMATO PRODUCTION USING HYDROPONIC TECHNOLOGY - AN INDUSTRY ANALYSIS

CHAPTER 17.

Domagoj Hruška *

ABSTRACT

The use of hydroponic technology is becoming increasingly important in agricultural production, as the quantity and quality of production in protected environments far exceed the achievements of other technologies. One of the most widely grown agricultural crops in hydroponic cultivation is the tomato, which has established itself as the dominant choice among producers over decades of production in controlled conditions. Given that investment in agricultural production in protected environments involves significant technological and market risks and is extremely capital-intensive, it is crucial to have an adequate understanding of the determinants of competitive advantage in this industry. This chapter provides insights into the industrial structure, the relationship between key market players, the strategies they use, and an assessment of market attractiveness and future market trends. The foundation on which the chapter is based is an empirical study conducted on a sample of experts from the fresh tomato hydroponic production industry in the Republic of Croatia. A total of 19 respondents provided their views on the intensity of industrial rivalry, the threat of new entrants into the industry, the threat of substitute products, the bargaining power of suppliers, and the bargaining power of buyers. The results of the research indicate a relatively high intensity of competitive dynamics within the industry and strong buyer bargaining power, while other competitive forces are of lesser importance to the profitability of the industry. By projecting the observed trends, decision-makers in the industry can more easily develop scenarios for achieving sustainable competitive advantages by securing an appropriate position within the hydroponic fresh tomato production industry in the Republic of Croatia.

Keywords: *strategic analysis, industrial structure, tomato production, hydroponic technology*

INTRODUCTION

The activity of agricultural production often carries a romantic connotation in the perspective of many individuals. "Cooperation with nature," to paraphrase an old marketing slogan, conveys the idea of harmony with the environment and a clear understanding of the results of one's work, something that is chronically lacking in modern life. However, a significant portion of agricultural products, especially fruits and vegetables of sufficient quality and quantity to be sold in retail chains, is produced under conditions that resemble a factory far more than a green meadow.

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In discussions about the prospects of agricultural production and the survival of rural areas, the term "self-sufficiency" in production is often used, referring to the level of production in relation to consumption on a national level. Data published in the National Strategy for Sustainable Operational Programs of Producer Organizations in the Fruit and Vegetable Sector in 2020 indicate that the Republic of Croatia fails to meet the level of national consumption for many agricultural crops. Given that we are neither a desert country nor a country of the far north and, on the contrary, possess highly favorable soil configurations and water availability, it is fair to ask: what is the problem? One possible answer is the underutilization of advanced technologies in production, and in the case of vegetable production, particularly the limited use of hydroponic systems in protected spaces such as greenhouses or polytunnels.

This chapter provides an analysis of the structure of the hydroponic fresh tomato production industry in the Republic of Croatia. It is important to emphasize that the fresh tomato industry is entirely different from the production of industrial tomatoes used for processing, despite involving the same plant. Fresh tomato production is currently the most dynamic segment of the agricultural sector in protected environments on a global scale, and Croatia is no exception. Over the past fifteen years, approximately twenty producers have established themselves in the fresh tomato market, operating on a total area of about 50 hectares of protected spaces, mostly greenhouses. In comparison, the Netherlands reports more than 1,760 hectares of greenhouse tomato cultivation and over 1,100 companies competing in the fruit and vegetable production industry in protected spaces (European Statistic Handbook 2023).

A suitable industry analysis allows decision-makers to better position themselves within the forces that define the competitive arena. The goal of business strategy is to ensure a company's long-term competitive advantage. One way to define competitive advantage is by achieving above-average profits in the industry in which the company competes (Porter 1994). This goal is becoming increasingly difficult to achieve due to the frequent and unpredictable changes the market brings today. For a company to succeed, it must develop the capacity to respond effectively to these changes.

The key to appropriate strategic actions lies in analyzing the current state and trends in the surrounding environment. Trends in the macroenvironment, such as political, economic, demographic, health-related, and other influences, represent significant sources of uncertainty. However, the primary impact on a company's prospects is found within the actions of competitors, customers, suppliers, and other factors in what is known as the industrial environment.

THE ROLE OF STRATEGIC ANALYSIS IN BUSINESS STRATEGY FORMULATION

The complexity of business models is continuously increasing, and business challenges are becoming more demanding. For a company to succeed, it must develop a strategy that enables it to respond effectively to the changes brought about by market and technological shifts. The extent to which companies are affected by their environment in the global business system is evident from the recent global economic crisis marked by shortages of key energy sources and rising overall price levels. Today, more frequently than ever, it is said that the successful future of a country, industry, or company depends on long-term strategy and strategic planning. Businesses that have been successful for years are more aware of the necessity and great significance of business strategy. For them, it is crucial to identify and monitor the factors shaping their business future and to enable them to adapt to new operating conditions.

The goal of the strategic management process is to define a business strategy that fulfills its fundamental purpose: creating value for consumers, achieving competitive advantage for the organization, and attaining above-average profits in a given industry.

The history of the strategic management discipline is based on two approaches to strategy: the structuralist approach (Porter, 1980) and the resource-based view (Barney, 1991). While the structuralist approach includes the company and its environment, the resource-based view predominantly focuses on the resources and capabilities available to the company. The focus of this chapter is an analysis of the industry derived from the structuralist approach to strategic management. Although fundamentally opposed, these two perspectives on competitive dynamics have stood the test of time, and a significant portion of contemporary approaches to strategic management is based on them (e.g., Kero and Bogale, 2023; Teece, 2023; Kühl, 2023).
Strategic analysis should primarily provoke reflection among business decision-makers. It is necessary to integrate a new perspective on key relationships and processes within the company. To achieve this, the form of strategic analysis is crucial. A solution mechanism that is elegant, easily comparable across industries, and applicable over time is a highly useful practical tool. Such an analytical framework is provided by an assessment of industry structure.

The goal of industry structural analysis is to assess the long-term profitability potential of a company and provide guidelines for developing competitive business strategies. The key principle of this approach emphasizes that a company cannot be viewed separately from its environment, particularly the industry to which it belongs. Therefore, the assessment of competitive positioning and business success relies on analyzing the industry in which the company operates. The development of a company's strategy must be based on the results of this analysis, as they help predict the long-term profitability of the industry, understand differences among competitors, and make decisions about various business moves.
The analytical framework we will use to analyze the structure of the fresh tomato production industry in Croatia is based on Porter's Five Forces model (Porter, 1988).

This model assumes that the long-term profitability of an industry, as well as the companies within it, depends on the influence of five key factors shaping competitive dynamics (Figure 1): (1) the intensity of competitive rivalry among companies operating within the observed industry, (2) threat of new entry - the presence of companies willing to enter the market, (3) the likelihood of customers switching to substitute products if they prefer them, (4) the bargaining power of buyers, and (5) the bargaining power of suppliers.

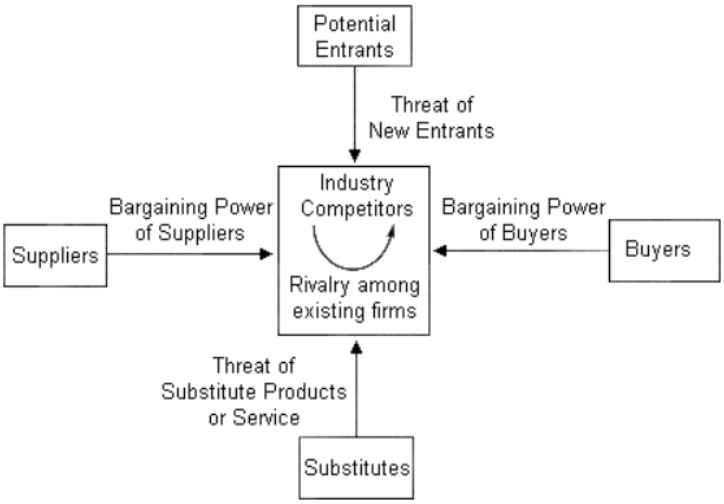

Figure 1 Five competitive forces model
Source: Porter, M. E. (1998). Competitive strategy: Techniques for analyzing industries and competitors. New York, NY: Free Press, p. 6.

Understanding the structure of an industry and the internal characteristics of a company is key to identifying the true strengths and weaknesses of the organization, as well as recognizing potential opportunities and threats from the environment. A detailed industry analysis enables strategists and managers to identify competitive advantages and weaknesses, providing a foundation for making better decisions in shaping strategy. The goal of such analysis is not only to recognize current challenges but also to find an optimal position within the industry that allows the company to effectively shield itself from competitive pressures.

RESEARCH METODOLOGY

The methodological approach of this chapter is based on the collection and analysis of data obtained through primary research, which included in-depth interviews, a survey questionnaire, and an analysis of relevant secondary data about the industry. The primary research was conducted on a sample of experts from the fresh tomato

production industry in Croatia, including recognized specialists and responsible individuals from leading companies in the sector.

In addition to interviews, the key research tool was a survey questionnaire. The first part of the questionnaire contains a series of statements divided into five groups, each representing one of the competitive forces. Respondents rated their level of agreement or disagreement with these statements using a five-point Likert scale, which measured their perceptions of the structural characteristics of competitive forces in the industry.
The questionnaire is based on the INDUSTRUCT instrument, developed by Pecotich, Hattie, and Low (1999), which has been successfully applied to various industries in Croatia (e.g., for an analysis of the bakery industry, see Brnos 2009). In this study, the original questionnaire was adapted and expanded to align with the specific characteristics of the fresh tomato production industry. Statements that did not fit the context were removed, while other relevant determinants of competitive forces were included. Ultimately, the survey questionnaire contains 52 indicators for measuring the intensity of competitive dynamics. The research was conducted with 19 industry experts, and an equal number of completed questionnaires were collected.

This chapter also incorporates elements of the action research method, as the author has been an active entrepreneur in the observed industry for over ten years. Action research is a method aimed at simultaneously investigating and solving problems. As the name suggests, action research involves conducting research and taking action at the same time. As a highly interactive method, action research is often used in social sciences, particularly in educational settings, as a form of systematic analysis that emphasizes reflection and integrates theory with practice. Action research is also significant among management researchers as an accepted paradigm used to validate various research findings (e.g., Eden, Ackermann 2018).

RESULTS AND DISCUSSION

The following section will present the results of the analysis for each of the observed forces of competitive dynamics in the Croatian fresh tomato industry.

The intensity of competitive rivalry

At the core of Porter's model of competitive forces lies rivalry among existing competitors. This force most directly reflects the attractiveness of a given industry. Rivalry between competing firms plays a crucial role in shaping industry dynamics, as the level of competition can significantly impact profitability and long-term growth prospects.

Table 1 presents the results of the empirical research, specifically the ratings of the intensity of competitive rivalry within the observed industry. The table includes the average ratings of individual statements that describe the intensity of each component of the observed force.

THE INTENSITY OF COMPETITIVE RIVALRY = AVERAGE			
No.	Topic	Question	Average
1.	Number of competitors (industrial concentration)	Our company competes with a large number of other companies.	2.35
2.	Intensity of competition	The terms that best describe competition in our industry are: "aggressive," "fierce," "intense."	3.44
3.	Likelihood of retaliation and countermeasures	In our industry, the competitive actions of one company have significant effects on other competitors, triggering retaliation and countermeasures.	4.30
4.	Availability of resources for competitive actions	In our industry, companies possess resources that enable them to sustain strong competitive actions and countermeasures against their competitors.	4.40
5.	Frequency of advertising battles	In our industry, advertising battles are frequent and highly intense.	3.12
6.	Intensity of price competition	Price competition in our industry is highly intense (competitors quickly and easily respond to price reductions in kind).	4.12
7.	Frequency of price competition	Price reduction is a common competitive action in our industry.	4.07
8.	Frequency of non-price competition	In our industry, companies rarely use non-price competition methods such as product quality, new product development, innovation, branding, advertising, etc.	3.57
9.	Limited industrial growth	Industrial growth is limited, so companies in the industry cannot achieve their development goals without threatening the market	3.23

		shares of their rivals.	
10.	Share of fixed costs and investments in equipment	Companies in our industry have a high share of fixed costs and allocate significant funds to machinery, equipment, and facilities.	4.29
11.	Lifespan of industrial products	Products in our industry have a short lifespan and cannot be stored.	4.55
12.	Similarity and lack of differentiation in industrial products	Products in our industry are very similar, with no differentiation factors.	4.14
13.	Excess capacity in the industry	Companies in our industry have excess capacity.	3.03
14.	Diversity of competitors by origin, strategy, and objectives	Competitors in our industry are very diverse in terms of product quality, cost structure, goals, strategies, management style, personality, and more.	2.14
15.	Exit barriers	Significant exit barriers, such as specific assets, economic dependence on the industry, governmental and societal pressures, high fixed exit costs, etc., prevent companies from leaving our industry.	3.79
16.	Intensity of rivalry	Companies within our industry compete intensively to maintain and/or increase their market share.	4.12
The average score of the competitive force			3.67

Table 1 The intensity of competitive rivalry in Croatian fresh tomato industry
Source: Authors' calculation

In Croatia's fresh tomato industry, the key factors with the greatest impact on industrial rivalry include product shelf life, the availability of resources for competitive actions, the likelihood of retaliation among competitors, and the proportion of fixed costs and investments in equipment. The shelf life of fresh tomatoes (rated 4.55) plays a crucial role due to the highly perishable nature of the product, which demands constant supply and sales dynamics. Additionally, the high availability of resources for competitive actions (4.40) enables producers to promote their products more aggressively and invest in technologies, while

significant fixed costs (4.29) further intensify competition, as producers must secure stable revenue to cover these expenses.

Moderate factors that also contribute to rivalry, albeit to a lesser extent, include the intensity and frequency of price competition and product similarity. Ratings of 4.12 for the intensity and 4.07 for the frequency of price competition indicate that price wars are present but not dominant. Instead of solely relying on price wars, Croatian fresh tomato producers also focus on other competitive aspects. The similarity and lack of differentiation between products (4.14) further increase competition, as consumers have limited choices between different tomato brands, making it challenging for producers to differentiate their products.

On the other hand, factors with the least impact on rivalry include the diversity of competitors in terms of origin, strategy, and goals, limited industry growth, and the number of competitors. The diversity of competitors (2.14) is the least significant factor, as market participants are generally similar in their business strategies and goals, reducing variation in competition approaches. Limited industry growth (3.23) and the number of competitors (2.35) are also not critical, as the fresh tomato market is relatively stable, with limited growth opportunities and a relatively small number of competitors.

The analysis focuses solely on domestic producers and does not account for the impact of imported tomatoes, which play a key role in the industry's operations. Imported tomatoes, often available at lower prices and throughout the year, represent a significant threat to domestic producers. Domestic competitors primarily perceive imports as the main challenge, further increasing the intensity of price competition (4.12) and the frequency of price wars (4.07) within the industry. Given the undifferentiated nature of products (4.14), which makes it difficult for consumers to distinguish between domestic and imported tomatoes, domestic producers are forced to lower prices to remain competitive, exacerbating the pressure, especially considering the high fixed costs and investments in equipment (4.29). Although industrial rivalry among domestic producers is rated as moderate, the threat posed by imported tomatoes significantly disrupts market stability and intensifies competition.

Supplier power

Suppliers exert their bargaining power by increasing the prices of their offerings and reducing the quality of products and services at the same price. It is essential to emphasize that suppliers are not limited to providers of raw materials and inputs but also include the labor market as a supplier of workforce, unions as their representatives, and financial institutions as suppliers of capital.

Table 2 presents the perceived strength of suppliers' bargaining power. According to the respondents, the bargaining power of suppliers, with a rating of 2.94, has a moderate impact on the profitability of the industry.

THE SUPPLIER POWER = WEAK			
No.	Topic	Question	Average
1.	Supplier concentration and share in input procurement	There are a small number of suppliers with a significant share in input procurement for our industry.	4.20
2.	Impact of inputs on the quality of industrial products	Supplier products can influence the final quality of our industry's products.	4.10
3.	Importance of supplier products	Supplier products represent essential inputs for our industry.	3.37
4.	Inability to store supplier products	The supplier products we use in our technological processes cannot be stored for any length of time.	1.78
5.	Diversity and differentiation of supplier products	Supplier products are differentiated—they vary significantly in their characteristics, price, and quality.	3.41
6.	Switching costs for suppliers	When switching suppliers, companies in our industry incur additional costs related to modifying the technological process, testing inputs, etc.	2.17
7.	Lack of information on prices, costs, and shares of suppliers	Companies in our industry are not well-informed about their suppliers, their prices and costs, market shares, etc.	2.19
8.	Seeking and obtaining concessions	Suppliers of raw materials and other inputs for our industry demand and receive concessions.	3.61
9.	Threat of supplier downward integration	Suppliers of products for our industry have significant potential (and pose a threat) for downward integration into	2.18

		industrial operations.	
10.	Supplier power	In our industry, a supplier or group of suppliers wields considerable power.	2.40
The average score of the competitive force			2.94

Table 2 The supplier power in Croatian fresh tomato industry
Source: Authors' calculation

The greatest influence on suppliers' bargaining power comes from the concentration of suppliers and the share of input procurement (4.2), as well as the impact of inputs on the quality of industrial products (4.1). High supplier concentration indicates a small number of dominant suppliers, which can potentially grant them greater bargaining power. The significant concentration of suppliers and the substantial influence of inputs on the quality of industrial products suggest that suppliers are critical for ensuring the quality of fresh tomatoes. Inputs such as seeds, fertilizers, and other resources directly affect the final product. Although the overall bargaining power of suppliers is rated as weak, the importance of these inputs for fresh tomato producers makes suppliers relatively significant stakeholders in the supply chain.

The importance of supplier products (3.37) and the diversity or differentiation of their products (3.41) are considered moderate factors. This indicates that the products offered by suppliers hold relative value for tomato producers but are not indispensable enough to grant suppliers substantial power. The diversity of products helps with market differentiation but is insufficient on its own to significantly increase supplier bargaining power. Additionally, suppliers' ability to seek and obtain concessions (3.61) suggests that some suppliers can secure certain advantages in negotiations, though this does not change the overall conclusion about their weak bargaining power.

The factors with the least impact on suppliers' bargaining power include the inability to store products (1.78), switching costs for producers (2.17), and the threat of forward integration (2.18). Low switching costs suggest that tomato producers can easily transition to alternative suppliers, further limiting the power of existing suppliers. The threat of forward integration, or the possibility that suppliers might become producers themselves, is also low, reducing their ability to dominate the market.

In conclusion, while there are some key factors that grant suppliers a degree of influence, such as concentration and input quality, the overall bargaining power of suppliers remains relatively weak compared to that of fresh tomato producers.

Threat of new entry

In addition to existing competitors, the attractiveness of an industry must also account for potential new entrants. New entrants bring additional capacities,

resources, and a desire to capture market share, which typically leads to a decrease in overall industry profitability. Table 3 presents the ratings of threats posed by new entrants.

THREAT OF NEW ENTRY = VERY WEAK (INVERSE MEASURE)			
No.	Topic	Question	Average
1.	Risk of retaliation when entering "in a big way"	In our industry, new competitors must enter visibly and with significant investments in technology, risking initial overcapacity and over-indebtedness, as well as a strong reaction from existing companies.	4.04
2.	Cost disadvantages related to economies of scale	New competitors entering the industry on a small scale must face significant cost disadvantages.	4.67
3.	Capital requirements – building brands	Entrants, or new competitors in our industry, must spend substantial resources to build their brands, recognition, and win over customers loyal to existing brands.	3.57
4.	Capital requirements – advertising and research & development	New companies entering our industry must invest large amounts of capital in risky and irreversible costs such as advertising and/or research and development.	3.02
5.	Capital requirements for entering the industry	Significant capital and/or financial resources are required to enter our industry.	4.45
6.	Access to distribution channels	New entrants to our industry will find it difficult to change the habits of satisfied customers and take them away from existing producers.	2.19

7.	Cost advantages unrelated to business scale	Companies already in the industry have cost advantages over new entrants unrelated to business scale or economies of size, such as specific technology, partnerships with suppliers, better locations, experience, etc.	4.03
8.	Government restrictions – regulations	Government policies and regulations make entry into our industry more difficult with requirements such as environmental protection standards.	1.91
9.	Availability of resources to prevent entry	Established companies in our industry possess significant resources that they can use to prevent new competitors from entering.	3.54
10.	Intensity of response to new entrants	The reaction (retaliation) of established companies toward new entrants in the industry has been and remains strong.	2.99
The average score of the competitive force			1.56

Table 3 The threat of new entry in Croatian fresh tomato industry
Source: Authors' calculation

The threat of new entrants in the Croatian fresh tomato industry is rated as very low, with an average score of 1.56. This inverse measure indicates that the lower the score, the smaller the threat posed by new competitors. A low threat suggests that the tomato industry has significant entry barriers, protecting the market share of existing producers.

The primary factors contributing to the weak threat of new entrants are cost disadvantages related to economies of scale (4.67) and the capital requirements for entering the industry (4.45). Economies of scale play a critical role as existing producers operating at a larger scale achieve lower production costs, making it challenging for new entrants to compete on costs. Similarly, high capital requirements for entering the industry (4.45), which include investments in equipment, infrastructure, and other resources needed for competitive tomato production, create an additional barrier.

Moderate factors that also reduce the threat of new entrants include the risk of

retaliation upon entering "in a big way" (4.04) and cost advantages unrelated to scale (4.03). Existing producers in the tomato industry can aggressively respond to new competitors by lowering prices or increasing promotional activities, posing a risk to new players. Additionally, specific cost advantages enjoyed by existing producers, such as favorable supplier contracts or access to cheaper resources, further diminish the chances of success for new entrants.

On the other hand, factors with the least impact on the threat of new entrants include access to distribution channels (2.19) and government restrictions or regulations (1.91). The relatively low score for access to distribution channels suggests that the tomato distribution network is well-established, and new players face few obstacles in entering the market through existing channels. Government regulation also has a minimal impact (1.91), indicating that legal and regulatory frameworks do not pose significant barriers to new players entering the industry.

Overall, the threat of new entrants remains low due to a combination of high cost barriers and advantages enjoyed by existing producers.

Threat of subtitution

Table 4 analyzes the threat of substitute products in the Croatian fresh tomato industry, which is rated as low, with an average score of 2.86. Substitute products are those that can fulfill the same or similar consumer needs but are derived from different sources, compositions, or production technologies. A low threat indicates that, although some substitutes exist, they do not pose a significant challenge to fresh tomato producers.

THREAT OF SUBTITUTION = WEAK			
No.	Topic	Question	Average
1.	Number of substitute products	Our industry produces products for which there are many substitutes.	3.87
2.	Availability of substitute products	The availability of substitute products limits the profit potential of our industry.	2.88
3.	Number of products meeting the same needs	The needs met by the products of our industry can easily be satisfied by many other products.	3.78
4.	Lack of intrinsic characteristics of the products	The products of the industry in which we compete lack unique intrinsic characteristics that would make it difficult to find	2.44

		substitutes.	
5.	Trend of improving the price-to-quality ratio of substitutes	Substitute products exhibit a stronger trend of improving their price-to-quality ratio compared to the products of our industry.	2.04
6.	Profitability of the substitute industry	Substitutes for our industry's products are produced in industries with high profits.	1.99
7.	Pressure from cheaper substitutes	There is significant pressure from cheaper substitutes (alternative products) in our industry.	3.04
The average score of the competitive force			2.86

Table 4 The threat of subtitution in Croatian fresh tomato industry
Source: Authors' calculation

The greatest influence on the threat of substitute products comes from their abundance (3.87), indicating that there is a considerable number of alternative products on the market that can meet similar dietary needs, such as other vegetables that can be used as substitutes in cooking. Although these products are available, they do not significantly threaten the market share of fresh tomatoes, but their number does create some pressure on the industry.

A moderate influence on the threat of substitute products arises from the pressure of cheaper substitutes (3.04) and the availability of substitute products (2.88). These factors collectively suggest that while substitutes exist, consumers still prefer fresh tomatoes due to their unique qualities.

The factors with the least impact include the trend of improving the price-to-quality ratio of substitutes (2.04) and the profitability of the substitute industry (1.99). This indicates that substitute products are not making significant progress in terms of price-to-quality ratio, nor are they profitable enough to pose a serious threat to the fresh tomato industry. Low pressure from these aspects further reduces the threat of substitutes, providing fresh tomato producers with a stable position in the market.

Buyer power

The bargaining power of buyers refers to their ability to influence prices and purchasing terms, which can reduce the profitability of producers. The components of the "Bargaining Power of Buyers" force are presented in Table 5.

BUYER POWER = STRONG			
No.	Topic	Question	Average
1.	Risk of retaliation when entering "in a big way"	In our industry, customers are highly concentrated (a smaller number of customers account for a significant share of total production).	4.48
2.	Cost disadvantages related to economies of scale	Customers collaborate to increase their bargaining power and secure better terms.	3.86
3.	Capital requirements – brand building	Customers are well-informed about the demand for our products and their prices; they even understand our cost structure and profitability.	4.54
4.	Capital requirements – advertising and research & development	Customers have the ability and potential for upward integration into our industry.	2.44
5.	Capital requirements for entering the industry	The products we provide to customers are very similar and interchangeable, lacking differentiation factors.	3.84
6.	Access to distribution channels	Customers of our industry's products can easily switch manufacturers at very low costs.	4.15
7.	Cost advantages unrelated to business scale	Customers of our industry's products purchase from a large number of producers.	4.08
8.	Government restrictions – regulations	The intensity of rivalry among the customers of our industry is very high.	4.11

9.	Availability of resources to prevent entry	In our industry, customers or groups of customers are powerful.	4.55
The average score of the competitive force			3.73

Table 5 The buyer power in Croatian fresh tomato industry
Source: Authors' calculation

The greatest influence on buyers' bargaining power comes from the low switching costs between suppliers of industrial products (4.81) and the inherent power of buyers (4.8). Low switching costs mean that buyers can easily change suppliers without significant financial or operational consequences, enabling them to negotiate better terms. Additionally, the high power of buyers (4.8) indicates that buyers hold a strong position in determining prices and conditions, presenting a significant challenge for fresh tomato producers.

Moderate factors influencing buyers' bargaining power include buyers' awareness of prices, costs, and profitability (4.54), the intensity of rivalry among buyers (4.22), and the number of suppliers of industrial products (4.08). Buyers are highly informed about market conditions, giving them an advantage in negotiations. The relatively high intensity of rivalry among buyers suggests competition among them to secure the best terms from suppliers. An increased number of suppliers in the market further diminishes producers' bargaining power, as buyers have more choices.

Factors with the least impact on buyers' bargaining power include the threat of upstream integration by buyers (3.44) and the similarity or lack of differentiation among industrial products (3.84). Although there is some threat that buyers might opt to produce their own tomatoes (upstream integration), this threat is not significant enough to substantially affect negotiations (some retail chains have their own production or are integrated into business groups that include tomato production and retail).

ASSESSMENT OF THE ATTRACTIVENESS OF THE FRESH TOMATO INDUSTRY IN THE REPUBLIC OF CROATIA

The research results for all forces are presented in Figure 2.

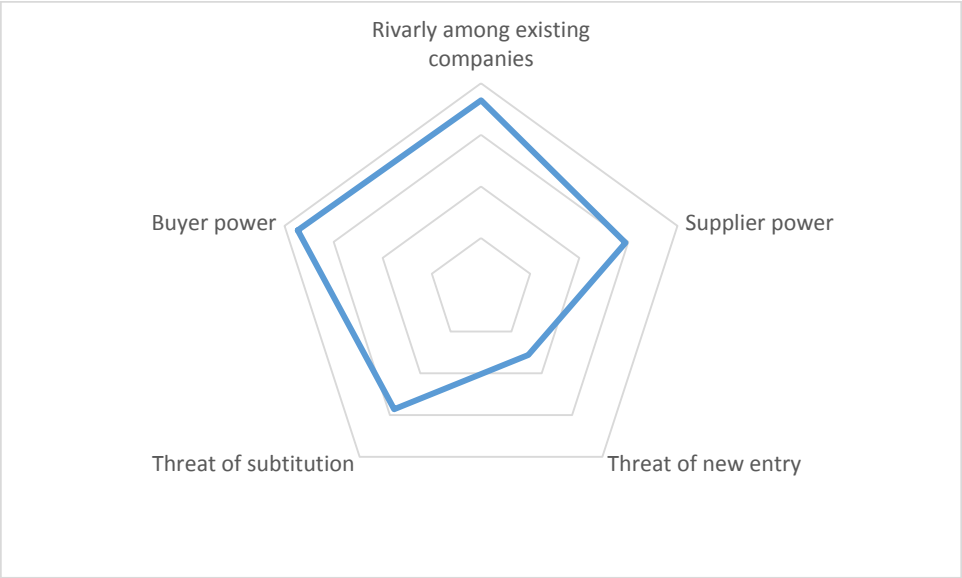

Figure 2 The strength of competitive forces in the fresh tomato production Industry in the Republic of Croatia
Source: Authors' calculation

The bargaining power of buyers in this industry is rated as moderate, with a score of 3.73. Buyers exert considerable influence, particularly due to factors such as buyer concentration (4.48) and awareness of prices and costs (4.54), which enhance their negotiating position. Low switching costs between suppliers (4.81) and the availability of numerous suppliers of industrial products (4.08) further increase buyer power by allowing them to easily shift between suppliers. However, the similarity and lack of differentiation among products (3.84) reduce their ability to significantly impact prices.

The level of industrial rivalry in Croatia's fresh tomato industry is also moderate, with a score of 3.67. This indicates that while there is substantial competition among existing players, it is not overly intense. Key contributors to rivalry include factors such as the availability of resources for competitive actions (4.40) and the frequency of price competition (4.12), showing that companies actively compete to retain or grow their market share. Additionally, a high score for the likelihood of retaliation and countermeasures (4.30) suggests that producers respond quickly to competitors' actions, making the market dynamic. On the other hand, the relatively low number of competitors (2.35) and the diversity of competitive strategies (2.14)

indicate that the market is somewhat fragmented, which reduces the intensity of competition.

The bargaining power of suppliers in this industry is rated as low, with an average score of 2.94. This suggests that fresh tomato producers in Croatia are in a relatively favorable position when it comes to sourcing inputs. The main factor contributing to stronger supplier power is the concentration of suppliers and their share in input procurement (4.2), which indicates a smaller number of key suppliers. However, the relatively low switching costs for producers (2.17) and the low threat of backward integration by suppliers (2.18) suggest that producers have flexibility in replacing suppliers, reducing their bargaining influence.

The threat of substitute products in this industry is also low, with a score of 2.86. While there is a significant number of substitute products (3.87) and products meeting similar needs (3.78), their presence is not dominant enough to substantially affect competition within the industry. Factors further reducing the threat of substitutes include the relatively weak trend of improving the price-to-quality ratio of substitutes (2.04) and the profitability of the substitute product industry (1.99). These indicators suggest that substitute products do not pose a significant threat to fresh tomato producers.

The threat of new entrants in the fresh tomato industry in Croatia is very low, with a score of 1.56. This indicates significant barriers to entry for new competitors. Key factors contributing to this score are cost disadvantages related to economies of scale (4.67) and the capital requirements for entering the industry (4.45). High entry costs, particularly those related to economies of scale and brand development, effectively deter new entrants. On the other hand, the relatively low intensity of responses to new entrants (2.99) suggests that existing players are not overly concerned about potential new competitors, which further reduces the threat.

CONCLUSION

The analysis reveals that the fresh tomato industry in Croatia is characterized by moderate levels of competition among existing players and moderate bargaining power of buyers. On the other hand, the threats from new entrants and substitute products are relatively low, and suppliers do not hold significant bargaining power. This provides producers with some room for adjustment and business optimization without excessive pressure from external factors. However, it is important to note that the domestic tomato industry faces a specific challenge not addressed in this analysis—tomato imports. Imports pose a significant threat to domestic producers as they often come at lower prices and with different quality standards. This particularly increases the risk posed by substitute products and intensifies rivalry within the industry, as domestic producers must compete with cheaper imported products that may be more appealing to end consumers.

Future research in this area could focus on a deeper analysis of the impact of international trade policies and imports on domestic fresh tomato producers, given the significant pressure that imported tomatoes exert on the local market. Additionally, it would be particularly beneficial to explore the economic and environmental aspects of integrating renewable energy sources (primarily geothermal) into hydroponic production processes, aiming to reduce costs and improve energy efficiency.

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SUSTAINABLE FISHERIES MANAGEMENT – INSIGHTS FROM EXPERIMENTAL ECONOMICS USING SIMULATIONS

CHAPTER 18

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ABSTRACT

This chapter presents the results of research focused on the sustainability of fisheries management and the contributions of experimental economics using simulations. The study examines and identifies key scientific approaches to addressing the issue of fisheries sustainability, particularly in relation to commons and common pool resources. Economic theories relevant to commons and common pool resources were analysed, along with management strategies aimed at achieving long-term sustainability of resources—especially fish stocks—while considering social, economic, and ecological criteria. As part of the research, an experimental study was conducted where participants engaged in simulations of fisheries management, making strategic decisions regarding the allocation of fishing fleets and the exploitation of common pool fish stocks. This was done in conditions where no central authority existed, and without communication or interaction among participants, within a free, unregulated market environment. The results of the experiment suggest that research in experimental economics using simulations can contribute to the development of models for sustainable fisheries and commons management. Despite certain limitations, these models offer a valid representation of real-world dynamics and can enhance theoretical paradigms, standards, and approaches to fisheries management. Additionally, they can support integrated coastal zone management efforts aimed at ensuring the long-term sustainability of fisheries.

Keywords: *sustainable management, fisheries, commons, common pool resources, experimental economics, simulations*

INTRODUCTION

Fishing in the Republic of Croatia has a centuries-long history and continues to be an important economic sector, both domestically and internationally, from both economic and ecological sustainability perspectives. Due to its geographical position on the Adriatic Sea, which is part of the Mediterranean, Croatia still maintains relatively rich and diverse fish stocks. This is supported by specific geographical and natural conditions, as well as the way of life of coastal communities. The Adriatic Sea is known for its significant biodiversity, which offers substantial opportunities for the development of fisheries (Debelić, 2013).

Croatian fisheries face challenges such as overfishing and declining fish stocks, necessitating new approaches to fisheries management. One such approach is the

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introduction of transferable fishing concessions (TFCs), which can contribute to sustainability through better regulation of fishing rights and internal market mechanisms (Mance et al., 2014).

Croatia has over 6,000 kilometers of coastline, including more than 1,000 islands, islets, and reefs, making fishing particularly important for coastal communities. The Adriatic Sea is relatively shallow, with minimal tidal fluctuations, making it ideal for the growth of various marine species and reducing the required investment in port infrastructure compared to other seas with greater tidal variations (Debelić 2013, 2018). On the other hand, the enclosed nature and relatively small size of the Adriatic Sea limit the size of its fish stocks. The most important fish resources in the Adriatic include small pelagic fish such as anchovies and sardines, which form the basis of commercial fisheries, along with various species of mollusks, cephalopods, and crustaceans, with shrimp and squid being the most commercially significant (DZS, 2024).

The ecological sustainability of fisheries has increasingly come to the forefront due to concerns about overfishing and the degradation of marine habitats. In recent years, the condition of benthic communities and associated trawl fisheries in the Adriatic Sea has been described as unfavorable (Vrgoč, 2012). For small pelagic fish, total annual catches and estimated biomass significantly declined during the 1980s and 1990s, although some recovery has been noted in recent years. However, this increase in catches has been accompanied by a decrease in the average size of individual fish, leading to a mismatch between increased catches and financial returns for fishermen. Increasing fleet capacity, despite the rise in total catches, has led to a long-term decline in catch per unit effort (catch per vessel) (Vrgoč, 2012). The growing pressure on fish stocks over recent decades highlights the need for measures such as the Total Allowable Catch (TAC) system to ensure the long-term conservation of fish resources (Vrgoč, 2012). In this context, stricter regulations for preserving fish stocks, including quota systems, regulated fishing zones, and seasonal fishing bans, are necessary. One of the major ecological challenges for Croatian fisheries is overfishing and the degradation of marine habitats.

As a member of the European Union (EU), Croatia is obligated to adhere to the EU's Common Fisheries Policy, which regulates many aspects of fishing in member states. This policy aims to ensure sustainable fishing in all EU waters, including the Adriatic Sea, while reducing the negative impact on marine ecosystems. A key measure is the introduction of quota systems that limit catches of specific fish species. Scientific monitoring and assessment of the status of fish stocks are crucial components of this policy.

The Croatian fishing fleet consists of various types of vessels used for catching different marine organisms, depending on the type of fishing and the targeted fish species. According to publicly available data, the fleet is relatively diverse. In 2021, the fleet comprised 7,757 vessels, of which 6,235 were active. Vessels shorter than six meters account for more than half of the fleet, while vessels between six and twelve meters in length make up over a third. Only around 7% of the vessels are longer than twelve meters (MPSR, 2024).

THEORETICAL OVERVIEW

The concept of the "tragedy of the commons," as presented by Hardin (1968), illustrates how collective interests can be compromised when individuals act solely in their own self-interest, attempting to exploit a resource before others can. This occurs within a zero-sum game context, where resources are finite, and whatever one individual claim is no longer available to others. This intention to deplete resources creates a dynamic conflict that can lead to the complete degradation of the common good. In such circumstances, the strategic behaviour of individuals becomes critical, as short-term profit-driven decisions result in long-term losses for all participants.

Strategic behaviour in the context of commons is often analysed through the lens of game theory, which studies individual decision-making in scenarios where outcomes depend on the actions of others. Elinor Ostrom (1990, 2005, 2010, 2012), a Nobel Prize winner in economics, demonstrated that local communities can effectively manage commons without the need for central regulation or privatization. This is achieved primarily through stakeholder participation in resource management systems, developing sophisticated rules and sanction systems tailored to the specific conditions of the community, thus avoiding the tragedy of the commons.

The further development of commons theory has been closely linked with game theory, particularly through works like those of Axelrod (1984), who showed through repeated simulations of the prisoner's dilemma that cooperative behaviour can emerge even among self-interested individuals, provided there is long-term interaction and the potential for reciprocity (Dasgupta & Heal, 1979; Kiser & Ostrom, 1982; Fudge & Leith, 2021). Axelrod's simulations highlight how long-term interests can encourage cooperation despite short-term incentives to exploit resources.

In the context of resource depletion games, identifying strategies to prevent resource collapse caused by overexploitation beyond the maximum sustainable yield (MSY) is crucial. Here, the system of Individual Transferable Quotas (ITQs) emerges as a viable long-term solution for the conservation of scarce resources. Together with other institutional measures, such as fishing moratoria and no-take zones, ITQs enable the introduction of market mechanisms that foster a more rational and sustainable use of resources. These models offer important insights into how institutions (norms) can be designed to promote sustainable behaviour (Williamson 1975, 2005).

The EU's new Common Fisheries Policy (CFP), which is integrated into the EU's Integrated Maritime Policy (IMP), promotes market mechanisms as a means to conserve fish stocks. By introducing TFC and ITQ systems, sustainable fisheries management is achieved through market-based allocation mechanisms that reduce excessive fishing effort while increasing the efficiency and stability of the fishing industry (Mance et al., 2014).

The following section presents the results of the simulations conducted, providing deeper insights into how such behavioural models and institutional tools can

contribute to the long-term conservation of commons and common-pool resources, as well as fostering cooperation among resource stakeholders.

DATA AND METHODS

For the purposes of this study, an experimental investigation was conducted in the laboratory of the Faculty of Maritime Studies at the University of Rijeka using the Fishbanks simulation system developed by Meadows and colleagues at the Massachusetts Institute of Technology (Meadows et al., 2012). Fishbanks (Sterman 2014a, 2014b) is a multiplayer simulation where participants assume the role of fishermen aiming to maximize their net worth by competing against other players for the appropriation of common-pool resources in the form of fish stocks. Participants in the experiment had the ability to strategically allocate their fishing fleets based on their assessments of the biophysical conditions of the shared resources (fish stocks) and the economic consequences of their decisions. They were also able to order new vessels and trade used vessels by buying or selling them.

The experiment involved fourth-year students who volunteered to participate at the conclusion of their summer semester. The research was conducted over three cycles: in 2018, 2019, and 2023. The results of the experiments were fully anonymous, with no personal names or data recorded, using only group names (nicknames) for each team. In each of the three experimental cycles, participants were divided into groups (teams), with each group functioning as a fishing company managing its fleet with the goal of maximizing economic performance. A total of 18 groups participated across the three cycles: six groups in 2018, seven in 2019, and five in 2023.

The primary objective for players in the simulation was to maximize their net worth by the end of the game. Net worth was defined as the sum of their bank balance and the monetary value of their fleet. In each iteration (representing a year or season), participants generated profit as the difference between income and expenses. Income was derived from the sale of fish caught, trading vessels on the secondary market among participants, and earning interest, while expenses included operational costs, purchasing used vessels from other players, acquiring new vessels, and interest payments. It is important to note that, according to the initial parameter settings used in the simulations, the impact of interest on both income and expenses was minimal and relatively insignificant. The primary source of income was from the sale of caught fish, with the amount of catch depending on the condition of the common-pool resource—the fish stocks—within the two fishing zones (pelagic/deep-sea and coastal) and the allocation of vessels to these zones in each iteration.

Players were tasked with making strategic decisions to allocate their fleets among three possible options in each iteration: sending vessels to pelagic fishing, sending vessels to coastal fishing, or keeping them in port (if a vessel remained in port, it did not engage in fishing and thus generated no revenue). After each iteration, participants were also given the opportunity to buy or sell used vessels on a player-to-player market with freely negotiated prices, allowing for unregulated trade

without central oversight, provided there was a match between supply and demand among the players.

Revenue from the sale of caught fish was calculated as the product of the quantity of fish caught and a fixed unit price of twenty monetary units per fish, which remained constant across all iterations. Regarding expenses, there were three levels of annual operating costs per vessel, depending on the chosen deployment for each vessel: 250 monetary units per vessel for pelagic fishing, 150 monetary units per vessel for coastal fishing, and 50 monetary units per vessel for staying in port. Another significant category of expenses was related to the purchase of used vessels on the secondary market, where prices were determined solely by the agreed-upon purchase price, and the acquisition of new vessels was set at 300 monetary units per vessel. The number of new vessels a player could purchase in each iteration was limited to a maximum of half the size of their existing fleet (rounded to the nearest whole number). At the beginning of the simulation, each player was initially allocated three vessels and a starting bank balance of 600 monetary units (200 monetary units per vessel).

The introduction of an ITQ (Individual Transferable Quotas) system into the simulation allowed for a more realistic modeling of fishermen's economic decisions, emphasizing how optimal quota allocation could reduce negative externalities and enhance the profitability of fisheries through sustainable management of fish stocks.

The value of the maximum sustainable yield (MSY), which results from the net growth of fish stocks, was particularly important for evaluating participants' income in the simulation, as well as for assessing the long-term sustainability of the common-pool resources—namely, the fish stocks. In the experiments conducted, the initial settings of the simulation assumed a maximum stock increase at a density of 0.6 on a scale from 0 to 1.0. In the experimental model, the net increase in fish stocks was set at 550 fish per season (iteration) for pelagic fishing and 330 fish per season for coastal fishing. Additionally, the catch efficiency of vessels was set at 25 fish per vessel per season in the pelagic zone and 15 fish per vessel per season in the coastal zone. Based on these parameters, it was possible to approximate that the maximum sustainable fleet size was around 44 vessels, determined by dividing the net increase in fish stocks by the catch efficiency of vessels in each zone.

The initial size of the fish stock in the pelagic zone was set at 2,500 fish, while in the coastal zone it was set at 1,200 fish, approximately corresponding to a stock density of 0.8, indicating a high density of healthy and abundant fish stocks.

In the conducted experiments, there was no central authority, no fishing quotas were imposed, and communication and cooperation among players (teams) were not allowed. This meant that players had to engage exclusively in free-market competition, without interference from a central authority or the establishment of self-organizing forms of formal or informal cooperation. This experimental setup was chosen to observe the dynamics of market interactions between players and between players and the simulated common-pool resource, without the control of an external central authority or self-regulatory mechanisms for resource management.

RESULTS

The findings of the experiment are analysed separately for each of the three iterations conducted in 2018, 2019, and 2023, with comparisons made between these cycles to derive general conclusions.

The experiments conducted in 2018 and 2019 indicated that it was likely that the fleet size would reach its peak after approximately 10 iterations. Beyond this point, the fleet size did not continue to increase, as it had surpassed the maximum sustainable fleet size, leading to overexploitation of the common-pool resources and a subsequent decline in income and profit. Consequently, in the 2023 experiment, only 11 iterations were conducted, which confirmed that total profit had already turned negative by that stage, rendering further iterations unnecessary.

As shown in Figure 1, the maximum sustainable fleet size (≈ 44 vessels) was reached within the first five iterations (seasons). This represents the highest number of active vessels that the common-pool resource—particularly the fish stock—can sustainably support in the long term. This finding is crucial for understanding the dynamics of the simulation, the behaviour of the players, and the preservation of the simulated common-pool resources.

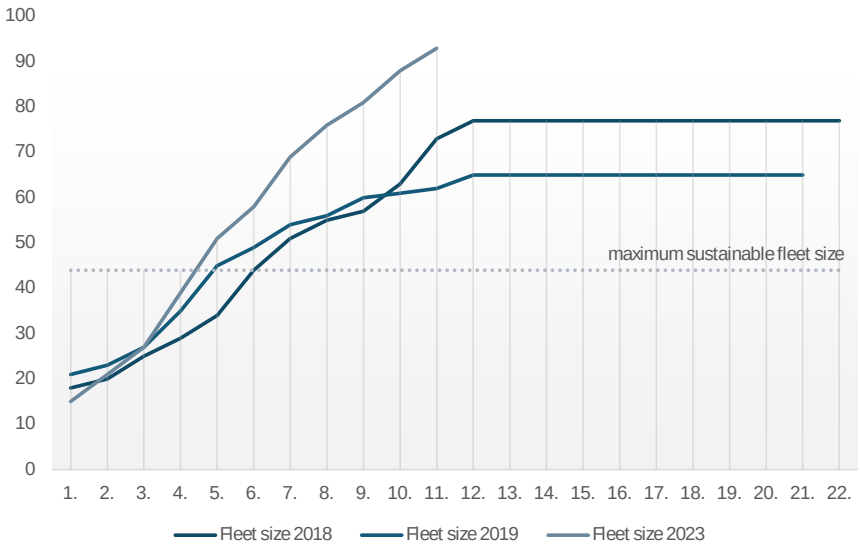

Figure 1 Fleet size over iterations of experimental simulations
Source: Author's creation

In the 2018 experiment, fleet size growth was somewhat slower during the first five iterations. Nonetheless, the maximum sustainable fleet size was reached by the sixth iteration and continued to increase until the twelfth iteration, at which point the fleet size significantly exceeded the sustainable limit. In contrast, during the 2023 experiment, players reached a fleet size that, by the eleventh iteration, had more than doubled the maximum sustainable threshold.

This rapid expansion in fleet size was driven by an intense surge in orders for new vessels during the initial iterations, as players competed to maximize their profits in the context of abundant common-pool resources—specifically, the fish stock—available at the start. However, this aggressive strategy, combined with a heightened level of fishing activity, quickly exerted substantial pressure on the common-pool resources, pushing extraction levels well beyond the Maximum Sustainable Yield (MSY). As a result, this led to the depletion of resources and a subsequent decline in catch levels, without any corresponding reduction in fishing effort or reallocation of the fleet (see Figure 2).

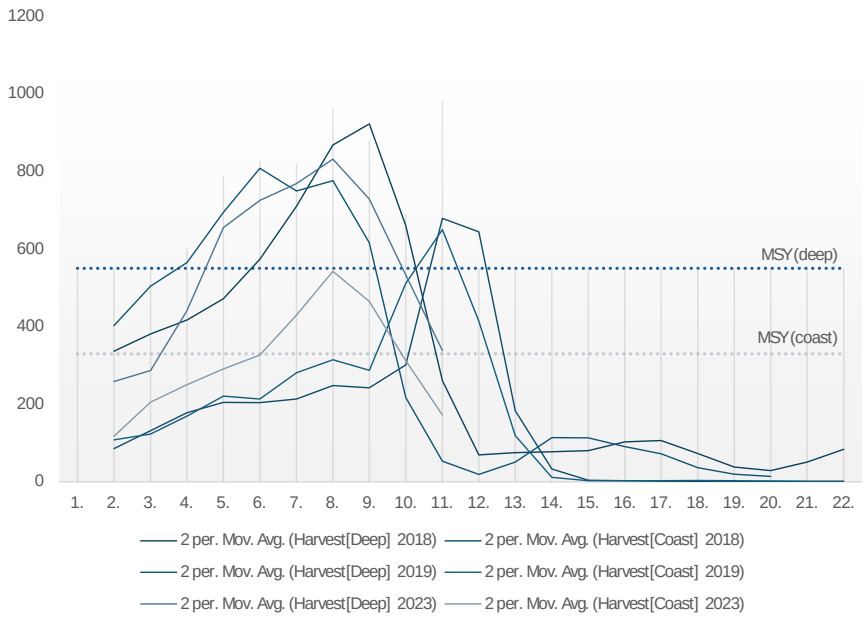

Figure 2 Catch size by fishing zones over iterations of experimental simulations (moving average over two periods) and MSY for fishing zones
Source: Author's creation

Given that the simulation included two independent fishing zones (pelagic and coastal), each with different sizes and densities of fish stocks, this resulted in varying levels of expected catch and Maximum Sustainable Yield (MSY) for each zone. Figure 2 illustrates the MSY levels for both zones along with the achieved catch levels of the fishing fleet. In the initial iterations, significantly higher catch levels were observed in the pelagic zone, primarily due to the initial allocation of a larger portion of the fishing fleet to this zone. This was because the unexploited fish stocks in the pelagic zone allowed for higher unit catches, leading to greater unit profit per vessel. However, as the common-pool resources in the pelagic zone became depleted, unit profits declined, prompting players to reallocate an increasing portion of their fleet to the coastal zone. Particularly after the 9th iteration, there was a marked increase in the catch volume in the coastal zone, while it declined in the pelagic zone due to two key reasons: depletion of the common-pool resources and the reduced allocation of the fishing fleet to that zone.

This pattern of changes in catch levels also resulted in a corresponding trend in aggregate profits, as shown in Figure 3.

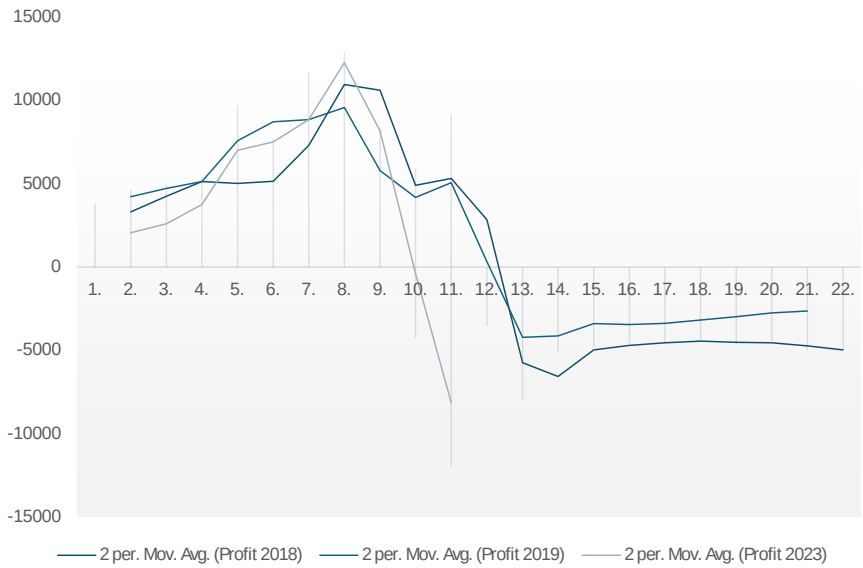

Figure 3 Aggregate profit over iterations of experimental simulations (moving average over two periods)
Source: Author's creation

As depicted in Figure 3, aggregate profit began to decline as early as the 8th or 9th iteration, turning negative (resulting in aggregate losses) by the 10th iteration in the 2023 experiment. In contrast, during the 2018 and 2019 experiments, losses were first observed in the 13th iteration, after which aggregate losses, with minor fluctuations, persisted continuously until the conclusion of the experiment.
The 2023 experiment vividly illustrates how the initial surge in fleet expansion quickly escalated to levels far beyond the maximum sustainable size. This rapid expansion, combined with an intense fishing effort during the early iterations, resulted in the fastest depletion of resources and the most dramatic decline in aggregate profits among all participants.

These aggregate outcomes were largely driven by the players' fleet allocation strategies within the simulation, as demonstrated in the subsequent figure (Figure 4).

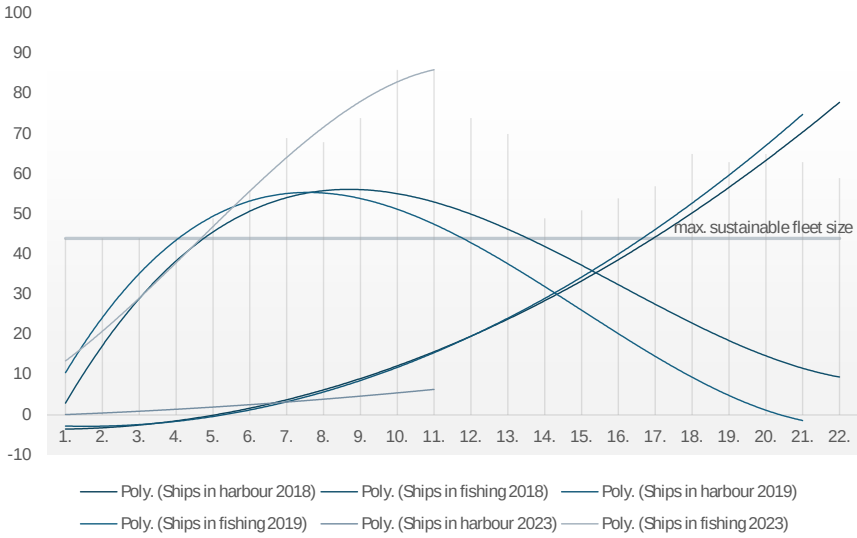

Figure 4 Polynomial trends of fleet allocation (vessels) over iterations of experimental simulations and MSY for fishing zones
Source: Author's creation

As shown in Figure 4, it can be observed that, during the initial iterations, players fully deployed their fleets for fishing (the figure displays the combined number of vessels in both fishing zones), rather than opting for the third available option of keeping vessels in port and refraining from fishing. The rapid increase in the number of vessels engaged in fishing during the initial iterations resulted from the concurrent expansion of the fleet size. However, as players' profits began to decline—along with aggregate profit around the 8th iteration—this triggered fundamental change in fleet allocation trends. By the 14th (or 15th) iteration, it became apparent that the number of vessels engaged in fishing had become equal to those kept in port. Beyond that point, the number of vessels actively fishing continued to decrease until the final stages of the experiment, when nearly all vessels were stationed in port without fishing activity.

Due to excessive fishing beyond the Maximum Sustainable Yield (MSY) level, which led to significant depletion of common-pool resources (fish stocks), catch levels had already dropped to very low—and unprofitable—levels by the 14th iteration across all experimental runs. As a result, the focus of the analysis shifted to the first 14 iterations. In terms of fleet allocation (see Figure 4), it is evident that even before the 14th iteration, and particularly after it, the distribution of vessels changed significantly. Initially, all vessels were heavily engaged in fishing, often exceeding the sustainable fleet size, but later, as catches, revenue, and profits declined—falling below profitable levels—more and more vessels were returned to port.

This reallocation, however, could not completely halt the losses since vessels stationed in port still incurred operational costs (50 monetary units), as previously described in the methodology, while generating no revenue. Nevertheless, this strategy of reallocating vessels did help slow the rate of escalating losses, especially

when fishing activity became unprofitable due to the exhaustion of common-pool resources (fish stocks) and the high operational costs associated with active fishing.

Thus, the primary focus was placed on the first 14 iterations, and the subsequent analysis presents polynomial trends for selected variables to further explore the risks of overfishing. The use of polynomial trends, rather than absolute values, was chosen to simplify graphical representation and facilitate the identification of patterns in players' strategic behavior and the status of common-pool resources.

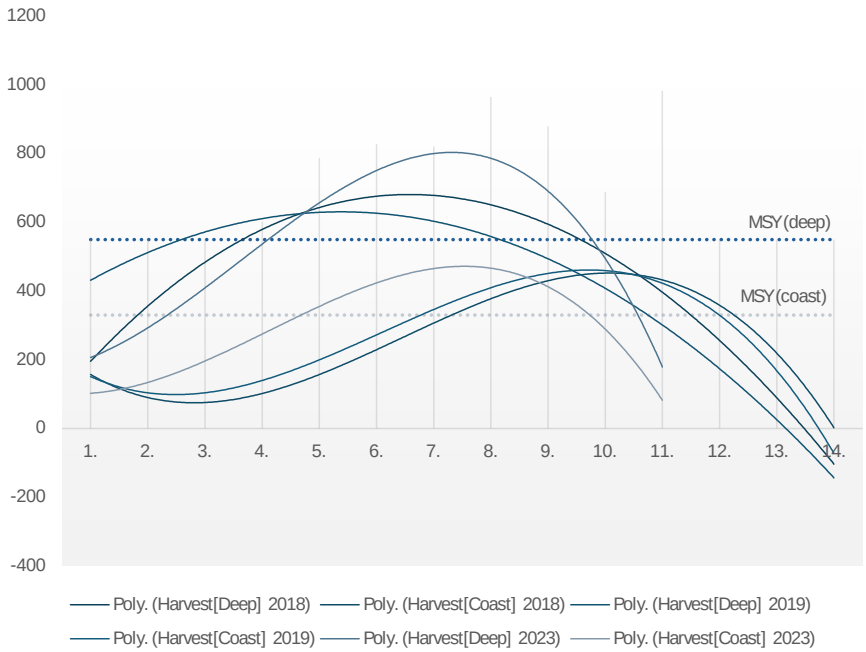

Figure 5 Polynomial trends of catch by fishing zones during the first 14 iterations of experimental simulations and MSY for fishing zones
Source: Author's creation

Figure 5 illustrates that catch intensity in the pelagic zone surpassed the Maximum Sustainable Yield (MSY) level as early as the 4th iteration, while in the coastal zone, this threshold was exceeded by the 7th iteration (and even by the 5th iteration in the 2023 experiment). This overexploitation quickly led to a steep decline in fish stock levels, as depicted in the subsequent figure (Figure 6).

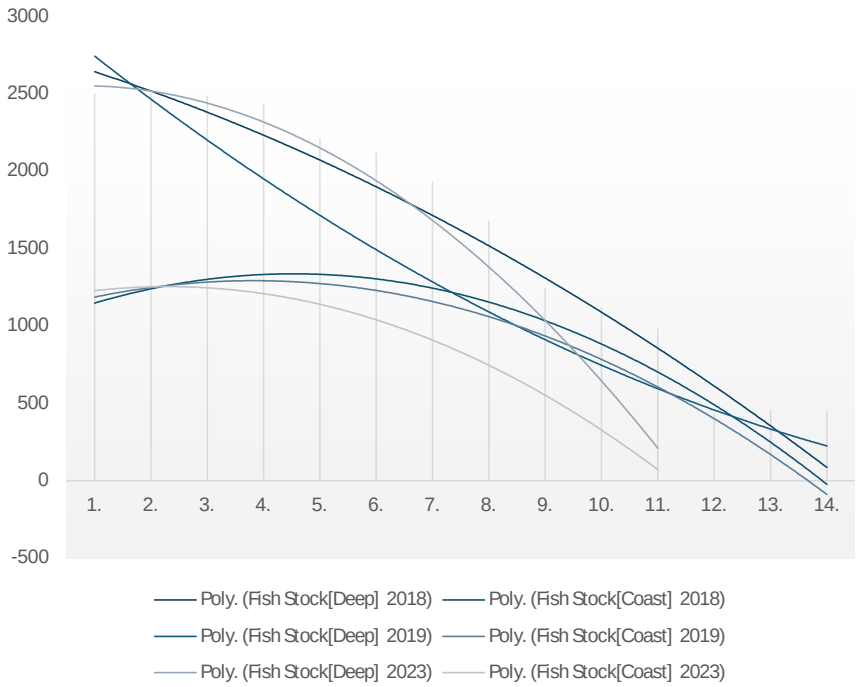

Figure 6 Polynomial trends of fish stock (fish reserves) by fishing zones during the first 14 iterations of experimental simulations
Source: Author's creation

Figure 6 clearly demonstrates that in the pelagic zone, polynomial trends indicate a decline in fish stock levels starting from the earliest iterations, with the rate of decline becoming exponential after the 4th iteration. This trend aligns with the rapid expansion of the fishing fleet observed from the outset, where a significant portion was initially allocated to the pelagic zone. This rapid concentration of effort quickly exhausted the fish stocks in that zone, leading to diminished catches and declining profits, which in turn drove an intensified reallocation of the fleet to the coastal zone.

However, the sharp increase in fleet size beyond the maximum sustainable limit by the 5th iteration also began to deplete fish stocks in the coastal zone. By the 14th iteration, and even earlier in the 2023 experiment, fish stocks in both zones were nearly depleted, with levels approaching zero as early as the 11th iteration.

These developments had a direct impact on the expected catch per vessel in both fishing zones, as illustrated in the following figure (Figure 6).

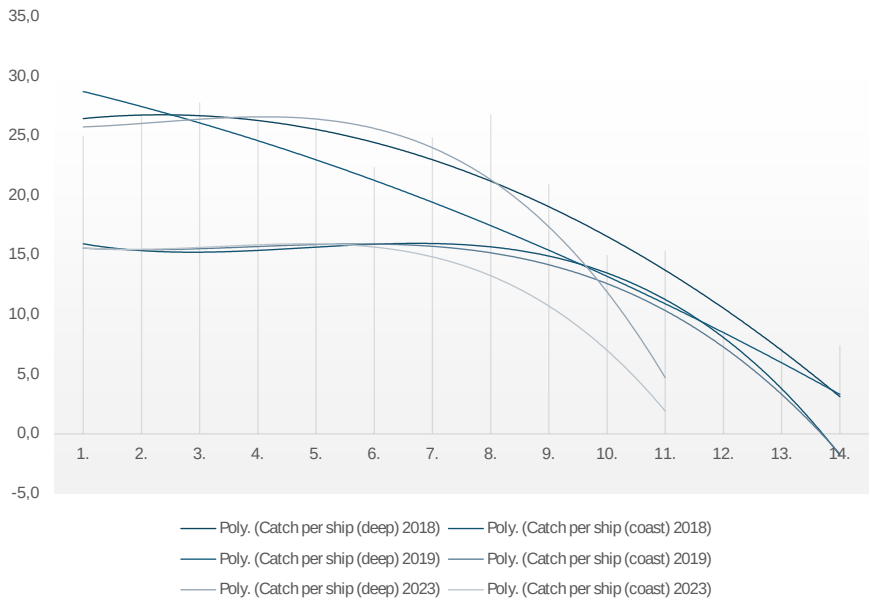

Figure 7 Polynomial trends of expected catch per vessel by fishing zones during the first 14 iterations of experimental simulations
Source: Author's creation

As depicted in Figure 7, the initial expected catch per vessel began to decline rapidly due to the intense pressure from sharply increasing catch levels that exceeded the Maximum Sustainable Yield (MSY) in both zones—first in the pelagic zone, followed by the coastal zone—as well as the fleet size surpassing the maximum sustainable threshold. This overexploitation quickly led to the depletion of common-pool resources, particularly the fish stocks, thereby compromising their sustainability.
The polynomial trends for the pelagic zone indicate a drop in expected catch per vessel right from the start of the experiment, whereas in the coastal zone, this decline became evident only after the 8th iteration. The lag in the coastal zone's decline, compared to the pelagic zone, can be attributed to players' initial strategy of prioritizing fishing efforts in the pelagic zone, where unexploited resources yielded higher expected catches and profits.

The decline in expected catch rates in the coastal zone was primarily driven by the reallocation of the fleet from the depleted pelagic zone to the coastal zone. This shift occurred as the unsustainable fleet size in the pelagic zone quickly exhausted its fish stocks. As profits in the pelagic zone began to plummet due to overfishing, players increasingly redirected their fleets to the coastal zone.
It is crucial to highlight that this fleet reallocation occurred well before the expected catch per vessel balanced out between the two zones. This was largely driven by the substantially higher operational costs in the pelagic zone compared to the coastal zone, which significantly eroded profits as fish stocks dwindled and the sustainability of common-pool resources was threatened.

DISCUSSION AND CONCLUSION

The conducted experimental research unequivocally demonstrates that under conditions exclusively governed by market forces - without institutions, self-regulatory mechanisms, or opportunities for communication among participants - players inevitably fell into the traps of the prisoner's dilemma and the tragedy of the commons. While this outcome may seem discouraging at first glance, the experiment underscored the potential to credibly simulate economic conditions and interactions among real economic actors, both with each other and in relation to common-pool resources.

The study's findings underscore the need to refine the use of market-based mechanisms, such as Transferable Fishing Concessions (TFCs) and Individual Transferable Quotas (ITQs). These mechanisms could potentially lead to more effective management of fishing activities while simultaneously preserving fish stocks, reducing pressure on common resources, and ensuring the long-term sustainability of fisheries.
While the experiment is inherently limited in its complexity and cannot fully capture all environmental and social dimensions of economic interactions, it nonetheless reveals theoretically and empirically sound possibilities for making management decisions aimed at achieving long-term fisheries sustainability through the application of experimental economics and simulation techniques.

The Croatian fisheries sector, an essential pillar of the national economy, currently faces significant challenges in achieving sustainable resource management of fish stocks and marine ecosystems. By leveraging EU policies, national legislative frameworks, and scientific expertise, Croatia has the potential to ensure the enduring conservation of its fish resources and marine habitats. Although aquaculture presents additional avenues for development, it requires prudent management to minimize its environmental impact. Sustainable fisheries are thus a critical objective for Croatia's future as a maritime nation and are vital for maintaining the ecological and economic balance of coastal communities.

Looking ahead, the future of Croatian fisheries rests on embracing sustainable development principles. This includes alleviating pressure on natural resources, fostering environmentally responsible fishing methods, and investing further in scientific research to deepen the understanding of marine ecosystem dynamics. Additional research is necessary to advance integrated coastal management and the sustainable stewardship of common-pool resources, particularly through the adoption and evaluation of modern scientific theories, methodologies, and approaches that emphasize active stakeholder involvement in resource management.

By introducing innovative institutional and market mechanisms, such as TFCs, ITQs, and Total Allowable Catch (TAC) systems, Croatia can better protect its fish resources and secure the long-term sustainability of its fisheries sector (Vrgoč, 2012; Mance et al., 2014).

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HOW TO COMMUNICATE TRADITIONAL OPEN SHEEP FARMING: THE EXAMPLE OF THE ISLAND OF CRES

CHAPTER 19

Jasmina Dlačić *

ABSTRACT

Traditional sheep farming has been the stimulus in the development of the island of Cres for years. In recent times, other priorities and activities have gained priority in this development. Although a part of the population is still engaged in sheep farming in the traditional way, the very idea of sheep farming has undergone significant transformation in the last thirty years. Changes in the environment, the need to focus on sustainable development on a global level, the strategic focus of the island of Cres on sustainable development and the preservation of cultural and historical heritage has led to the need to differently direct communication towards the key public. Furthermore, the question arises as to how traditional sheep farming on the island of Cres can be conveyed to the interested public while focusing on sustainable development. Through examples of good practice in communicating about traditional sheep farming on the island of Cres, elements for effective communication with a focus on sustainability are identified. Various activities such as events, projects and economic activities focused on traditional sheep farming contribute to the island's focus on sustainable community development.

Keywords: *communication, marketing approach, sustainable development, traditional sheep farming, island of Cres.*

INTRODUCTION

For years, traditional sheep farming has been a stimulus to the economic development of the island of Cres. In recent times, other priorities and activities have gained priority in this development, such as tourism through accommodation and hospitality services (Cres-Lošinj Islands Development Plan until 2027, 2022). Agricultural activity mainly includes sheep farming and olive growing, the oldest branches of activity on the island of Cres, and in addition to the above, beekeeping, vegetable growing, and viticulture are present to a lesser extent. Although part of the population is still engaged in sheep breeding and developing traditional sheep breeding, the very idea of traditional sheep breeding has changed a lot in the last thirty years.

Industrialization, focusing on other sectors such as tourism, depopulation of the island, reduced number of younger population (Cres-Lošinj Islands Development

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Plan until 2027, 2022) and the unprofitability of exclusively dealing with sheep farming in the traditional way (Pavoković and Randić n.d.) and directing the island of Cres to sustainable development and the preservation of cultural and historical heritage (Cres Island Development Charter, 2015), traditional sheep farming ceases to be an important driver of the development of the island of Cres.

Sustainable development implies the belief that it is necessary to change and improve the behaviour of individuals in order to respect the needs of other groups and protect the planet for future generations (Sharp 1992). Likewise, sustainable development implies mutually coordinated development of the social, economic and environmental dimensions (Andresson et al., 2022). Also, both at the level of the EU (EUR-lex n.d.) and at the level of Croatia (National Island Development Plan n.d.) they stress the importance of sustainable development, i.e. sustainable development of island environments. In the literature, it is pointed out that the greatest emphasis of sustainability is on production and the agricultural sector (Wang et al., 2019).

From the point of view of consumers, sustainable consumption develops on the basis of excessive consumption and the need to change consumption habits (Jackson 2014), and this is highlighted among the most important goals of sustainable development (UN 2002), with an emphasis on the improvement of technology and the supply of environmentally friendly products, services and infrastructure development, that is, encouraging environmentally responsible behaviour through efficient production processes and resource utilization. In doing so, the consumer's needs must be met and the negative impact on the environment reduced (Nefat, 2015).
Unrestrained and uncontrolled consumption can reduce the quantity and quality of natural resources (Field et al., 2021), therefore, business entities should develop sustainable business practices, i.e. encourage and communicate about their sustainable efforts so that consumers perceive their products, services and infrastructure as those that are consistent with their values and preferences regarding sustainable behaviour (Peterson et al., 2020).

If we look at the communication aspect of the product or service, it implies highlighting the specific characteristics of the product, i.e. conveying the physical, functional and symbolic values of the same with the aim of attracting and gaining the attention of consumers and building and maintaining relationships with consumers (Filipović et al., 2024: 115). Applying the above to sheep farming as the dominant agricultural activity on the island of Cres, and bearing in mind the strategic orientation of the island communities towards sustainable development, a research question arises: how can traditional sheep farming on the island of Cres be communicated to the interested public with a focus on sustainable development?

In the following, the concept of communication, i.e. communication aspects with a focus on sustainable development, is elaborated through the example of communication activities (events, manifestations, projects and economic activities) on the island of Cres. Also, guidelines are suggested and challenges in the development of communication practices are identified.

COMMUNICATION FOR SUSTAINABLE DEVELOPMENT

Communication and elements of communication

Communication itself is a complex process that consists of several elements that contribute to the transmission of the message to the media to the end users, i.e. it also includes a feedback loop (Filipović et al., 2024). Communication includes the sender and receiver of information, coding and decoding of the communication message, transmission medium, feedback and noise in the communication channel (Kesić, 2003). It also includes a set of activities that send and exchange information about the product or service with consumers, either through direct or indirect communication. In order for communication itself to be successful, it is based on several goals. The goals of communication are (Tkalac Verčič, 2015): to inform, convince, motivate and build common understanding. Which goal the communication message will satisfy depends on the subject of communication. Informing itself also implies educating the audience (Grbac, 2014). Persuasion as a goal of communication is not necessarily persuasion to buy a certain product or service but can include discreetly drawing the audience's attention to a specific goal of a business entity, such as supporting traditional activities of the population and preserving cultural and historical heritage. By motivating the audience to participate in certain activities or visit certain events, the attendance of a certain event and the visibility of the efforts of the organizers, as well as the visibility of the communication message, are achieved. Building a common understanding through a better and more complete understanding of the efforts of a business entity that wants to present its activities to the target public makes it possible to guide the communication process.

Communication messages are aimed at different audiences. The public is made up of different target groups whose wishes and needs for information should be satisfied by building networks of relationships with them (Filipović et al., 2024). Target groups can influence the business entity itself through their (non)reaction to a communication message, but also on the achievement of set goals by supporting a certain activity, for example by visiting a certain event or participating in its implementation. According to Tkalac Verčič (2015), according to the degree of importance for the business entity, the following are distinguished: primary, secondary and marginal public. Primary audiences can greatly influence the business entity itself through their reactions to communication messages and are extremely important to the business entity itself. On the other hand, secondary public are those public that the business entity does not primarily address through communication messages, but certainly indirectly influences their reactions. In doing so, it is necessary to analyse the information needs of a certain public, their potential for understanding and accepting new information, and the adoption of that information (Callison and Lamb, 2004).

Knowing the target audience is an important factor in deciding what information to share, how that information should be prepared, and what media should be used to share the information (Agunda 1989). Differentiation of communication strategies, methods of audience engagement, types of media and preferences of individual target groups (Lamm et al. 2019) affects strategies and ways of sharing information

and communicating. If we add the development of technology and the change in the way of communicating and sharing information and the engagement of the target audience, we come to the conclusion that the senders of the communication, i.e. business entities, are in a challenging situation in order to develop a positive perception towards the communication message, i.e. the event or activity about communicate (Ashley and Tuten, 2015). If the consideration is expanded and traditional sheep farming is viewed as an experiential good, based on the premises of Kaštelan Mrak and Kaštelan (2023), it can be concluded that traditional sheep farming can be communicated by involving the target public in the process of creating or providing a service, i.e. creating an event or manifestation. Thus, through involvement in the process of creation and provision, users can participate in the very communication of a certain event or manifestation.

Also, the identification of key public (Tkalac Verčič, 2015) is necessary in order to direct communication. Key public are presented through internal public, media, consumers, government institutions and business entities. Namely, successful and high-quality communication is achieved through the adaptation of the communication message and the way of communication to each key public.

Communicating in the context of sustainable development

Sustainable development includes development based on reducing negative changes in society and reducing negative impacts caused by inappropriate use of resources and their excessive exploitation (Adger and Winkels 2014). Sustainable development is approached through a complete overview of economic, social and ecological indicators (Ruta and Hamilton, 2007). The ultimate goal of sustainable development is the utilization of the environment and resources to meet the current needs of society without jeopardizing the future (Adger and Hodbod 2014).

In communication with consumers, an increasing number of business entities communicate about socially responsible business, which is reflected in their strategy (Jardas Antonić et al. 2022), whereby sustainability is seen to the greatest extent through sustainability in production and the agricultural sector (Wang et al., 2019). Also, in communication and public perception, a lot of attention is focused on nutrition, i.e. encouraging sustainable food consumption (Holt et al., 2015), where one of the aspects is related to the reduction of food waste, especially among younger people (Šeškar et al., 2022). Also, the sustainable use of clothing (Rumble et al., 2014) is one of the focuses in communication and public perception when talking about sustainable development and the negative impact of certain industries on the environment. The textile industry is also characterized as a major polluter (Quantis 2018), and as a result, a sustainable fashion industry movement is developing, which is gaining more and more attention among young consumers (Dlačić et al., 2021). At the same time, a difference was observed between the attitudes and behaviour of consumers when discussing sustainable fashion products (Rašić et al. 2023). Considering the complexity of the topic itself, a good combination of choosing the time when the communication message is sent, the type of message, choosing the communication channel and choosing the target audience is needed (Lamm et al., 2019).

Focusing on sustainable development can be seen from several aspects. From the macro marketing aspect, where the attention is related to the sustainability of society as a whole, and from the micromarketing aspect, where it is tied to local communities as well as achieving sustainability in smaller communities. Such an example is the island of Cres, i.e., the area of the island of Cres where sustainable development and preservation of cultural and historical heritage are focused (Cres Island Development Charter 2015). The above is also connected with the signing of the Declaration on Smart Islands, i.e. the guidelines adopted at the initiative of island local self-government units and other stakeholders on the islands in 2017, with the aim of developing smart, inclusive and successful island communities for an innovative and sustainable Europe (National Island Development Plan n.d.) and by defining the Development Plan of the Cres-Lošinj Islands until 2027 (2022). The mentioned documents emphasize sustainability in terms of a sustainable economy and a desirable work environment, smart management of space and natural resources, and sustainable exploitation and restoration of cultural heritage (Cres-Lošinj Islands Development Plan until 2027, 2022).

Taking into account the focus of the island of Cres on sustainability and the orientation of the economy towards the tourism sector through accommodation and catering services, as well as agricultural activity, which includes mostly sheep farming and olive growing (Cres-Lošinj Islands Development Plan until 2027, 2022), on the island of Cres 230 family farms and 14 business entities of various forms of organization and 2 cooperatives were registered. The aforementioned forms of agricultural business entities breed Cres Pramenka sheep, an autochthonous breed of the island of Cres, through sheep farming, and are the dominant economic agricultural activity.

Traditional sheep farming itself has changed under the influence of industrialization and demographic changes. The aforementioned affects the way of dealing with sheep farming, which is still based on tradition and traditional farming in open pastures, where sheep spend the whole year (Pavoković and Randić n.d.). Also, considering that the Pramenka sheep is adapted to the ecological conditions on the island of Cres, the strategic focus on preserving the heritage of the island of Cres is not unusual (Cres Island Development Charter 2015), as well as directing and encouraging sustainable development of the island.

COMMUNICATING TRADITIONAL SHEEP FARMING: THE EXAMPLE OF THE ISLAND OF CRES

In order to understand communication about traditional sheep farming, it is necessary to understand key public. They are presented through the internal public, the media, consumers, government institutions and business entities involved in sheep farming and agriculture. The research methods for analysing the communication of traditional sheep farming on the island of Cres include the analysis of content on websites and social media (Facebook and Instagram), in published articles on portals about the island of Cres and traditional sheep farming, and the historical method used to search available documentation along with the strategic positioning of the island of Cres.

The internal public is represented through individuals, i.e. family farms engaged in sheep farming, i.e. traditional sheep farming. It should be mentioned that on the island of Cres, in addition to sheep, of which there are more than 10,000 (Cres-Lošinj Islands Development Plan until 2027, 2022) and 102 farms engaged in their breeding, there are also goats, donkeys and horses in slightly smaller numbers. It is necessary to ensure the conditions for this public to continue practicing traditional sheep farming, as it also contributes to the ecological preservation of the island of Cres (Pavoković and Randić n.d.).

The media, as the next key public, are responsible for communication with other key public such as consumers and business entities. Namely, through various forms of communication using traditional (TV, radio broadcasting, posters, newspapers, magazines) and digital media (internet and social networks) (Grbac, 2014; Kesić, 2003; Ružić et al., 2014), communication messages aimed at promoting events, manifestations, projects and economic activities. The communication message is placed on the website of the Tourist Board of the City of Cres (www.visitcres.hr), but also on social networks, both on Instagram and on various Facebook pages, profiles and groups aimed at monitoring, informing and educating in addition to events and events on the island of Cres.
This is how traditional sheep farming is promoted at the International Festival of bagpipes (Figure 1), which has been held on the island of Cres in Orlec and the island of Lošinj in Nerezine for thirteen years (Bagpipes festival, the thirteenth time in Nerezine and Orlec 2024), through social networks (International festival of bagpipes 2024, Festival of bagpipes in Orlec 2018) and on websites (Mijeh, bagpipes and everything similar to him 2024, International festival of bagpipes – visitcres.hr n.d.).

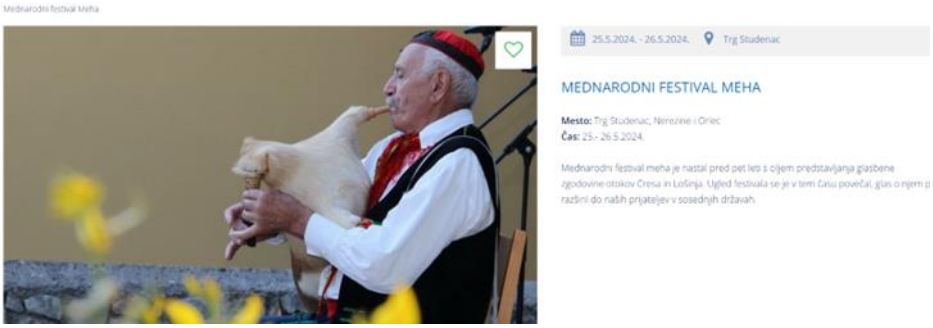


Figure 1 International festival of bagpipes
Source: International festival of bagpipes – visitcres.hr (2024)

There is also the Cres on the plate event, i.e. the Cres Lamb and Cheese Food Festival (Figure 2), which is organized by several associations and organizations on Cres. As part of the event, a felting workshop and musical performances by island folklore groups are held in addition to the gastronomic offer.

Figure 2 Cres on the plate – Cres lamb and cheese Food Festival
Izvor: Cres lamb and cheese Food Festival (2024)

In order to promote traditional sheep breeding, the Pramenka association organizes the Cres sheep event for the 16th time (Record Exhibition of Cres sheep: Sheep hairdressers show skill, speed and creation 2023, Visit Cres and enjoy the "Cres sheep" event with a rich program and a performance by Alen Vitasović 2024). At the event, traditional sheep farming and the preservation of the Pramenka, an autochthonous breed, are promoted through the presentation of sheep, a sheep shearing competition, and through the selection of the best ram and the best collection of sheep. There is also a gastronomic offer of products based on sheep meat and processed products.

Ana Mužić pod budnim okom oca Antona / Snimio W. SALKOVIĆ

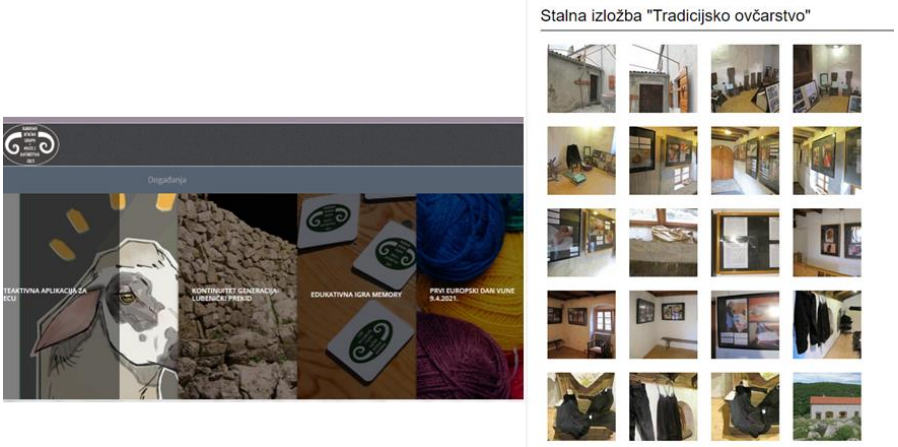
Pogledati se moglo deset kolekcija ovaca / Snimio W. SALKOVIĆ

Figure 3 Festival Cres Sheep
Source: Record Exhibition of Cres sheep: Sheep groomers showed skill, speed and creativity (2023), After two missed years, a shepherd's festival was held in Orlec (2022).

Also, the Ruta Association (2024) promotes education (Figure 4) and sustainable development and participates in the preservation of the cultural, ecological, touristic and social identity of the island of Cres through the processing of island wool and the production of felted wool products (Ruta Association – Facebook, 2024).

Figure 4 Ruta Association Cres
Source: Ruta Association (2024), Ruta Association – Facebook (2024)

Through the establishment of the Sheep Breeding Museum in Lubenice (Figure 5), emphasis was also placed on the preservation of sheep breeding and the display of traditional sheep breeding throughout history (Sheep Breeding Museum 2024).



Figrue 5 Sheep Breeding Museum
Source: Sheep Breeding Museum (2024)

The publishing house, which aims to preserve tradition in addition to traditional sheep farming (Figure 6), promotes the preservation of the tradition of the island of Cres in addition to sheep farming.

Figure 6 Publishing
Souce: Sheep breeding museum (2024)

Consumers are represented by both tourists and excursionists as well as the local population. Namely, through participation in manifestations and events, they give their support to the preservation of traditional sheep farming.

Governmental institutions contribute to the sustainability of traditional sheep breeding through various subsidies for the breeding and preservation of sheep breeding, as well as the maintenance of pastures and an ecological approach to traditional sheep breeding. Education about, for example, the alternative use of sheep's wool as fertilizer and mulch (How to use sheep's wool as fertilizer and mulch? 2023) is also one of the ways in which government institutions can influence the positive development of traditional sheep farming.

Business entities participate in the economic development of the island of Cres through traditional sheep farming, but also opening up business opportunities such as the opening of a cheese factory (Figure 7) in Loznati (I hope that the cheese factory will encourage the people of Cres to engage in animal husbandry 2021; Business in the village of Loznati with only 37 inhabitants : The united brothers develop sheep farming and build a modern cheese factory 2019; The construction of a cheese factory in Loznati started 2019) and the development of sheep and goat farming, as well as offering products to consumers through the catering business, as well as sheep and goat milk products.

Figure 7 Development potential – cheese opening
Source: Business in the village of Loznati with only 37 inhabitants: United brothers develop sheep farming and build a modern cheese factory (2019), I hope that the cheese factory will encourage the people of Cres to engage in animal husbandry (2021)

CONCLUSION

In the past, traditional sheep farming was the basis of the economic development of the island of Cres. In addition to the sectors of activities related to tourism that have taken precedence in the economic development of the island of Cres, agricultural activities, namely sheep farming and olive growing, continue to contribute to the same. With the strategic orientation of the development of the island of Cres towards the sustainable development and preservation of cultural and historical heritage, it is necessary to focus agricultural activities on the sustainable development of traditional sheep farming, but also on the ecological and sustainable development of olive growing, as these are the two most represented agricultural activities.

With the aim of communicating about traditional sheep breeding with identified key public, certain steps have already been taken and manifestations and events have been designed to promote it with a focus on the sustainable development of the island of Cres. In addition to the above, the challenges faced by sheep breeders were also identified, such as non-native game, wild boar and fallow deer, whose hunting is difficult due to the karst and inaccessible terrain (Pavoković and Randić n.d.). Non-native game endangers not only the breeding of sheep, but also destroys the dry walls used to keep the sheep, which stay in pastures all year round, in their habitats, i.e. with their owners. Considering the strategic direction of the island, the future is to focus on ecological sheep farming, but with the supervision of the competent authorities. Through education, it is possible to achieve a better use of sheep's wool, either for felting and making products, such as decorative objects made of felted wool that renters can use as special gifts. It is possible to educate young people about the possibilities of using sheep's wool through education in primary and secondary schools, for example through creative workshops for children. Sheep wool can be used for ecological fertilizer in agriculture. While manifestations and events

that promote traditional sheep farming, such as the Festival of Fur, the Cres sheep and the Cres lamb and cheese festival, are extensively communicated in various media, it is suggested to work on new activities and events, such as the inclusion of virtual reality (Grudić Kvasić, 2023) through visits to old shepherds' dwellings where visitors would experience the traditional way of life related to sheep farming. The aforementioned activities would attract tourists and visitors to the island of Cres even in the off-season, in order to ensure and encourage the sustainable development of the island of Cres and the local community.

Future analyses could look at communication towards different target groups, for example the perspectives of the older and younger generations, or the views of individuals involved in traditional sheep farming and those focused on tourism. Also, looking at communication through the perspectives of individuals involved in different target groups through primary research, could offer a new perspective and provide guidelines for communication adapted to individual target groups.

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SPECIFICITY OF PROSCIUTTO AS AN EXPERIENTIAL PRODUCT

CHAPTER 20

Mladen Rajko *

ABSTRACT

Prosciutto is one of the highest quality cured meat products in the Republic of Croatia, and is deeply rooted in tradition and specific production methods adapted to geographical and climatic conditions. Istrian, Dalmatian, Krk, and Drniš prosciutto are particularly famous in Croatia and they carry the protected designations of origin (PDO) and protected geographical indications (PGI), which ensure their authenticity and quality. The traditional processes of salting, air drying, and ripening are vital to preserving the unique sensory characteristics of prosciutto, which include rich aromas, specific texture, and nutritional values. The chapter explores the specificities of prosciutto as a gastronomic delicacy, the importance of location and tradition in its production technology, and the role of quality marks in preserving authenticity and market identity. Moreover, the importance of branding prosciutto is analyzed, primarily through its connection with tourism and events. The research indicates that in order to increase recognition and sale of prosciutto on the domestic and international markets, investment in marketing, branding, and digital promotion, while preserving traditional production methods, is essential while an increase in the export of prosciutto requires adaptation to regulatory standards, expansion of distribution channels and better education of consumers.

Keywords: *prosciutto, tradition, European protection, branding, experiential good*

INTRODUCTION

Prosciutto is one of the world's most valued cured meat products and is particularly important in Croatian gastronomy. This delicacy product occupies a central place in traditional Croatian cuisine, and the history of its production goes back centuries. Prosciutto is especially valued for its specific production methods, which include traditional salting, air drying, and long-term ripening. Each region where prosciutto is produced has developed unique techniques that contribute to various flavors and aromas, depending on the microclimatic and geographical conditions. Croatia has several recognizable types of prosciutto, such as Istrian prosciutto, Dalmatian prosciutto, Krk prosciutto and Drniški prosciutto, each of which is linked to a specific geographical area. These regions nurture a centuries-old prosciutto production tradition based on local natural conditions such as bora, mild Mediterranean climate,

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and sea salt. This combination of natural factors and traditional production methods ensures the high quality of prosciutto and makes it a unique product.

The introduction of quality marks such as the Protected Designation of Origin (PDO) and the Protected Geographical Indication (PGI) has been instrumental in preserving the authenticity and quality of prosciutto. These marks, awarded by the European Union, serve as a shield against counterfeiting and guarantee that the prosciutto is from a specific geographical area and is produced according to strictly defined traditional methods. This assurance not only protects the product but also safeguards the cultural identity of local communities. Beyond product protection, these labels also play a pivotal role in the marketing and promotion of prosciutto, both domestically and internationally. The branding of Croatian prosciutto, rooted in its origin, tradition, and quality, enhances product recognition and bolsters its competitiveness in the global food industry. This chapter dissects the specifics of prosciutto production in the Republic of Croatia, the role of marks of origin and geographical origin and quality in preserving tradition, and how branding and marketing can fortify its presence in the domestic and international markets.

THE SPECIFICITY OF PROSCIUTTO AS A UNIQUE GASTRO DELICACY

Prosciutto – dried pork leg, is one of the most valued and recognizable meat products in the world of gastronomy. Its specificity lies in traditional production methods, rich taste, and peculiarities related to the drying and ripening method, making it a unique delicacy. This meat product is deeply rooted in the Mediterranean diet, and each region that produces it has developed specific techniques that contribute to the unique profile of prosciutto. In Croatia, prosciutto occupies a special place in the culinary arts, especially in regions such as Dalmatia, Istria, Drniš, and Krk, which are known for the high quality of this product. One of the main specificities of prosciutto is the production process, which includes salting, drying, and ripening. These methods have been perfected over the centuries and passed down from generation to generation, creating a unique product in every climate. In Dalmatia, for example, prosciutto is traditionally salted with sea salt and dried in the bora; the natural wind from the mountains gives it a unique taste and texture. On the other hand, in Istria, prosciutto is dried without smoking and seasoned with aromatic herbs such as rosemary and laurel, which contributes to a specific aroma.

These traditional methods are key to the authenticity of prosciutto, as each stage of production affects its final taste, smell and texture. Air-drying prosciutto ensures slow ripening that allows the meat to develop a rich and layered flavor, while salting prevents spoilage and helps preserve the natural properties of the meat. Prosciutto is not only a delicacy because of its taste, but it is also a rich source of nutritional value. It contains high amounts of protein, essential fatty acids, vitamins and minerals, which makes it a nutritious and healthy option, especially in the context of

the Mediterranean diet. By drying, prosciutto loses water, which concentrates nutrients, and the ripening process develops its characteristic taste. This combination of rich flavor and health benefits makes prosciutto a smart and delicious choice for those who value both taste and nutrition.

The sensory characteristics of prosciutto also set it apart as a unique delicacy. Ripe prosciutto is characterized by a rich aroma, a delicate smell, balanced saltiness, and a characteristic pink-red color. The texture can vary from softer to firmer, depending on the duration of ripening, but it always retains the melt in the mouth that is a sign of a quality product. Each bite of prosciutto offers complex layers of flavor that develop through long-term drying and ripening, which makes it incomparable to other meat products. The unique flavors of prosciutto, from the rich aroma to the delicate balance of saltiness, are a testament to the skill and tradition that goes into its production. Prosciutto is a unique gastronomic delicacy that combines centuries-old tradition, natural production methods, and specific climatic conditions. Each region in which it is produced has its own distinctive techniques, resulting in a variety of flavors, aromas, and textures. Prosciutto is not only a part of the culinary tradition, but also a symbol of Croatia's regional identity and cultural heritage. Due to its authenticity, rich taste and nutritional values, prosciutto deserves the status of a unique and highly valued delicacy, both in Croatia and around the world.

PROSCIUTTO IS AN EXPERIENTIAL GOOD - PRODUCT

Experiential goods are products or services whose quality and value can be fully assessed by consumers only after experiencing or using them. Unlike the so-called "search goods," the quality consumers can quickly assess before buying (e.g., clothes, electronics), experiential goods require real experience to evaluate their true value. Examples of experiential goods include food in restaurants, travel, works of art, movies, music albums, or specific products such as wine or prosciutto. The consumer often only knows his experience with these products once he uses them (Ashton, 2014). The quality of these goods can vary depending on many factors, such as personal tastes, current circumstances, and even mood during use. One of the critical characteristics of experiential goods is the need for trust when purchasing, given that consumers can only be partially sure in advance of the quality or satisfaction they will receive. Therefore, they often rely on reviews, recommendations, or the brand to reduce uncertainty (Kaštelan et al., 2023).

Prosciutto is a classic example of an experiential good because its actual value and quality are something consumers can fully appreciate only after consumption. Although its color, shape, or packaging can be seen before purchase, the taste, texture, and overall enjoyment of prosciutto are revealed only when consumed. Various factors such as the region of origin, drying method, climate, and even the pig's diet make each prosciutto unique, which makes it challenging to make an objective assessment before the experience. Customers often look for prosciutto

based on recommendations, the manufacturer's reputation, or under the influence of previous positive experiences. Consumers may rely on reviews or brands to decide, as with other experiential goods. However, true satisfaction comes only upon consumption when the complex aromas and rich flavors that characterize premium prosciutto are discovered. This process of enjoying prosciutto makes it not just a food but an experience that can hardly be measured or quantified before it is experienced. This is precisely why prosciutto belongs to the category of experiential goods; its valuation comes from the moment of consumption and its connection with culture and tradition.

THE ROLE OF TRADITION AND LOCATION IN THE TECHNOLOGY OF THE PRODUCTION OF PROSCIUTTO IN THE REPUBLIC OF CROATIA

Prosciutto, a traditional Croatian dry-cured ham, is produced following centuries-old methods and specific geographical conditions.This culinary gem, deeply embedded in Croatian heritage, mirrors the diversity of regional cultures and local nuances. The Republic of Croatia, particularly regions like Dalmatia, Istria, Drniš, and Krk, is renowned for its prosciutto production, each region boasting its own unique methods and technologies shaped by distinct climatic and geographical factors. Tradition and location are pivotal in shaping the distinctiveness and quality of prosciutto. The following table delineates the characteristics of all protected prosciutto in the Republic of Croatia, including the type of protection, production location, processing form, and the use of smoke and spices in production.

	Istrian Prosciutto	**Dalmatian Prosciutto**	**Drniš Prosciutto**	**Krk Prosciutto**
Protection Type	Designation of Origin (PDO)	Geographical Indication (PGI)	Geographical Indication (PGI)	Geographical Indication (PGI)
Production Location	Istria - mainly Central Istria	Lika-Senj (City of Novalja), Zadar, Šibenik-Knin, Split-Dalmatia, and Dubrovnik-Neretva counties	City of Drniš and neighboring municipalities of Promina, Ružić, Unešić, and areas in Biskupija, Šibenik-Knin county	Island of Krk
Hip Bone	YES	NO	NO	YES
Smoke	NO	YES	YES	NO
Skin	NO	YES	YES	YES
Subcutaneous Fat	NO	YES	YES	YES
Dried in Bora (wind)	YES	YES	YES	YES
Spices	Sea salt, pepper, garlic, bay leaf, and rosemary	Sea salt	Sea salt (washed afterward for reduced saltiness and enhanced sweetness)	Sea salt, pepper, bay leaf, and rosemary

Table 1 Specifics of prosciutto production in the Republic of Croatia
Source: Created by the author

The traditional production of prosciutto in Croatia is based on techniques passed down from generation to generation, and the processes of salting, drying, and ripening the meat play a central role. Salting of prosciutto is usually carried out exclusively using sea salt, without the addition of chemical preservatives, thus maintaining the authenticity of the product. Salting is followed by drying in the air, which can last several months, depending on the climatic conditions and the region's specifics. In Dalmatia, prosciutto is dried in the bora - cold wind from the mountains, which enables natural and slow drying. This process is crucial because it contributes to forming prosciutto's characteristic taste and texture.
On the other hand, in Istria and Krk, prosciutto is dried without smoking, and a mixture of spices such as garlic (for Istrian prosciutto), pepper, laurel, and rosemary is used, which results in a mild and aromatic taste (Karolyi, 2023). These traditional production methods ensure the high quality of prosciutto and contribute to the preservation of the cultural identity of local communities. Prosciutto production is a technological process that preserves centuries-old customs and skills passed down from generation to generation (Petričević et al., 2022).

Geographical location plays a crucial role in prosciutto production technology because the specific climatic conditions of each region directly affect the drying and ripening process. In Dalmatia and on Krk, bora provides optimal conditions for drying prosciutto in the air. In contrast, the relatively dry climate helps to control humidity and prevent the development of unwanted microorganisms. This natural way of drying gives prosciutto a characteristic taste and texture that cannot be achieved under other conditions. In Istria, the subtropical climate with warm summers and mild winters also contributes to the specificities of Istrian prosciutto. Ripening in such conditions enables a slow and natural flavor development process that is gentler and less intense than Dalmatian prosciutto. Such subtle differences in climatic conditions create a variety of prosciutto within Croatia, where each product bears the unique stamp of the region from which it comes. In addition to the microclimate, the region's geographical position also plays an important role. Proximity to the sea and mountains and different altitudes affect the speed and quality of prosciutto drying. For example, prosciutto produced at higher altitudes, such as some parts of Dalmatia and Krk, go through a slower ripening process, which results in a richer flavor and more intense aroma. Although prosciutto production technology relies heavily on tradition, introducing modern techniques has become inevitable to meet high standards of quality and food safety. Modern producers often use temperature and humidity controls to ensure optimal conditions for curing prosciutto. However, at the same time, they strictly respect the traditional methods that are key to preserving authentic taste.

It is important to note that the harmonization of tradition and modern technology did not damage the authenticity of Croatian prosciutto. On the contrary, it has enabled manufacturers to preserve the quality and recognition of their products on the global market while at the same time increasing the efficiency of production processes and ensuring consistency in quality. The role of tradition and location in the technology of prosciutto production in Croatia cannot be emphasized enough. Traditional methods, closely related to unique geographical and climatic conditions, ensure that prosciutto remains an authentic and high-quality product. The local

microclimate, gale-like winds, and specific spices and drying methods contribute to the variety of prosciutto between regions. At the same time, the combination of these traditional methods with modern techniques enables producers to preserve the cultural heritage and, at the same time, meet the high-quality standards in the modern food industry.

PROTECTION OF PROSCIUTTO: THE ROLE OF MARKING OF ORIGIN AND GEOGRAPHICAL ORIGIN IN PRESERVING TRADITION AND MARKET IDENTITY

Due to its unique production tradition, specific climatic conditions, and taste, prosciutto in Croatia is gaining more and more recognition in the domestic and international markets. In order to preserve authenticity and prevent unfair competition, various protection measures for prosciutto have been introduced through systems of quality marks, such as marks of geographical origin and authenticity. These labels not only protect prosciutto on a legal level but also play a crucial role in preserving tradition, ensuring quality, and promoting the economic development of local communities. Considering the global food industry changes, prosciutto production in Croatia faces challenges such as modernization, standardization, and market competition. In this context, the protection of prosciutto is becoming increasingly important to preserve this product's authenticity and prevent imitations that could reduce its value on the market. The protection of prosciutto in Croatia is achieved through a system of labels that guarantee the quality and authenticity of the product. The European Union offers several labels that protect products related to specific regions and production methods. The two critical labels used to protect prosciutto are the Protected Designation of Origin (PDO) and the Protected Geographical Indication (PGI).

1. Protected designation of origin (PDO) refers to products that are entirely produced, processed, and prepared in a specific geographical area, where all aspects of production must be related to that region. This mark guarantees that the prosciutto comes from a particular region and is produced according to traditional methods specific to that area.

2. The Protected Geographical Indication (PGI) allows the product to be partially produced or processed in a particular region. This is an essential tool to protect prosciutto that can be produced according to traditional methods, but it does not require that all stages of production be tied to one place.

In Croatia, three types of prosciutto have received the European protected designation of geographical origin (PGI): Dalmatian prosciutto, Krk prosciutto and Drniš prosciutto, while Istrian prosciutto has received the European protected designation of origin (PDO). Each prosciutto has unique characteristics based on geographical location, climatic conditions, and tradition. For example, Istrian prosciutto is produced without smoking, which gives it a unique taste, while Krk, Dalmatian, and Drniš prosciutto are smoked, which gives them a specific aroma. These marks protect prosciutto on the market from counterfeits and ensure the recognition of the original product. The protection of prosciutto in the Republic of

Croatia is part of a broader legal framework that regulates the protection of agricultural and food products. It is based on European Union legislation that enables member states to protect their traditional products. The European Commission approves requests to protect marks of origin and geographical origin, ensuring that Croatian prosciutto is recognized and protected on the common European market.

The process of obtaining a trademark is complex and involves numerous steps. Manufacturers must submit a request to the competent authorities, along with detailed documentation proving the product's history, production methods, and specific characteristics. After that, the request will be evaluated at the national and European levels. This process ensures a high protection and quality guarantee level, which is crucial for placing prosciutto on the international market. Protecting prosciutto through quality marks also has significant economic advantages for producers. Prosciutto with protected labels often fetch a higher price on the market because consumers recognize the authenticity and quality of the product. Quality marks also provide a competitive advantage over similar products from other countries, such as Italian or Spanish prosciutto. This is especially important for Croatian manufacturers who want to expand their presence in the European and global markets.

In addition, designations of geographical origin and authenticity help preserve jobs in rural areas, where prosciutto production is an important source of income. Local communities benefit from the increased recognition of their products, which contributes to the development of rural tourism. Prosciutto becomes more than a food product – it becomes a symbol of the region and its cultural heritage. Despite its many advantages, the protection of prosciutto faces certain challenges. One of the main challenges is harmonizing traditional production methods with modern food safety standards and requirements for sustainable production. Producers must ensure that their products meet strict regulations and at the same time preserve the authenticity and quality of prosciutto. Also, there is a need to stress the importance of consumer awareness about the meaning of quality labels. Although the PGI and PDO labels offer a high level of protection, many consumers are not sufficiently educated about their meaning, which can affect the demand for protected products. Therefore, it is crucial to implement campaigns that will raise awareness of the importance of authentic products and their connection with geographical origin, empowering consumers to make informed food choices.

Protecting prosciutto in the Republic of Croatia through designations of geographical origin and quality is critical to preserving the authenticity of this product and protecting traditional production methods. These labels ensure the recognition of Croatian prosciutto in the domestic and international markets and contribute to the development of local communities and the promotion of cultural heritage. Although there are challenges in adapting to modern standards and strengthening awareness among consumers, protecting prosciutto through legal frameworks is still one of the most critical steps in preserving the quality and identity of this unique product.

BRANDING OF PROSCIUTTO IN THE REPUBLIC OF CROATIA

Prosciutto branding in the Republic of Croatia is crucial in ensuring recognition, preserving quality and authenticity, and strengthening competitiveness in the domestic and international markets. As a product with deep roots in Croatia's cultural and gastronomic tradition, prosciutto has become a symbol of originality and quality, making it an ideal food product for branding. Considering the specificities of Croatian prosciutto, such as geographical origin, production methods, and unique taste, branding not only contributes to preserving the identity of this product but also helps promote Croatian gastronomic heritage. One of the critical elements of the branding of prosciutto in Croatia is the designations of geographical origin and authenticity awarded by the European Union. These labels protect prosciutto from imitations on the market and have marketing potential in the branding process. Labels of geographical origin and authenticity help consumers recognize products as authentic and, at the same time, as products from a specific region known for traditional production. In this way, quality marks are essential in creating trust among consumers, who are increasingly interested in products with a clearly defined origin and authenticity.

The branding of prosciutto in the Republic of Croatia is often closely related to the regions where prosciutto is traditionally produced. Istrian prosciutto, Dalmatian prosciutto, Drniški prosciutto and Krk prosciutto represent not only products but also regions that nurture their own gastronomic traditions. Each of these regions has developed a unique identity through specific production methods, microclimate conditions, and taste characteristics, further strengthening the brand of these prosciuttos on the market. Prosciutto branding also plays a vital role in developing tourism in Croatia. As a country with a rich gastronomic heritage, Croatia is increasingly investing in promoting its indigenous products through tourist routes, festivals, and fairs. Prosciutto has become an indispensable part of the tourist offer, especially in regions such as Dalmatia and Istria, where visitors can learn about the production process of prosciutto and enjoy tasting it. Although branding prosciutto brings numerous advantages, producers also face challenges. One of the main challenges is harmonizing modern food quality and safety standards with preserving traditional production methods. Producers must ensure that prosciutto retains its authenticity while meeting the demands of the international market, which sometimes requires investment in modernizing production facilities.

Branding prosciutto in the Republic of Croatia is not just a marketing strategy, but a key process in preserving the authenticity and quality of this traditional product. Through the system of designations of geographical origin and authenticity and promotion on the domestic and international market, prosciutto becomes a symbol of Croatian gastronomic heritage and a recognizable delicacy. Regional identities, tourist offers and specific production methods help strengthen the prosciutto brand, which creates added value for producers and ensures long-term recognition of this product on the global market (Krajnović, Rajko, Matić, 2015).

Events promoting prosciutto

Several events dedicated to prosciutto are held in the Republic of Croatia, which promotes this traditional delicacy in gastronomy and culture. These manifestations are essential events that bring together producers, consumers, and tourists and, at the same time, promote the quality and recognition of Croatian prosciutto on the domestic and international markets. Some of the most famous events dedicated to prosciutto are:

International Prosciutto Fair in Tinjan (ISAP)
It is held annually in the municipality of Tinjan, in Istria, called the "municipality of Istrian prosciutto." This international fair gathers prosciutto producers from Croatia and other countries such as Italy, Austria, Portugal, Spain, Montenegro, and Slovenia. The event includes the exhibition and sale of prosciutto, tastings, product evaluation, and awarding prizes. Tinjan has become a recognizable place for prosciutto lovers, and the fair contributes to strengthening the brand of Istrian prosciutto on an international level (more information about the event at: https://tinjan.hr/isap/o-manifestacija).

Days of Croatian prosciutto
This is one of the most important events dedicated to prosciutto in Croatia, held at different locations throughout the country. The event brings together prosciutto producers from various regions, including Dalmatia, Istria, Krk, and Drniš, and the goal is to promote prosciutto with the designation of protected geographical origin and authenticity. Days of Croatian prosciutto allow visitors to taste various prosciutto, participate in workshops, and learn more about the production process (more information about the event can be found at https://hrvatskiprsut.com).

Prosciutto Festival in Drniš
Drniš is historically known for producing top prosciutto, and this festival gathers producers from Drniš and the wider area. The festival includes prosciutto tastings, product exhibitions, and prosciutto quality competitions. Culinary workshops and presentations are also held, and visitors can learn more about the traditional methods of producing Drni prosciutto. This event emphasizes the importance of preserving local traditions and the promotion of Drnis prosciutto as a recognizable gastronomic delicacy (more information about the event can be found at: https://www.facebook.com/drnis. web/?locale =hr_HR).

Krk prosciutto fair (Krk prosciuttofest)
This event promotes Krk prosciutto, protected by the designation of geographical origin and is one of the most famous products from the island of Krk. The fair includes tastings, exhibitions, and sales of prosciutto from Krk. Workshops are organized on the production process, as well as lectures on the history and tradition of prosciutto production in Krk. The Krk Prosciutto Fair has become an important event for promoting the island's gastronomy and tourism (more information about the event can be found at https://k.hr/tradicionalne-manifestacije).

Prosciutto festival in Sinj
This event brings together prosciutto producers from Dalmatia and the surrounding areas. The prosciutto fair in Sinj offers visitors the opportunity to taste different types of prosciutto and other autochthonous Dalmatian products. Workshops, lectures on prosciutto production, and awarding prizes for the best prosciutto are organized. This event promotes Dalmatian prosciutto but also strengthens the tourist offer of the region (more information about the event can be found at: https://www.sinj.hr/19-nacionalni-sajam-prsuta-i-trajnih-suhomesnatih-proizvoda-sinj- 2024).

These events promote prosciutto as a gastronomic product, strengthen its brand, and help preserve the tradition of prosciutto production in Croatia. Through promotion at these events, prosciutto becomes a recognizable symbol of local culture and an essential element of the tourist offer, thereby contributing to the economic development of the regions that produce it.

Marketing and market positioning of prosciutto

Prosciutto, a cherished product of Croatian gastronomic heritage, holds significant untapped market potential. To fully exploit this potential and enhance the marketing and sale of prosciutto in the Republic of Croatia, it is imperative to devise comprehensive strategies. These strategies should focus on branding, digital marketing, tourism, and consumer education. Strengthening the brand is a pivotal step in this process. With consumers increasingly valuing products with quality labels such as Protected Geographical Origin (PGI) and Protected Designation of Origin (PDO), it is crucial to consistently promote these labels. By leveraging clearly defined brands such as Istrian, Dalmatian, Krk, and Drniš prosciutto, producers can highlight the unique characteristics of their products, such as traditional production methods, authenticity, and local cultural ties. Stronger brands instill consumer confidence and foster greater recognition in both domestic and international markets.

Digital marketing plays a crucial role in modern business, and its importance is also growing in the food sector. Prosciutto producers should invest in an internet presence through social networks, websites, and online stores. Creating quality content such as videos on the production process, interviews with producers, and high-quality photos can attract attention and inform consumers about the value and quality of prosciutto. Social networks such as Facebook, Instagram, and YouTube allow manufacturers to reach a wider audience and establish direct contact with potential customers. Online platforms also offer the opportunity to sell prosciutto directly to consumers, thus reducing dependence on traditional retail chains.

Gastronomic tourism presents a significant opportunity for boosting prosciutto sales. Croatia, a popular tourist destination, can leverage this by promoting prosciutto through organized tastings, visits to producers, and local festivals. By developing gastro-tourism routes that include visits to prosciutto production plants and organizing events with tastings and culinary workshops, prosciutto can become a key attraction for tourists, thereby positively impacting its sales. Educating consumers about the quality and specifics of prosciutto can also play a crucial role in

increasing sales. Campaigns highlighting the difference between industrially produced prosciutto and traditional small plants can motivate consumers to appreciate and choose a higher-quality product. Furthermore, education about GIs and authenticity can help consumers recognize the value of these certificates.

Improving the marketing and sale of prosciutto in the Republic of Croatia requires strengthening the brand, using digital channels, connecting with tourism, and educating consumers. These strategies can contribute to the greater recognition of prosciutto, ensure long-term sales growth, and strengthen its position in the domestic and international markets. Increasing the export of Croatian prosciutto can significantly contribute to strengthening the Croatian food industry and promoting the national gastronomic heritage at the international level. Although prosciutto from Croatia, especially from Istria, Dalmatia, Krk, and Drniš, has marks of protected geographical origin and originality and is recognizable by its quality, the export potential has not yet been fully exploited. Several vital strategies could contribute to export growth: branding and international promotion, expansion of distribution channels, and adaptation to regulatory requirements.

Prosciutto producers should expand their distribution channels to reach a wider audience. Cooperation with international retail chains, specialized delicatessen stores, and inclusion in online food sales platforms can increase the availability of prosciutto in markets with a high demand for premium products. Increasing the export of Croatian prosciutto requires coordinated efforts in promoting, expanding distribution networks, and harmonizing with market standards. These strategies can enable Croatian producers to take advantage of the growing interest in premium meat products internationally.

CONCLUSION

Prosciutto, as one of the highest quality and most sought-after cured meat products in the Republic of Croatia, stands out for its authenticity, deep-rooted tradition, and specific production methods adapted to the microclimatic conditions of regions such as Istria, Dalmatia, Drniš and Krk. This chapter analyzes the specificities of prosciutto as a unique gastronomic delicacy and the importance of its branding and preservation of authenticity using protected designations of origin (PDO) and geographical origin (PGI). Traditional production methods, including salting, air drying, and long-term ripening, are crucial to achieving the sensory characteristics of prosciutto that make it a unique and high-value product on the global market. Also, this chapter emphasized the importance of connecting prosciutto with tourism through manifestations and events that promote authentic domestic products. Given the contemporary challenges in the food industry, such as global competition and adaptation to quality standards, continuous investment in the marketing and branding of prosciutto is crucial. Increasing recognition in the international market requires digital promotion, distribution channel expansion, and consumer education about the value of protected quality marks. In conclusion, prosciutto is a product and a symbol of Croatian cultural heritage. Preserving traditional production methods, modernization, and adaptation to global market standards can enable further growth of its recognition and demand in domestic and international markets.

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SUSTAINABILITY AND THE PERSPECTIVE OF BEEKEEPING IN CROATIA

CHAPTER 21.

Tomislav Geršić *

ABSTRACT

Beekeeping is a millennia-old practice of maintaining bee colonies and producing honey and other bee products. Bees are one of the key ecosystem stakeholders for they enable biodiversity, pollination, crop yield growth, and produce honey and other bee products. The EU is the 2nd largest honey producer in the world. Beekeeping in Croatia is well-developed, but beekeepers face a series of challenges which are reflected in the reduction of total production. Changes in climate conditions significantly impede the beekeepers' position, bring about new challenges that are difficult to overcome and endanger the future of beekeeping. The cheap honey of poor quality from Asia, mainly China, which is also frequently counterfeited, presents unfair competition to the Croatian and European beekeepers. Beekeepers need to adapt to the present circumstances and advance the level of their knowledge and skills to face the existing challenges. The adaptation includes, among other things, the increase in the number of hives and bee colonies, a focus on other bee products like propolis, royal jelly, bee venom, beeswax and bee pollen, as well as the integration of bee products as part of tourism offerings.

Keywords: *bees, beekeeping, honey, challenges, perspectives*

INTRODUCTION

As an ancient, millennia-old practice, beekeeping has evolved to become the basis of contemporary agriculture and environmental sustainability. Beekeeping is defined as an agricultural sector that ensures the sustainability of ecosystems and rural development through the production of honey and other bee products (Šedik, Pocol, and Horska, 2017). The honeybee (Apis mellifera) is not only a key pollinator of natural and agricultural ecosystems but also a bioindicator of environmental health (Feketéné Ferenczi, Szűcs, and Bauerné Gáthy, 2024). The pollination provided by bees is essential for achieving desired yields of fruits, nuts, oilseeds, and other crops. It is estimated that animal pollination enhances global crop yields by an additional $235 to $577 billion annually (Feketéné Ferenczi, Szűcs, and Bauerné Gáthy, 2024). More than 80% of spontaneous wild plants and over 85% of all agricultural crops are pollinated by honeybees (Bekić and Jovanović, 2015). According to estimates by Vercellii et al. (2021), this bee pollination contributes to an increase in crop value of

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at least €150 billion globally, accounting for about 9% of total agricultural production for human use.

Despite the crucial and positive roles that bees play, beekeepers face a range of increasing challenges in maintaining and breeding them. This chapter presents the multiple importance of beekeeping, the challenges faced by beekeepers, and strategies for sustainable beekeeping.

THE IMPORTANCE OF HONEYBEES

Honeybees are essential for the preservation of plant biodiversity and ecosystem stability. They are the primary animal pollinators in most ecosystems, playing a crucial role in providing pollination services that ensure the conservation of plant biodiversity (Vercelli et al., 2021). In Europe, honeybees are the only insects that produce food (Tlak Gajger, 2020). Pollination is one of the most important ecosystem services, even more significant than honey production (Vrabcová and Hájek, 2020). The economic value of bee pollination is enormous, contributing billions of dollars annually to agricultural production worldwide. In fact, about 90% of the benefits provided by bees come from their pollination capabilities, while only 10% relates to honey and other bee products (Vrabcová and Hájek, 2020). In the EU, bee pollination contributes at least €5 billion annually to agricultural production (Feketéné Ferenczi, Szűcs and Bauerné Gáthy, 2024).

Pollination is a vital ecosystem service that supports global food crop production (Klein et al., 2007). Due to their ability to travel great distances and their specific flower visitation patterns, honeybees are key pollinators for monocultures (Šedik, Pocol and Horska, 2017). As pollination primarily depends on bee populations, a decline in these populations can lead to significant ecological and economic challenges regarding ecosystem sustainability and food supply security (Šedik, Pocol and Horska, 2017). Over recent decades, there has been increasing concern due to rising mortality rates among bee colonies across Europe, the USA, and Asia (Jacques et al., 2017). Climate change is causing shifts in flowering times and habitats of certain plant species, leading to spatial and temporal mismatches between pollinators and their floral food sources (Van Espen et al., 2023). These impacts ultimately contribute directly to reduced availability of nectar and pollen, thereby diminishing honey production and other bee products as well as pollination activities (Vercelli et al., 2021).

According to Feketéné Ferenczi, Szűcs and Bauerné Gáthy (2024), pollination is economically crucial in all agricultural systems and is also offered as a commercial service. Honey production and commercial pollination services can be complementary—honey production mainly occurs in summer while pollination takes place in spring. Farmers pay beekeepers for bringing colonies to pollinate their crops. In the USA, contracts for pollination have surpassed honey production as the

primary source of income for beekeepers, despite increased honey consumption. They emphasize that while the shortage of honey due to rising demand can be easily compensated for, the shortage of bees necessary for providing pollination services poses a more challenging problem to address.

BEE PRODUCTS

Honey is undoubtedly the most important, abundant, sought-after, and consumed bee product. Approximately 1.8 million tons of honey are produced globally each year, with around 283,000 tons coming from Europe (Vercelli et al., 2021). China is the largest producer of honey worldwide, while Europe ranks second with about 600,000 beekeepers and 17 million hives (Key facts about Europe's honey market, accessed August 24, 2024). Notably, 95% of European beekeepers do not consider themselves professional beekeepers, with only 3% managing more than 150 hives (Novelli, Vercelli, and Ferracini, 2021). Since 2010, the global demand for honey has been increasing at a rate of approximately 19,500 tons per year (Garcia, 2018). Despite being the second-largest honey producer globally, the European Union meets only 60% of its honey needs through domestic production and imports the remainder primarily from China and Ukraine (Kleisiari, Kleftodimos and Vlontzos, 2023).

Due to its high nutritional value, honey is considered an important food item and medicine, with consumption steadily rising. The current average annual consumption worldwide is between 250 to 300 grams per capita (Popescu et al., 2021). Honey is also used in culinary applications as a spice, preservative, sweetener, and for marinating; it is added to meat dishes, baked goods, and is a key ingredient in many recipes (Raguž, 2017).

Interestingly, a link has been established between honey consumption and longevity. As described by Topal et al. (2019), analysis has shown that beekeepers have longer telomeres on their chromosomes compared to non-beekeepers. Since telomere length reflects biological age, beekeepers may enjoy a longer lifespan compared to those who are not beekeepers. The length of telomeres is directly related to the duration of regular honey consumption; frequent daily consumption of honey correlates with longer telomeres.
Honey production significantly depends on the number of hives, the rationalization of hive migration, and technological modernization in beekeeping practices (Šedik, Pocol, and Horska, 2017). According to data from 2015 (Brščić, Šugar Korda and Poljuha, 2017), the average honey production per hive in Croatia was 20 kg. However, a study published in 2020 (Tomljanović et al.) involving a sample of 117 beekeepers in Croatia found an average annual production of only 14.69 kg per hive. This decline can likely be attributed to various detrimental factors such as climate change, bee diseases, and chemical treatments of crops. Additionally, smaller beekeepers typically practice stationary beekeeping—keeping hives in one location

year-round. In contrast, professional beekeepers migrate their hives (transhumance) throughout the year to locations with currently blooming plants, achieving significantly higher yields per hive—up to 60 kg of honey per hive (Grgić et al., 2018), and in exceptionally good years, this can reach up to 75 kg per hive (Šakić Bobić et al., 2018).

Bees participate in the market not only with honey but also with various other products. In more than 92 million registered beehives worldwide, including about 17 million in Europe, bees produce the following products for human use: royal jelly, propolis, bee venom, beeswax, pollen grains, new swarms of bees, and queens (Vercelli et al., 2021). Swarms of bees and queens are products that help beekeepers further develop their colonies and beekeeping businesses. Producers of other beekeeping products (primarily propolis) are mostly large beekeepers with more than 100 hives (Grgić et al., 2018).

Propolis is a resinous substance collected by honeybees from plants, known for its antibacterial properties. Bees use it to fill small cracks in the hive and for disinfection, while in human applications, it is utilized in the production of cosmetics and medicines. Traditionally, propolis has been used to treat various skin injuries and conditions such as burns, irritations, ulcers, psoriasis, sore throat, and toothache. It is sold raw in chunks or powder form and as a solution (Bekić and Jovanović, 2015). According to Tomljanović et al. (2020), beekeepers find propolis production equally appealing as honey production.

Royal jelly is a valuable bee product that is in high demand. It is produced in special glands of bees and serves to feed larvae and the queen bee. This creamy yellow substance can be used in food as well as an ingredient in cosmetic and pharmaceutical products. It is sold fresh or freeze-dried (lyophilized). Collecting royal jelly requires significant beekeeping experience (Bekić and Jovanović, 2015). Preparations of royal jelly are primarily used to strengthen the immune system, reduce stress, improve concentration, decrease joint inflammation, and regulate blood pressure. Due to its complex composition and strong biological activity, royal jelly is a valued dietary supplement and a popular ingredient in cosmetic formulations (Hadžimujuić et al., 2016).

Bee venom is gaining increasing importance in pharmacy, medicine, and cosmetics due to its anti-inflammatory, fungicidal, antibacterial, antipyretic, and other therapeutic effects along with its highly active biological components (Mutapčić et al., 2016). Produced by worker bees in a specialized gland, it serves primarily to protect the colony from unwanted intruders. Bee venom is used to create medical and cosmetic products such as gels, creams, balms, ampoules, and masks that have anti-aging and anti-inflammatory properties (Bekić and Jovanović, 2015).

Beeswax is produced by special glands of worker bees and is essential for constructing bee colonies. Due to its applications across various industries, beeswax is a highly sought-after market product. Besides selling the wax itself, beekeepers

can use it to produce candles, cosmetic preparations, and as a foundation for their own hives (Bekić and Jovanović, 2015).

Pollen grains are collected by bees to feed the brood and are the primary source of protein necessary for the complete development of bees. They are rich in enzymes, vitamins, and minerals and are used by humans as a dietary supplement—either fresh or dried (Bekić and Jovanović, 2015). Due to their diverse chemical composition, standardization and application of pollen grains in functional food production, dietary supplements, and medicines are challenging. They are beneficial for health because they contain numerous biologically active components with positive health effects as well as many antioxidants. However, due to insufficient scientific research on their varied chemical, physical, and health properties—along with a lack of knowledge regarding collection technologies, preservation methods, packaging, and distribution—their use remains limited both independently and in combination with other bee products or medicinal herbs. Currently, they are only used to a limited extent in pharmacy, medicine, and food technology (Jašić et al., 2016).

SPECIFICITIES AND INDICATORS OF THE BEEKEEPING SECTOR IN THE EUROPEAN UNION AND CROATIA

The main indicators of the beekeeping sector include the number of hives, the share of professional beekeepers, and honey yield (Šedik, Pocol, and Horska, 2017). The distinction between professional and non-professional (semi-professional and hobby) beekeepers is defined in the literature in two ways: by the number of hives and based on whether beekeeping is the beekeeper's main activity, supplementary activity, or hobby. Bučar et al. (2020) state that hobbyists are those who have up to 30 hives, those with 31 to 60 hives are considered to have beekeeping as a supplementary occupation and hobby, those with 61 to 150 hives are semi-professionals, and only those with 151 hives or more are classified as professional beekeepers. Šedik, Pocol, and Horska (2017) also consider beekeepers with more than 150 hives to be professionals. On the other hand, Tomljanović et al. (2020) differentiate between professionals—those for whom it is their sole occupation—beekeepers for whom it is a supplementary occupation, and hobby beekeepers—regardless of the number of hives they own. In their 2021 study involving seven European countries, Guiné et al. found that about 90% of beekeepers have up to 150 hives and are mostly non-professional or hobby beekeepers; a quarter of them are certified as organic producers of honey and bee products, with their main products being honey (75-98%), wax (15-45%), and bee colonies (13-32%). The average honey yield per hive ranged from 21 to 50 kg per year—where Estonia and Finland had the highest yields at 38 and 36 kg respectively, while Portugal had the lowest average yield at 13.7 kg.

Although honey and other bee products serve as either food for daily consumption or raw materials for industrial, medical, or pharmaceutical needs, their production occurs almost exclusively at the level of small family farms or even solely by individuals. Family members and friends play an important role in beekeeping, with only 2% of participants in the study conducted by Guiné et al. in 2021 indicating employment of workers for beekeeping.

Overview of Beekeeping in the EU

According to data from the European Commission from April 2024 (Honey Market Presentation, 2024, accessed on August 29, 2024), in 2022 there were about 710,000 beekeepers in the European Union who averaged 29 hives per beekeeper—totaling approximately 20.3 million hives—with only 3% having more than 150 hives. In that year, they produced about 285 thousand tons of honey, with an average yield per hive among European beekeepers in 2022, 21 kg of honey. According to the same data, the European Union imported around 190 thousand tons of honey in 2022, making it the second largest honey importer in the world after the USA (which imported about 205 thousand tons that same year). The EU imports most honey from China (about 60 thousand tons in 2023), Ukraine (about 45 thousand tons in 2023), and Argentina (about 20 thousand tons in 2023), while the total value of honey imports into the EU in 2023 was approximately €359,312,000. At the same time, the European Union exports just under 25 thousand tons of honey (in 2023), which constitutes less than 10% of its total production. Popescu et al. (2021) identify Spain, Romania, and Hungary as the largest honey producers in the EU, followed by Germany, Greece, Poland, France, Italy, Bulgaria, and Portugal—all these countries together produce 76% of honey in the EU.

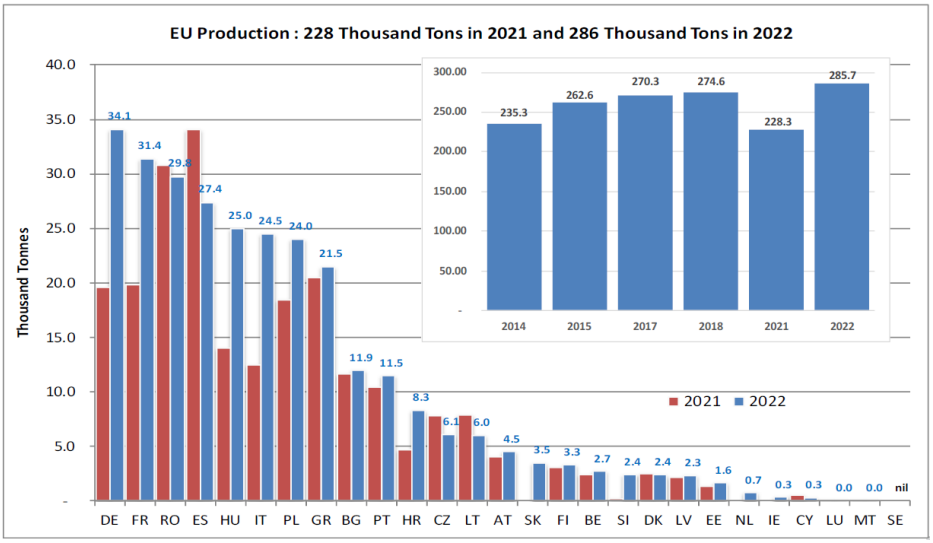

Figure 1 Total honey production in the EU
Source: European Commission, 2024, EU Honey Market Presentation, p. 13

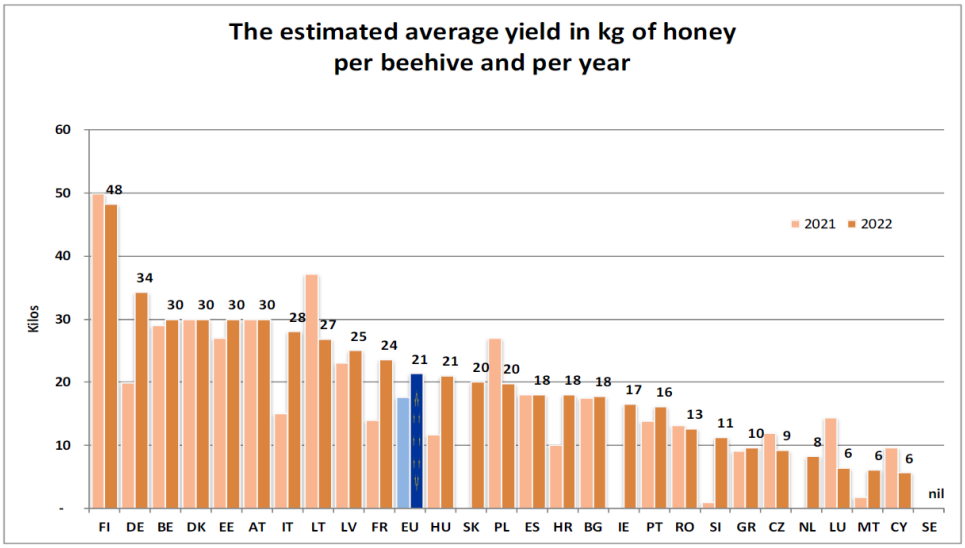

Figure 2 Estimated average yield in kg of honey per hive
Source: European Commission, 2024, EU Honey Market Presentation, p. 14

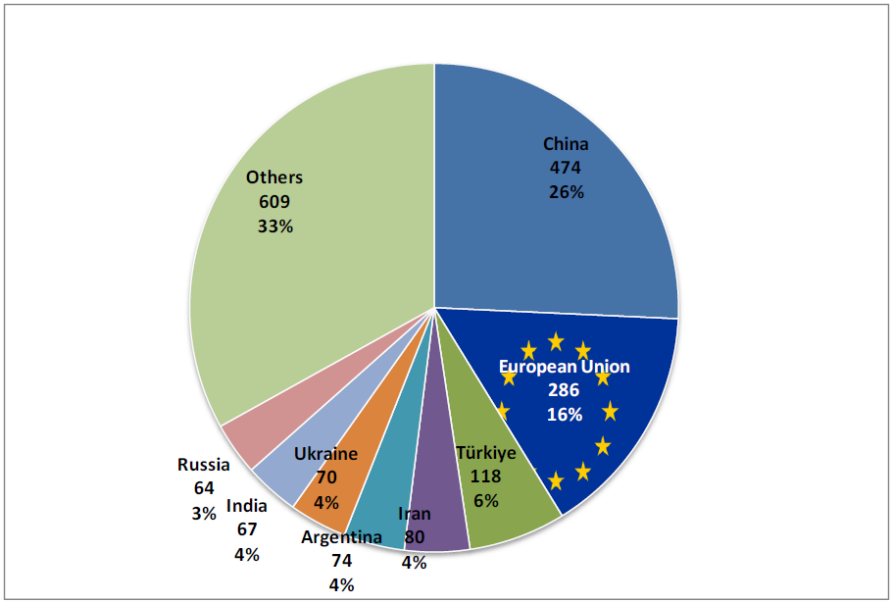

Figure 3 Global honey production per country
Source: European Commission, 2024, EU Honey Market Presentation, p. 18

Findings and Research on the State of Beekeeping in Croatia

The beekeeping tradition in Croatia is long-standing, with the first written document on beekeeping being the Vinodol Code from 1288 (Šakić Bobić et al., 2018). The three most significant beekeeping regions in Croatia are the hilly-mountainous, Pannonian, and Mediterranean areas (Čop et al., 2022). According to data from the

Croatian Beekeepers Association (Croatian Beekeepers Association, n.d., accessed August 29, 2024), there were 9,365 active beekeepers in Croatia at the time of accessing the statistical database, of which 6,113 had registered family farms (OPG), with 12,044 active apiaries and 457,396 registered hives. The highest annual honey production recorded in Croatia was in 2015 at 11.5 thousand tons, while by 2020 production had decreased to only 6.6 thousand tons (Čop et al., 2022). According to data from the Ministry of Agriculture, in 2022, 8,295 tons of honey were produced, and 2,352 tons were imported. Based on this data, self-sufficiency in 2022 was 77.9%, while in the same report for 2021, self-sufficiency was 72.8% (Croatian Ministry of Agriculture, 2023:61, accessed September 14, 2024).

Grgić et al. (2018) found in their research on a sample of beekeepers in Croatia that only one-third of honey producers operate within family farms under the VAT system, primarily those with more than 60 hives.

Tomljanović et al. (2020) reported that beekeeping in Croatia has been continuously growing at an average annual growth rate of 4.47% for the number of bee colonies and an average annual growth rate of 12.81% for honey production based on data from 2019. A study conducted in 2017 on a sample of 117 beekeepers found that professional beekeepers averaged 135 hives, those for whom it is a supplementary activity averaged 39 hives, and hobby beekeepers averaged 18 hives; although they constituted the smallest group (4.27% of the sample), professional beekeepers owned 17.90% of the total number of hives and produced 20.85% of the total honey quantity in the observed sample—professional beekeepers produced an average of 17.04 kg of honey per hive annually, while those for whom it was a supplementary activity and hobby beekeepers produced an average of 14.58 kg and 13.24 kg per hive respectively, confirming that experience in beekeeping plays a crucial role in success and efficiency improvements. Tomljanović et al. interestingly note that professional beekeepers gain up to 7.5 times more experience annually than the average beekeeper due to managing a larger number of hives and apiaries, which requires more maintenance work. According to the same study, most beekeepers—51.85%—inherited their beekeeping activity. Notably, this percentage is highest among professional beekeepers, all of whom (100%) inherited their beekeeping activity, while among those for whom it is a supplementary activity or hobby, it is 42.86% and 58.33%, respectively. This data can also explain the greater efficiency and success of professional beekeepers: they acquired their knowledge and skills within a family context from previous generations who had more time and inherent motivation to educate their offspring and pass down knowledge and skills accumulated over years and decades. Additionally, among participants in this research, the lowest average age was found among professional beekeepers at 39 years old, while the average age for those whose beekeeping is a supplementary or hobby activity was approximately 43.91 years and 47.16 years respectively. (Does this also indicate that as beekeepers age, they reduce their number of hives and working intensity, transitioning from professional to semi-professional and ultimately hobby status? This could be a subject for potential future research.)

According to research conducted by Grgić et al. in 2018, small-scale beekeepers predominantly maintain stationary operations, while larger-scale beekeepers relocate their hives to increase honey yields per hive. The highest yields per hive were observed among beekeepers with between 60 and 100 hives, which are likely to reflect an optimal range of hives that an independent beekeeper can manage while maximizing production; this number of hives remains easily movable, which is a key factor in achieving higher yields per hive. The same authors note that the most common sales channels for registered producers are market sales and direct sales; larger producers also link a smaller portion of their sales to tourism-related activities.

Consumer Behavior and Preferences

Consumer behavior and preferences regarding honey exhibit notable variations across different countries and regions. Research by Brščić, Šugar Korda, and Poljuha (2017) highlights that Irish consumers prefer honey with a dark golden color, while in Germany, Austria, and Switzerland, dark honeydew honey is favored. In Uruguay, consumers lean towards dark reddish types of honey, whereas in Hungary, acacia and flower honey are preferred. In Croatia, the same authors found that most consumers buy honey twice a year (33.6%) or once a month (29.4%), predominantly (75%) directly from producers. Croatian consumers tend to prefer mild flavors and lighter colors of honey, with acacia honey being the most favored type, followed by flower honey, honeydew, and other varieties.

Kleisiari, Kleftodimos, and Vlontzos (2023) highlight conclusions from the literature indicating that the main factors influencing consumer behavior regarding the purchase, quantity, and frequency of honey consumption include organoleptic properties, price, packaging, perceived nutritional value, crystallization occurrence, advertising/promotion methods, demographic characteristics of consumers, as well as psychographic elements such as the adoption of a healthy lifestyle and diet. A study conducted in Croatia (Brščić, Šugar Korda, and Poljuha 2017) found that consumers primarily value and assess honey based on its intrinsic properties of taste, aroma, and smell when purchasing it. Following these factors, availability and other intrinsic properties such as the type of honey and its consistency are also important. Consumers rated the label and packaging of honey as unimportant, while their attitudes towards brand and color were neutral. The authors conclude that these intrinsic properties of honey, which consumers prioritize most, represent the quality of honey. They also note that it can be concluded that customers prefer domestic honey, suggesting that they trust the quality of Croatian honey. Consumers purchase and consume honey for its health benefits, and awards received at exhibitions do not influence their selection and purchase decisions. The authors recommend that beekeepers and other commercial producers emphasize the health benefits of their honey when shaping marketing strategies, as research results indicate that these are the primary motivations for purchasing and consuming honey.

CHALLENGES IN BEEKEEPING AND HONEY PRODUCTION

To maintain competitiveness, beekeepers as well as other farmers must adapt their decisions according to constantly changing circumstances—economic, political, social, environmental—as well as fluctuating input and output prices, unstable weather conditions, and rapid technological changes (Feketéné Ferenczi, Szűcs and Bauerné Gáthy, 2024). Beekeeping has faced a series of challenges and difficulties for years. Bee colonies depend on environmental factors; adverse impacts on bees can ultimately lead to disruptions in nutrition, welfare, and overall human life (Tlak Gajger, 2020). The continuous loss of bee colonies in Europe over the past decade is explained by various factors including climatic conditions, changes in land use practices, reduced food sources such as pollen and nectar, pesticide use in agriculture, spread of pathogens (diseases, parasites, predators, viruses), high bee mortality rates, a decrease in the number of beekeepers, unfair competition from low-quality or adulterated imported honey as well as the skill level in beekeeping (Sperandio et al., 2019; Feketéné Ferenczi, Szűcs and Bauerné Gáthy, 2024; Vercelli et al., 2021; Kleisiari, Kleftodimos and Vlontzos, 2022).

Climate change is a global and multifaceted issue that affects the distribution and quantity of various ecosystems and organisms, including plants and pollinators. According to estimates, by 2050, it is projected to lead to a global reduction in productivity ranging from 2% to 15% and an increase in food prices by 1.3% to 56%, along with a loss of agricultural income at the EU level of 16% (Katunar and Vretenar (eds.) 2023: 38).

Rising temperatures affect the survival and life cycle of insects. Climate change impacts the activity and effectiveness of pollination performed by insects, leading to a significant decline in bee populations and biodiversity. It directly influences the emergence of diseases, parasites, predators, and viruses, as well as the increasing use of pesticides; beekeepers have observed a decrease in the availability of nectar, pollen, and honeydew sources. Honey production has been halved due to reduced pollen production caused sometimes by drought and sometimes by frost. Mild winters lead to higher infestations of various bee diseases and pests, all of which affect overall honey production and the maintenance of bee colonies (Vercelli et al., 2021). Due to climate change, there are changes in the usual flowering times of many crops, with flowering occurring later or the flowering period being shortened; some plant species can no longer thrive in the same areas and are thus spatially unavailable to bees. Elevated temperatures and mild winters also affect bee hibernation, causing a shortening or even complete absence of hibernation, which subsequently negatively impacts the development of new brood (Van Espen et al., 2023). The occurrence of hail and frost in late spring, during flowering time, reduces the available food sources for bees, prompting beekeepers to resort to feeding bees with sugar syrup and patties. At the same time, fruit growers attempt to minimize damage to their crops by using pesticides and herbicides, which adversely affect bees. On the other hand, adverse climatic effects are markedly regional and more

severely impact southern European countries compared to northern ones, as determined by Van Espen et al. (2023). According to some models, it is also predicted that agricultural production will decrease in southern parts of Europe while northern regions will become suitable for cultivating crops that were not previously grown there (Katunar and Vretenar (eds.) 2023: 38).

Kleisiari, Kleftodimos and Vlontzos (2022) cite decreasing profitability in the sector as a primary reason for the reduction in professional beekeepers and high bee mortality rates. They emphasize that pest occurrences and diseases exposure to chemicals, reduced plant biodiversity, climate change and destruction of natural bee habitats have led to increased investment needs for maintenance thus raising costs for beekeepers. In certain areas cases of winter losses reaching up to 35% of bee colonies are no longer rare (Perichon et al., 2024). Additionally, difficulties arise from poor quality imported honey primarily from China, which is produced by adding sugar or early harvesting, also containing false declarations about origin. García (2018) points out that Asian beekeepers often harvest immature honey with high water content achieving higher yields while reducing costs; this immature honey is then industrially processed through filtration dilution elimination of residues followed by dehydration and packaging. Since this drying process occurs not in hives but factories, such honey lacks some known positive properties associated with natural honey production which humans can imitate but not reproduce because bees mix nectar with their own secretions and enzymes—only this unique natural transformation guarantees the final physical biochemical health properties of honey. This is likely why Japan—the third largest global market for imported honey—primarily imports Chinese honey for industrial use while simultaneously increasing imports from Argentina, Canada and Hungary for direct table use (Čop et al., 2022).

Beekeeping itself represents measures taken by beekeepers to maintain bee colony health and achieve production goals—according to research, beekeepers can directly and indirectly contribute to achieving these goals through increasing their beekeeping skills (Sperandio et al., 2019). In the European Union using antibiotics to combat common bee diseases is prohibited due to potential health risks of allergic reactions posed by antibiotic presence in honey or any other food (Bilandžić et al., 2018). Therefore, beekeepers should employ other available measures and invest in their knowledge and skills to combat diseases and increase efficiency and production within their apiaries.

PERSPECTIVE

Adapting beekeepers as well as all other farmers to current conditions is essential for facing challenges. Effective decision-making and agricultural production are directly linked. Farmers associate effective decision-making with internal and external factors: internal factors represent agricultural practices and methods,

product marketing, economic reasons, behaviors, goals and sustainability, while external factors include weather conditions, diseases, prices, and government regulations and policies (Feketéné Ferenczi, Szűcs and Bauerné Gáthy, 2024).

To cope with existing challenges, beekeepers need to adopt many new practices and measures to maintain health and strength of bee colonies as well as their income levels. These measures include feeding bees sugar due to nectar shortages, adopting more effective techniques for preventing and treating diseases, intensive hive migrations and increased production within colonies—all requiring higher costs, of both materials and labor (Vercelli et al., 2021). Possible ways to cope with challenges also include increasing hive and bee colonies numbers, diversifying production through other bee products and integrating them into tourism services (Bekić and Jovanović 2015). According to Čop et al. (2022), beekeepers will increasingly turn towards other bee products like bees, queen bees and royal jelly production due to good market demand and prices making them attractive, while slowly turning honey into a byproduct. Bekić and Jovanović (2015) suggest developing api-tourism, producing royal jelly, bee venom, propolis and wax products, producing nectar-producing plants, and collecting pollen for diversification related to beekeeping products and services diversification. Although often cited as an example of diversification opportunity, the majority of beekeepers believe organic beekeeping is not promising due to high investment and production costs, according to Grgić et al. (2018). However, perceptions may change in future since consumers show increasing interest in high-quality and organic honey (Vercelli et al., 2021).

Puškadija (2016) emphasizes the fact of a continuity of climate change and changing weather conditions, describing through extensive historical data a *small ice age* lasting over 400 years from the mid-15th century until the late 19th century during which even freezing of the Adriatic Sea occurred. He concludes based on historical data that human impact on climate is minor since climatic extremes existed earlier, but beekeepers must adapt to the new conditions and provide bees with support for survival. He recommends timely queen bee replacement early feeding of bees, adjusting the technology and adjusting working with bees to the climate and grazing conditions, concluding that only those who adapt survive nature, and only those who learn survive beekeeping.

CONCLUSION

Global demand for honey is continuously increasing. Beekeeping has dual significance: economic and ecological. The economic importance of beekeeping is reflected in meeting market needs for honey and other bee products, as well as in the pollination of crops, which leads to higher yields. The ecological significance and role of beekeeping, as an ancient practice of maintaining bee colonies and producing honey and other bee products, are seen in the context of preserving biodiversity

among plant species. However, a review of the literature indicates that beekeeping worldwide faces numerous difficulties and challenges.

The European Union is the second-largest honey producer in the world, while China holds the title of the largest producer. Imported honey from Asian countries is one of the issues faced by beekeepers in the EU and Croatia. Asian honey is not produced according to European standards—specifically, it is not made in a completely natural manner. Instead, immature honey is industrially processed and dried, resulting in higher yields per hive, accelerated honey production, and the removal of that portion of production that typically occurs within the hive and the bee organism itself. This process also eliminates the health benefits that honey usually provides, which are a primary motivator for consumers to purchase honey. Furthermore, according to European standards, such honey is considered adulterated and causes market imbalances by representing unfair competition against naturally produced European and Croatian honey. The issue of Asian and Chinese honey has drawn the attention of European regulatory bodies.

In contrast to this market problem, other issues faced by beekeeping cannot be resolved through regulation and market oversight. Infectious diseases, viruses, parasites, reduced availability of nectar and pollen, pesticide use in fields, bee die-offs, milder winters, spring frosts, hail, etc., are examples of a whole range of challenges that beekeepers encounter in their daily work. All these challenges are linked to the climate change that we are witnessing. However, the impact of climate change is not uniform everywhere: research indicates that southern European countries are more affected than northern ones.

Continuous education and knowledge expansion, along with the adoption of new methods, will likely become the foundation of modern beekeeping. Beekeepers need to continuously adapt to existing circumstances and enhance their knowledge and skills. This will require an increase in the number of hives and bee colonies as well as diversification of the production portfolio by focusing on other bee products such as propolis, royal jelly, bee venom, beeswax, and pollen grains, along with integrating bee products into tourism offerings.

Based on empirical research conducted in Croatia (Tomljanović et al., 2020), it was found that all professional beekeepers included in the study inherited their activity—unlike semi-professional and hobby beekeepers, where this percentage is significantly lower at 42.86% and 58.33%, respectively. It can be assumed that individuals who start beekeeping professionally are those who have acquired their knowledge and skills from previous generations in a family environment where they had much more time to learn. Their predecessors also had much more inherent motivation to pass down knowledge, skills, and experiences accumulated over years and decades to their offspring. This assumption suggests a proposal for future empirical research. Additionally, among participants in this study, the lowest average age was found among professional beekeepers (39 years), while the average age for those whose beekeeping is a supplementary or hobby activity was

approximately 43.91 years and 47.16 years respectively. It would be interesting for future research to empirically determine whether these data indicate a trend—that is, whether older beekeepers tend to reduce their number of hives and working intensity as they transition from professional to semi-professional and ultimately hobby status.

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WHAT DO WINE TOURISTS WANT?

CHAPTER 22

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ABSTRACT

Wine tourism represents a fast-growing segment of the tourist market, at the center of which is the experience of wine tourists who travel for the purpose of experiencing wineries in well-known wine regions. Much empirical research in the field of wine tourism is focused on examining the attitudes of visitors to wineries and wine events. However, since such research may miss the possibility of examining the intentions and perceptions of future visitors, this chapter aims to identify the salient features of wineries and wine regions from the perspective of potential wine tourists, with the aim of understanding the features that could influence the decision to visit a winery or wine region. For this purpose, a survey focused on potential wine tourists in the Primorje-Gorski Kotar and Istria counties was conducted. A total of 108 valid responses were collected through the survey. Factor analysis identified the following four factors that represent different dimensions of the wine tourism experience: the ambiance, the cultural heritage of the destination, the winery experience, and the local wine and gastronomic offer of the destination. Moreover, the regression analysis found that the local gastronomic offer of the destination is a significant predictor of the winery experience. The results of the research imply that the motivation for choosing a wine region as a tourist destination, that is, the intention to visit a certain winery, is not only influenced by the desire to enjoy wine, but also by the features of the tourist offer and the region's natural and cultural heritage.

Keywords: *wine tourist, wine tourism, factor analysis, motivation, experience*

INTRODUCTION

In the last two decades, wine tourism has been the focus of research by scientists and practitioners in the wine industry and tourism. Namely, its significance stems from the multiplicative effects that wine tourism achieves at the macro and micro levels. At the global level, wine tourism is considered the main driver of the economic and social development of many rural areas (Trigo and Silva, 2022), where it affects the increase in employment and economic growth (Faria, Lourenço-Gomes, Gouveia and Rebelo, 2020). In addition, wine tourism provides a strong competitive advantage to countries with a developed wine industry in certain regions such as Piedmont (Italy), Mendoza (Argentina), La Rioja (Spain), Bordeaux (France), Napa Valley (USA) and Porto (Portugal) (Getz 2000). Finally, wine producers also use all the advantages of wine tourism with the aim of achieving strategic goals, continuous growth and development, and positioning on the map of tourist trips motivated by

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relaxation, gastronomy and culture (Santos, Ramos, Almeida and Santos-Pavón 2020). In this context, wine tasting and sales activities are most often carried out during visits to wineries, tours of vineyards and wine cellars, and the organization of wine festivals. These resources generate income not only for wine producers but also for other providers of complementary services, and the synergy of which creates the experience of visitors in wine tourism (Torres, Barrera, Kunc and Charters, 2021).

However, despite its popularity, wine tourism today faces numerous difficulties, related to the developments in the wine and tourism industry. Thus, for example, many winemakers in France and Australia, due to crises related to the pandemic, falling demand and increasingly strong competition, are faced with the destruction of vineyards or the write-off of surplus wine at extremely low prices, and through the national economies' attempt to save local wine producers (Forbes, 2023). In addition, the global wine market is experiencing a shrinking consumer base due to inflation and pessimistic expectations about future income (Mintel, 2024). Also, the so-called baby boomers – by far the most numerous segment of wine consumers, are getting older and consuming less wine than was usual (IWSR 2024). The above imposes the need for new considerations and innovations in marketing and management activities in the field of wine tourism. The challenges also relate to developments in the tourism industry, where tourists today are primarily looking for exceptional experiences that are in line with their interests and lifestyle (Oh, Fiore and Jeoung, 2007). The concept of experience in wine tourism means the experience that tourists have experienced in contact with several elements that make up the product of wine tourism, such as wines, wineries, wine roads, vineyards, festivals and the wine environment in a broader sense, i.e. the context within which consumption of wine tourism products takes place (Winescape). The experience of a wine tourist has a significant impact on subsequent attitudes about wine, wine consumption, and loyalty to a specific producer and region (Gómez-Carmona, Paramio, Cruces-Montes, Marín-Dueñas, Montero, and Romero-Moreno, 2023). Therefore, understanding the essential elements that influence the perceived quality of the experience and the intention of (re)visiting can help winemakers and tourism policy makers to identify their potential audience, that is, to correctly determine their market orientation.

In the scientific literature, wine tourism was mostly viewed from the perspective of the supply side, i.e. wineries and producers (Hall, Longo, Mitchell and Johnson 2000), while at the same time much empirical research was limited to examining visitors to wineries and wine events (Marzo-Navarro and Pedraja-Iglesias, 2009). Despite the progress made in the last decade in researching the profile of potential wine tourists (Alebaki, Menexes and Koutsouris, 2015), the reasons why people travel to a particular wine region, as well as the factors that influence their behaviour, have not yet been fully explained. Also, considering possible cultural variations, it is necessary to examine the motivation and preferences of wine tourists in different socio-economic settings (Fairbairn, Brand, Ferreira, Valentin and Bauer, 2024).

The purpose of this chapter is to identify the salient attributes of wineries and wine regions from the perspective of potential wine tourists, and to understand the

features that could influence the decision to visit a winery or wine region. The work is structured in such a way that, after the introductory considerations, a theoretical presentation of wine tourism and tourists, as well as experiences in wine tourism, follows. Following the chapters that elaborate the methodology and summarize the results of the research, the chapter concludes with recommendations and implications of the research.

LITERATURE REVIEW

Wine tourism

The significance of the wine tourism phenomenon stems from the synergistic action of tourism and the wine industry, and its success depends on the operationalization of the so-called 'wine tourism value chain', which consists of the following components: basic resources, viticulture, wine production – wineries and wine export on the one hand, and wine tourism on the other hand (Getz and Brown, 2006). For this reason, wine tourism is often considered part of agricultural, rural, cultural and industrial tourism (Duarte Alonso, Kok and O'Brien, 2020). Wine can also be seen as a cultural product that largely determines the development of tourism in certain regions. Namely, as suggested by Asero and Patti (2009), wine, like many autochthonous regional products, can be defined as a 'territorially intensive product' considering that it strongly reflects the identity of the territory where it was produced.

Wine tourism is commonly defined as " visitation to vineyards, wineries, wine festivals, and wine shows for which grape-wine tasting and/or experiencing the attributes of a grape-wine region are the prime motivating factors for visitors" (Hall and Mitchell, 2000: p. 447). It follows from the above definition that tourists are primarily motivated by their interest in wines and the desire to visit places that offer wine tasting and purchase. However, newer conceptions imply that wine tourism does not only include visiting wineries or vineyards. Moreover, the uniqueness of wine tourism today is manifested in the fact that visitors expect an authentic experience that creates emotions, arouses interest in learning about wine production and local cultural and historical heritage, and that involves different senses, before, during and after their stay in the destination/winery, that is, participation in the wine tourism event. Carlsen (2004: 5) states that "wine, food, tourism and the arts are collectively the core elements of the wine tourism product and provide the lifestyle package that wine tourists aspire to and seek to experience".

Charters and Ali-Knight (2002) cite the example of the Champagne region in France, which offers a rich 'package of benefits' consisting of cultural heritage, historical landmarks, restaurants, attractive landscapes, as well as a number of attractions related to the experience of wine tourism in the narrower sense - visiting wineries, wine museums and underground wine cellars. In other words, the satisfaction of tourists, that is, the experience of visitors in wine tourism is not only influenced by the wine tasting experience, but also by other factors such as features of the landscape, cultural and historical heritage and local attractions in the region.

Wine tourism experience

Customer experience implies internal and personal responses of consumers to any direct or indirect contacts with producers (Brakus, Schmitt and Zarantonello, 2009). The best-known conceptual framework for experience research was designed by Pine and Gilmore (1999), who suggest that the experience is a combination of four dimensions: educational ("learning something new"), aesthetic ("enjoying the scenery"), entertaining ("being entertained") and the escape dimension ("a break from everyday life"), which is called the 4E experience model. Effective experience management generates positive cognitive, affective, emotional, social and physical reactions of consumers.

The experience of visitors in wine tourism is a complex, multidimensional phenomenon made up of different components. Garibaldi and Sfodera (2020) summarize the components of the wine experience in three dimensions: *learning, hedonic experience* and *winescape*. Learning refers to the processes of wine production and marketing, the history of the winery and the region, and to tasting and getting to know the attributes of wine. The most common activity in which the education dimension of wine tourism is realized is a wine tasting, i.e. a visit to a winery where, in addition to tasting the wine itself, visitors also evaluate related elements such as the presence of local products accompanying the tasting, information provided, atmosphere, lighting, interaction with staff, equipment, landscaping, view and the like (McNamara and Cassidy, 2015). The hedonistic dimension includes elements of fun and pleasure, and Holbrook and Hirschman (1982: 92) describe it as "consumers' multisensory images, fantasies and emotional arousal in using products". In the context of wine tourism, the hedonistic experience (Bruwer and Rueger-Muck, 2019) can be realized at festivals, in wine shops and museums of wine and heritage, using wellness services, walks in the vineyards and the like. The winescape implies that wine tourism is not based only on tasting and buying wine, but is determined by the physical environment, landscape, cultural and historical sights, local gastronomy and the authenticity of the destination (Johnson and Bruwer, 2007).

Getz and Brown (2006) point out that the wine tourism experience includes three main features: wine-related features, destination features (such as attractive scenery and pleasant climate) and cultural activities (such as unique accommodation, fine dining and gourmet restaurants). Crespi-Vallbona and Mascarilla-Miró (2020) believe that basic ingredients of a memorable wine tourism experience refer to participation, hedonism, significance, knowledge, nostalgia, tasting, novelty and local culture.

Wine tourists

Although a lot of research has been conducted on the subject of wine tourism and wine tourists, to date there is no generally accepted definition of a wine tourist in the literature, but scientists describe wine tourists in different ways, depending on the intention, perspective and nature of the research. O'Neill and Palmer (2004: 270) define wine tourists as “any person, whether day-tripper or overnight visitor, who engages in the act of wine appreciation while visiting a wine-producing region”.

Wine tourists are initially profiled in the literature using different socio-demographic characteristics. The Australian Tourism Commission (1997) thus describes wine tourists as "highly educated people without children and with above-average incomes". Dodd and Bigotte (1997) suggest that it is income that is one of the best predictors of wine consumption and that wine tourists will not enjoy group trips, as well as "cheap package arrangements". Although in the United States wine tourists have long been viewed as "affluent, educated, white males" (Goodlad and Phillip, 2022: 199), today the numbers are increasingly turning in the direction of younger participants in wine tourism. Moreover, the Mintel study (2024) states that the so-called "millennials" (born between 1981 and 1996) are leading in the amount of wine drinking compared to all other age groups, i.e. they are taking over the largest group so far - the so-called "baby boomers" (born between 1946 and 1964). Byrd, Canziani, Hsieh, Debbage and Sonmez (2016) conclude that wine tourists have different demographic characteristics, but that they are connected by a high socioeconomic profile in terms of education, income and profession.

Given that there is disagreement about which socio-demographic characteristics are significant variables in defining the profile of wine tourists, variables such as interests, knowledge, involvement and lifestyle are used for the purposes of segmentation of wine tourists. From the perspective of the wineries themselves, wine tourists are often classified into the following segments: a) casual tourists who are only interested in tasting wine, b) sophisticated wine connoisseurs who are interested in getting as much information as possible, and c) visitors who do not have special knowledge, but are interested for learning and for the experience of visiting a winery (Charters and Ali-Knight, 2002). Reflecting this intuitive segmentation of the wineries themselves, Hall and Macionis (1998) divided wine tourists into three categories: 1) “wine lovers”, 2) “wine interested”, and 3) “curious tourist”.

Exploring the interests of wine tourists, Charters and Ali-Knight (2002) observe wine tourists through four categories: 1) “wine lover”, 2) “wine interested”, 3) “wine novice” or curious tourist, 4) “hanger on” or tourist who goes to a winery as part of a group. Wine lovers have a comprehensive education in the field of wine, and are motivated to buy wine, taste and learn about wines, or about pairing wine and food. Tourists who are interested in wine have wine tasting experience, but not extensive knowledge about wines. Wine novices enjoy wine tourism activities, but they are more interested in active participation, i.e. visiting wineries and vineyards, than tasting. Tourists who go to a winery as part of a group are usually not interested in wine and visit wineries as tourist attractions.

The concept of involvement is one of the most commonly used segmentation criteria (Sharp, Dawes, and Victory, 2024), which significantly contributes to understanding the behaviour and intentions of consumers (Souza Gonzaga, Capone, Bastian, and Jeffery, 2021), as well as wine tourists (Cohen and Ben-Nun, 2009). The concept of involvement is often described as the level of interest (Molina, Gómez, González-Díaz and Esteban, 2015), that is, as the integration of the consumer with the product (wine tourism) that allows consumers to " integrate self and object, thereby allowing themselves access to the object's symbolic properties" (Holt, 1995: 2). In other words, by means of involvement or the process of integration, consumers build their

own identity by using objects of consumption. In addition, involvement in wine products significantly affects the intention to participate in wine tourism (Wu and Liang, 2020).

It is also possible to classify wine tourists according to other criteria such as: level of wine knowledge (Alebaki, Menexes and Koutsouris, 2015; Ellis and Caruana, 2018), function of wine consumption (Kruger and Viljoen 2021), i.e. wine consumption preferences (Vretenar 2023). Although the preferences of wine consumers, as well as their knowledge about wines, determine the profile of wine tourists to a considerable extent, some authors believe that these factors do not necessarily explain the desire to travel, that is, the intention to participate in wine tourism activities, given that the motivation of wine tourists goes beyond wine consumption and that knowledge does not have to be an indicator of their behaviour (Charters and Ali-Knight, 2002).

In conclusion, it can be stated that two basic procedures for analysing wine tourists as a potential market segment are represented in the literature today: (a) classification of consumers with regard to the demographic factors of their origin, age, and education; and (b) consumer classification according to more complex, psychographic indicators such as interest, involvement, values and lifestyle (Marzo-Navarro and Pedraja-Iglesias, 2009; Molina et al., 2015). At the same time, it is considered that psychographic indicators will explain to a greater extent the behaviour of tourists, their potential consumption, tourist infrastructure and the contents they expect from the experience of visiting a winery.

METHODOLOGY

For the purpose of this research, the target population included people interested in wine. The survey was carried out from 1st until 15th July 2024, and the questionnaire was distributed in an online form. Winemakers in Primorsko Goranska County and Istarska County were asked to post this questionnaire on their social media sites and forward it to their contacts. Therefore, the sample included people interested in wine, not winery visitors. The questionnaire consists of four sections. To obtain the profile of potential wine tourists, the questionnaire contains questions related to participants' socio-demographic characteristics (age, gender, education level, income level and household characteristics), wine involvement (Atkin, Garcia, and Lockshin, 2005), and number of winery visitations. Additionally, 42 items measuring winery and wine region attributes (Cohen and Ben-Nun 2009; Getz and Brown 2006) were included in the last section. These attributes were used to identify important aspects of wineries and wine regions.

Wine involvement was measured as a self-assessment of own's interest in wine, namely responders were asked to select the option that best corresponds to their interest in wine (Interested in wine – low to moderate wine involvement level, wine is an important aspect of lifestyle – moderate to high wine involvement level, and drinking wine makes me happy – high wine involvement level). Responders were then asked to rate the importance of various winery and wine region attributes in relation to their intention to visit a winery or wine region (a five-point Likert scale

ranging from 1 (totally not agree) to 5 (totally agree) was used for measuring purposes). The data was processed using descriptive and multivariate statistics. Descriptive statistics was used to describe a general description of the sample. A principal components analysis was done to determine the factors underlying the attributes of the winery and wine region. Oblimin rotation was used since there was no theoretical assumption that the factors were unrelated (Field, 2005). an eigenvalue of 1.00 or more was used to identify potential factors. After the factor structure was determined, internal reliability was determined by computing Cronbach's alpha. Factors were calculated as a mean value for each respondent (DiStefano, Zhu and Mîndrilă, 2009).

To determine the influence of wine region attributes (ambiance, cultural heritage of the region and local wine and gastronomic offer of the destination) on winery attributes, a regression analysis was applied. The ordinary least square method was used to assess regression parameters. The regression model was then tested for multicollinearity, heteroscedasticity and specification issues – RESET test (Baum, 2006; Parlow, 2011; Ramsey, 1969; Torres-Reyna, 2009). Variance inflation factors were calculated to detect the severity of multicollinearity (Tabachnick and Fidell 2007), while Breusch–Paganov test was used to test for heteroskedasticity (Breusch and Pagan, 1979). Robust standard errors were used because the assumption of homoscedasticity was not met (Parlow, 2011).

RESULTS AND DISCUSSION

A total of 108 responses were collected. Socio-demographic characteristics and behaviour variables were presented in Table 1.

Variable	**Frequency**	**%**
Total	108	100.00
Gender		
female	76	70.4
male	32	29.6
Age (in years)		
18 - 24	1	0.9
25 - 34	12	11.1
35 - 44	50	46.3
45 - 54	34	31.5
55 - 64	8	7.4
65 and older	3	2.8
Education level		
Completed high school	9	8.3
Completed college or university	50	46.3
Completed postgraduate studies	49	45.4
Income level		
Below Croatian average income	9	8.3
Around Croatian average income	50	46.3
Above Croatian average income	49	45.4

Families with children (under 18 years of age)		
Yes	62	57.4
No	46	42.6
Number of winery visitations in the last two years		
Once or more	82	75.9
Less than once	26	24.1
Wine involvement		
„Interested in wine“	43	39.8
„wine is an important aspect of lifestyle“	16	14.8
„drinking wine makes me happy“	49	45.4

Table 1 Descriptive statistics
Source: Data processed by authors

There were more female responders (70.4%) than male responders (29.6%). Responders mostly had between 35 and 44 years of age (46.3%), followed by those responders who were between 45 and 54 years of age (31.5%), and between 25 and 34 years (11.1%), while there were the least responders aged 18 to 24 (0.9%). Over half of the responders (57.4%) had children younger than 18. The most dominant level of income was around Croatian average income (46.3%), followed by above-average income (45.4%), while only 8.3% of responders had below-average income. The percentage of responders with completed college or university level (46.3%) and completed postgraduate studies level (45.4%) was almost the same. Almost 76% of responders visited a winery in the last two years, compared to 24% who did not visit a winery in the last two years. Most of the responders (45.5%) showed a high wine involvement level (drinking wine makes me happy), followed by those who expressed a low to moderate wine involvement level (40%). The least number of responders chose moderate to high wine involvement level (wine is an important aspect of lifestyle; 14.5%)

The perceived importance of wineries and wine regions attributes were presented in Table 2; these attributes impacted how responders perceived quality and were crucial in forming future visitation intentions. Means and standard deviations were listed in the table, and attributes were ranked based on their respective means.

No.	Attribute	Mean	Standard deviation
1	Friendly and helpful staff	4.56	0.835
2	Wine tasting	4.51	0.859
3	Staff well acquainted with the wines	4.45	0.880
4	Winery and vineyard tour	4.34	0.856
5	An inspiring landscape	4.29	0.907
6	The atmosphere in the winery	4.23	0.923
7	Pleasant interior decoration of the winery	4.23	0.913
8	Suitable working hours	4.15	1.021
9	Convenient road access to the winery	3.99	1.037
10	Attractions in the region relevant to friends	3.97	1.080
11	Information about the wine production process	3.95	1.139
12	Intact environment	3.94	1.049

13	Restaurants in the region	3.94	1.007
14	Attractions in the region suitable for family	3.87	1.128
15	Information on pairing wine and food	3.81	1.051
16	Purchase of special wines in the region	3.81	1.201
17	Group and individual winery tours	3.81	1.219
18	Information about the history of the winery	3.74	1.088
19	Information about the region	3.72	1.058
20	Well marked roads	3.72	1.101
21	Quiet and serene region	3.72	1.058
22	A large number of wineries in the region	3.71	1.144
23	Well-known wine region	3.71	1.077
24	Shops and markets with local products	3.63	1.090
25	The high reputation of the winery	3.63	1.124
26	At least one well-known winery in the region	3.61	1.214
27	Easily accessible tourist information	3.57	1.137
28	Restaurant within the winery	3.56	1.088
29	A conversation with a winemaker	3.53	1.211
30	Open wine cellar days	3.44	1.233
31	Wine festivals in the region	3.30	1.270
32	Artistic performances and concerts	2.97	1.300
33	Participation in the production process	2.94	1.244
34	The region near the place of residence	2.88	1.243
35	Art shops in the region	2.83	1.279
36	The winery offers activities suitable for children	2.82	1.413
37	The region is popular among Croatian visitors	2.76	1.214
38	Wine museum in the region	2.76	1.183
39	Attractions suitable for children in the region	2.76	1.400
40	Archaeological sites in the region	2.71	1.388
41	Possibility of buying wine accessories/accessories in the region	2.69	1.195
42	Sports facilities in the region	2.42	1.305

Table 2 Perceived importance of wineries and wine regions attributes
Source: Data processed by authors

The most important attributes were "friendly and helpful staff" (4.56), "wine tasting" (4.51) and "staff well acquainted with the wines" (4.45), followed by "winery and vineyard tour" (4.34), "an inspiring landscape" (4.29) and "the atmosphere in the winery" (4.23). All six of the most important attributes relate to the features of the winery, with a particular emphasis on the helpfulness, friendliness and expertise of the staff. The least significant attributes were to "the winery offers various activities suitable for children" (2.82), "the region is popular among Croatian visitors" (2.76), "wine museum in the region" (2.76), "attractions suitable for children in the region" (2.76), "archaeological sites in the region" (2.71), "possibility of buying wine accessories/accessories in the region" (2.69), with the least significant attribute being "sports facilities in the region" (2.42). All these attributes were connected to the destination.

These findings are similar to those of Cohen and Ben-Nun (2009), who tried to predict essential attributes related to wine tourism in Israel. Their results also show

that winery attributes, namely wine tasting (4.26), information about the wine production process (4.22) and winery atmosphere (4.08) were the crucial ones. Similar to our findings, Cohen and Ben-Nun (2009) identified sports facilities in the region as the least important attribute.

To reduce the number of variables and to identify latent constructs related to winery and wine region attributes. a principle component analysis was conducted, with an eigenvalue of 1.00 or more criteria used to identify four factors (Table 3).

Variables	**1**	**2**	**3**	**4**
The winery is located in a pristine/unpolluted environment	.893			
The landscape surrounding the winery is inspiring	.826			
The interior of the winery is pleasant	.655			
There are interesting archaeological sites in the region		.912		
The region offers a wide variety of artistic performances and/or concerts		.870		
There are shops in the region that offer special arts or crafts		.807		
Possibility to visit the winery and the wine cellar			.944	
Possibility to learn interesting information about the wine production process			.823	
Unique atmosphere in the winery			.694	
A region known for wine growing and winemaking				-.844
Existence of shops/markets in the region that offer local agricultural products				-.815
Existence of restaurants in the region with a unique menu				-.815
Eigenvalues	5.347	1.661	1.297	1.018
% variance	44.560	13.842	10.810	8.486
% cumulative variance	44.560	58.401	69.211	77.697
Cronbach's α	.834	.871	.811	.820

Table 3 Factor analysis of wine tourism attributes
Source: Data processed by authors

Items with loading below .5, those items not loading on any particular factor, and cross-loadings were deleted resulting in the retention of 12 items. The identified factors were labelled as *1) Ambiance, 2) Cultural heritage of the destination, 3) Winery attributes, and 4) Local wine and gastronomic offer of the destination*. Cronbach's alpha coefficients were between .811 and .871, while all four factors accounted for 77.697% of the accumulated variance. The Kaiser-Meyer-Olkin measure, used to determine how suited data was for factor analysis, was 0.839, suggesting that applying factor analysis was suitable (Field 2005).

The results of the factor analysis partially confirm the structure. i.e. the wine tourism dimensions determined through previous research on the potential wine tourists' behaviour. Namely, Getz and Brown (2006) were the first to provide a theoretical framework and examine the relative importance of different regional attributes in influencing the potential wine tourists' behaviour i.e. their decision to choose a

travel destination. In the aforementioned work, three key components of wine tourism were determined using exploratory factor analysis (characteristics related to wine, attractiveness of the destination and cultural products), and the same methodology was used in subsequent works by other researchers to test the multidimensionality of the potential wine tourists' motivation from an experiential point of view (Table 4).

Author	Setting	Method	Motivation factors
Sparks (2007)	Australia	Principal Axis Factoring	Destination experience, personal development, wine/winery experience
Cohen and Ben-Nun (2009)	Israel	Principal Axis Factoring	Atmosphere in the winery, cultural activities, family facilities
Clemente-Ricolfe, Escribá-Pérez, Rodriguez-Barrio and Buitrago-Vera (2012)	Spain	Principal Component Analysis	Interest in wine, leisure and cultural heritage
Marzo-Navarro and Pedraja-Iglesias (2012)	Spain	Principal Axis Factoring	Winery services, additional activities, destination attraction, tourism development, cultural product
Alebaki, Menexes and Koutsouris (2015)	Greece	Principal Component Analysis	Educational experience, socialization, destination attractiveness, wine product. vineyard aesthetics, reputation and novelty

Table 4 Dimensions of Wine Tourism as Motivational Factors of Potential Wine Tourists
Source: Data processed by authors

Variable	Original model			Corrected model		
	β	Standard error	Significance level	β	Standard error	Significance level
Constant	1.773	0.359	0.000	1.773	0.427	0.000
Ambiance	0.223	0.098	0.025	0.223	0.119	0.062
Cultural heritage of the destination	0.138	0.063	0.126	0.138	0.068	0.156
Local wine and gastronomic offer of the destination	0.346	0.090	0.001	0.346	0.103	0.003
F test	**17.334**		0.000	**15.221**		0.000
RESET test	**2.46**		0.067			
Breusch–Pagan test	**10.54**		0.001			
R^2	**0.333**					

Table 5 Regression analysis results
Source: Data processed by authors

A regression analysis was done to test the influence of the ambiance, cultural heritage of the destination and local wine and gastronomic offer of the destination on winery attributes (Table 5). Through regression analysis two independent variables were significant, namely ambiance and local destination gastronomy, in predicting winery attributes. The first variable was significant at $\alpha = 0.05$, while the second variable was significant at $\alpha = 0.01$. Both composite variables had positive signs, suggesting that the increase in their value resulted in an increase in the value of the dependent variable. The model explained 33.3% of the variance. F test was significant, suggesting that all three independent composite variables were significant in predicting winery attributes.

The Breusch–Pagan test was significant, so the model was corrected using robust standard errors. Through the corrective assessment of the model, the t value of both significant composite variables was reduced, namely the ambiance variable was no longer significant at $\alpha = 0.05$. The Ramsey RESET test did not detect specification issues, i.e. the model was not misspecified.

CONCLUSION

The behaviour and motivation of tourists are continuously changing. Today's wine tourism visitors travel often. looking for new and authentic experiences and exceptional content and activities. Creating an experience that would meet and exceed the expectations of wine tourists requires a good knowledge of current trends. that is. the needs and wishes of wine tourists. The content and theme of the work are based on the principles of behavioural economics. in which consumer behaviour is observed with the aim of achieving their satisfaction. i.e. improving existing and developing new products. The analysis of the intrinsic components of tourism products that satisfy wine tourists is crucial for the development of wine regions and the adaptation of tourism projects to the interests of wine lovers. Additionally. by examining the behaviour and perception of "non-visitors". different segments of the population can be covered. such as wine lovers of the younger generation who do not necessarily visit wineries. but could be the next generation of wine tourists. In addition. it is possible for "non-visitors" (or those who have never visited a winery) to become wine tourists. who have different viewpoints than those considered traditional wine tourists today.

In the chapter a survey was conducted aimed at wine lovers. The socio-demographic and behavioural characteristis of the respondents are in accordance with the profile of wine tourists who are described in the scientific literature as persons of "high socioeconomic level in terms of education. income and profession". Namely. the survey is dominated by respondents who have incomes at or above the average in the Republic of Croatia. and respondents who have completed higher school/faculty. i.e. completed post-graduate studies. The majority of respondents belong to the group of high involvement in the context of wine and have visited the winery at least once in the past two years.

Based on the results of the descriptive analysis. the most important features of wine tourism according to the respondents' perceptions were highlighted. On a scale of 42 characteristics of wineries/wine regions. respondents gave the highest marks to the items related to the characteristics of the winery. with an emphasis on wine tasting and the service friendliness and expertise of the staff. Factor analysis identified the following four factors that explain 77.7% of the total variance and can be considered key determinants of wine tourism: the ambiance inside and outside the winery. the cultural heritage of the destination. the winery experience. and the destination's local wine and gastronomic offer. It was also determined by regression analysis that the experience itself. that is. the experience of visiting a winery. is strongly influenced by the destination's local wine and gastronomic offer. which emphasizes the importance of a good presentation of such an offer to tourists.

When considering this research. it is necessary to single out several limitations that can be classified into two areas: empirical research process and data processing and analysis. The research was conducted on a smaller sample of wine lovers. so the results cannot be applied to the segment of wine visitors in the Republic of Croatia. Future research could include visitors to wineries and fairs. domestic and foreign tourists. students. and the like. Likewise. the research was conducted with the aim of testing the dimensionality of the characteristics of wineries and wine tourism. and variables related to social networks were not included. although the research was conducted on social networks. Future research could look at the role of social networks in the formation of consumers' experiences of wineries and wine regions. Also. future research could go in the direction of improving the characteristics of wineries and wine regions in terms of identifying additional characteristics.

The research was focused on respondents from Primorje-Gorski Kotar and Istria counties. as tourist destinations in the Republic of Croatia where wine and gastro tourism are gaining significant momentum. The contribution of the work consists in finding out the essential components of wine tourism. which to the greatest extent determine the motivation of potential tourists for choosing a wine region as a tourist destination. that is. on the intention of visiting a certain winery. Understanding the perceptions and intentions of potential wine tourists could help wineries. regional tourism policy makers and all other stakeholders in designing successful marketing and management strategies in the domain of wine tourism.

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WINE BOTTLE LABEL DESIGN OF THE CROATIAN AUTOCHTHONOUS GRAPE VARIETY ŽLAHTINA: A TEXT-LINGUISTIC ANALYSIS

CHAPTER 23.

Daniela Ježić *

ABSTRACT

Although Croatia is a relatively small country in the Mediterranean, its location provides a fertile climate for the cultivation of many different grape varieties. Viticulture and a rich winemaking tradition of over 2,500 years have resulted in a list of 258 grape varieties that can be grown today on the territory of the Republic of Croatia. Among them, the autochthonous Croatian wine variety žlahtina was chosen for the analysis of the wine bottle label design. The chapter explores the visual codes on the wine bottles of different producers of žlahtina, that is, the front and back labels. Since the wine bottle label can be defined as a specific text genre, a text-linguistic analysis of the selected labels was carried out. Žlahtina wine bottle labels were analysed on three different levels: the communication-pragmatic, thematic and linguistic-stylistic level. The focus of the analysis is on the macro level, as it includes the analysis of the visual element that attracts the consumer's attention. The obtained results provide data on the characteristics of the text genre *wine bottle label* at the linguistic and the semiotic level.

Keywords: *text linguistics, text genre, žlahtina, label design, wine*

INTRODUCTION

Although interest in wine for foodstuff and medicinal purposes goes back almost as far as the history of mankind, the scientific approach to wine is somewhat more recent. According to Jardas Antonić et al. (2023), the first scientific works on the subject of wine appear in the 18th century, while the concept *wine industry* only emerged at the beginning of the 20th century, and the real momentum only began in the 1950s with the development of agriculture (Grahovac, 2011). It should be noted that, as expected, the most represented fields of research are agriculture, food science, chemistry, biotechnology, ecology, economics and management and social sciences, while the humanities, including linguistics, are not engaged in wine to the same extent (Jardas Antonić et al., 2023). With the aim of contributing to scientific research on wine in the field of linguistics, this chapter deals with the text-linguistic aspect of the wine bottle label design.

From a text-linguistic perspective, a wine label is regarded as a text genre and can

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Note: This chapter falls within the scope of the humanities, the field of philology, and has been reviewed accordingly.

therefore be analyzed according to the principles of text linguistics. However, previous research related to wine labels is mainly marketing- and business-oriented and investigates the relationship between label design and price (Bonafede 2010; Mueller et al., 2010), consumer preferences (Choi and Joo, 2021; Chamorro et al., 2020; de Mello and Pires, 2009) or to observe eye movements during the perception of wine label elements (Barbierato et al., 2023; Laeng et al., 2016). Regardless of the content of the packaging and the quality of the wine, the first impression is always linked to the visual element and influences consumers' attention (Orlowski et al., 2022).

Given the fact that viticulture and winemaking tradition have been present in Croatia for more than 2,500 years, the fertile climate in this area has enabled the cultivation of many different grape varieties due to its geographical location (Katunar, 2019; Jardas Antonić et al., 2023). The result of these conditions is a list of 258 grape varieties that can be cultivated on the territory of the Republic of Croatia today (Official Gazette 25/2020). The Croatian autochthonous grape variety žlahtina was selected from this list for the corpus of the research, and the front and back labels of žlahtina wine bottles were analyzed. The aim of the chapter is to prove the importance of the label as a text genre and to examine and describe the visual codes and elements that appear on both the front and back labels of the žlahtina bottle.

TEXT LINGUISTICS

Text linguistics starts from the definition that the basic element of communication is the text, but it is not only about the form of sentences linked together. The focus is on the communicative competence of both the sender and the recipient of the message, and its aim is to establish a functional communication link (Brinker et al., 2014: 15–16; Adamzik, 2016: 6; Heinemann and Viehweger, 1991: 126). Thus, the most important aspect of the text is its function, i.e. its purpose in communication, and the social context, general knowledge, and the cultural background knowledge of the sender and recipient certainly contribute to a better understanding and interpretation of the text. Based on the above findings, specific, i.e. “non-traditional” texts can be understood as a specific text genre (Ivanetić, 2003).

According to Beaugrande and Dressler (2010), for a text to be a text, it should also fulfill seven standards of textuality, otherwise the text is not communicative. The standards are cohesion, coherence, intentionality, acceptability, informativity, situationality and intertextuality. Averintseva-Klisch (2013: 4) states that cohesion is "the connection of the components of the surface structure of the text with grammatical and lexical means", while coherence refers to the deep structure of the text and gains meaning in the world knowledge of the sender, i.e. in his general knowledge. Intentionality is the sender's intention to create a cohesive and coherent text, while acceptability refers to the recipient. Informativity refers to the amount of new knowledge in the text, while situationality and intertextuality refer to extra-linguistic elements that contribute to a better understanding of the message, namely its relevance to the communication and its relation to other similar texts (Adamzik, 2016; Beaugrande and Dressler, 2010; Jurin, 2010; Ježić, 2024).

Text genres are global forms of text organization (Ivanetić, 2003: 2), and they serve to facilitate communication within the language community, i.e. to provide information about common thematic, illocutionary and stylistic means (Ivanetić, 2003; Fix 2008; Brinker et al., 2014). The general knowledge of the communication participants and the socio-cultural elements to which the speakers of such a language community adhere have a great influence on the understanding and perception of text genres (Fix, 2008). Based on the above, the starting point for determining the text genre *label* in this analysis is the function that the text has, which according to Brinker et al. (2014: 97) focuses on the communicative intention of the sender that is expressed in a particular text by means that are conventional in the language community, and the recipient of the message recognizes the same intention and understands what is conveyed by the text. There are five basic functional text types, namely assertives, directives, commissives, expressives and declaratives (Brinker et al., 2014; Ivanetić 2003). Assertives state how things are, i.e. facts about extra-linguistic reality are presented (Jurin, 2013: 166), and can be divided into the informative, explicative, animative and orientative subtype. Directives cause the recipients of the message to act or they influence their attitude, commissives oblige the sender to act or refrain from acting, expressives express an attitude towards a person, and declaratives serve to influence changes in the extra-linguistic reality.

The methodology of the corpus description is based on the findings of Brinker et al. (2014), Ivanetić (2003) and Jurin (2010) as well as on the adapted Model of the analysis of text genres in pre-election campaigns (Ježić, 2024: 60). The description is based on three text levels: communication-pragmatic, thematic and linguistic-stylistic. The first level refers to the function of the text in the communication process and on a macro level to the appearance of the text itself, i.e. the graphic presentation, the use of photos, icons, font or color. These elements of the analysis are actually those that attract the attention and interest of the recipient of the message (cf. Burger 2005: 209). The thematic level refers to the core, i.e. the content of the text, and on the linguistic-stylistic level, the syntax, lexis and style are analyzed.

ŽLAHTINA GRAPE VARIETY

Žlahtina is currently one of the most awarded and appreciated Croatian grape varieties on the market (Maletić et al., 2015: 93). Its name derives from the word žlahta or šljahta, i.e. nobility, and comes from the Polish language, where it denotes the lower and middle Polish nobility that held self-government in Poland from the 15th to the 18th century (Hrvatski jezični portal, 2024), and it can be concluded that žlahtina is considered a noble grape variety.

It is a unique white grape variety that is autochthonous to the Republic of Croatia (Romić et al., 2008; Maletić et al., 2015; Ivandija, 2008). According to the Rulebook on the National List of Recognized Cultivars, i.e. grape varieties intended for the production of wine and other grape and wine products (Official Gazette 25/2020), the žlahtina grape variety is on the list of Cultivars approved for the cultivation of vines in the Republic of Croatia, and according to the same Rulebook, žlahtina is

recommended for cultivation in subregions 8 and 9, i.e. Hrvatska Istra and Kvarner and Hrvatsko primorje. Žlahtina is mainly cultivated in the Kvarner area on about 150 hectares of vineyards, which is 75% of all vineyards in this area (Stipanović et al., 2022). It is most widespread on the island of Krk, where it was introduced in the 80s of the 19th century (Ivandija, 2008), more precisely in Vrbničko polje, an elongated depression near the town of Vrbnik, where it has been cultivated since the period between the two world wars (Krk Island Tourist Board 2023). The field is suitable for growing žlahtina because most of the land is arable with fertile soil and is rich in water (Romić et al., 2008).

The most famous wine of the žlahtina grape variety is produced in this area, namely the Vrbnička žlahtina (Žlahtina – plemenita sorta bijelog grožđa, Croatia.hr 2024). According to EU Regulation 1308/2013, "wine" is the product obtained exclusively from the total or partial alcoholic fermentation of fresh grapes, whether or not crushed, or of grape must. If, like žlahtina, it bears a protected designation of origin, it may have an actual alcoholic strength of not less than 4.5% vol. Žlahtina is considered a high-yielding variety, it has firm stems and long, large bunches, and the berries are evenly developed, with rich flesh and firmer skin. The wine produced from žlahtina is clear and dry and its color is straw yellow to golden yellow. The taste is harmonious and light, and fruity aromas and flavors stand out (Ivandija, 2008: 123; Žlahtina – plemenita sorta bijelog grožđa, Croatia.hr 2024).

Since the production of žlahtina takes place exclusively in the geographical area of Hrvatsko primorje and that at least 85% of the grapes for wine production come exclusively from this geographical area and their quality and characteristics have been created mainly or exclusively under the influence of specific natural and human factors of the geographical environment (Official Gazette 141/2010), the žlahtina of all the producers mentioned in this research bears the PGI mark, i.e. the mark of Protected Geographical Indication. Furthermore, žlahtina also bears the Protected Designation of Origin (PDO) for wine at European Union level (Official Gazette 32/2019) and, according to the product specification under EU Regulation 1308/2013, the žlahtina grape variety may be grown in the protected areas called Primorska Hrvatska and Hrvatsko Primorje. A region or locality meeting the requirements of Art. 93. that the quality or characteristics of the product are the result of the influence of specific natural and human factors in that area, that the grapes come exclusively from that area, that the production takes place in that area and that the product is made from grape varieties of the *Vitis vinifera*. The žlahtina variety is the most commonly cultivated variety in the PGI "Hrvatsko primorje", while in the PGI Primorska Hrvatska, žlahtina is the most commonly cultivated white variety in the central part of this area (EU 1308/2013). The protected seal of origin also guarantees that it is a quality wine (EU 1308/2013).

According to the official website of the Krk Island Tourist Board (2023), the producers of Vrbnička žlahtina are the following wineries and cooperatives: Frajona (Figure 1, bottle 1), Katunar Estate Winery (Figure 1, bottle 2), Kuća vina Ivan Katunar (Figure 1, bottle 3), Poljoprivredna zadruga Gospoja (Figure 1, bottle 4), Poljoprivredna zadruga Vrbnik (Figure 1, bottle 5), Vinarija Nada (Figure 1, bottle 6) and Vinarija Šipun (Figure 1, bottle 7), while OPG Tohoraj's žlahtina is missing from the list (Figure 1, bottle 9). Certainly worth mentioning is the žlahtina from Vinska

kuća Pavlomir (Figure 1, bottle 8), which does not come from the island of Krk, but from the Vinodol valley, where žlahtina has been cultivated and produced since 1994 (Pavlomir, 2017). Considering the fact that it is the most represented autochthonous Croatian wine variety bearing the protected designation of origin "Hrvatsko primorje", the labels of žlahtina wine bottles were used as the research and analysis corpus for this chapter.

Figure 1. Bottles of žlahtina
Source: created by the author, photos taken from the manufacturers'/distributors' websites

THE IMPORTANCE OF THE WINE LABEL AS A TEXT GENRE

According to the definition, a label is a "sticker (inscription, slip of paper) on which the type, quantity, price, origin of a good, content or destination of a shipment, etc. is noted" (Enciklopedija.hr 2024). The given definition refers to any type of goods, i.e. products labelled with some additional information, which leads to the conclusion that it is a more or less arbitrary selection of the content available on the label. However, when it comes to foodstuff, "a label is any tag, brand, mark, pictorial or other descriptive matter, written, printed, stenciled, marked, embossed or impressed on, or attached to the packaging or container of food (EU Regulation 1169/2011). According to the same Regulation, foodstuff information is mandatory and its presentation is regulated by Art. 13. Wine, i.e. the labelling of wine with a wine label, is also subject to the above-mentioned regulation, and the wine label thus constitutes a kind of identity card for each wine and must contain all information required by law.

However, the question arises as to whether a wine label can be considered a text at all and therefore as a text genre. As already mentioned, for something to be considered a text, it must fulfill seven standards of textuality (Beaugrande and Dressler 2010). A wine label is certainly a limited sequence of characters that is cohesive and coherent, and the sender's intention to create such a text is also present, and the recipient must accept it as such. Furthermore, the relevance of the information on the wine label and the relationship of the wine label to other types of labels are also required. Although it is a "non-traditional" form of text, it is a text

nonetheless. As Graddol states (cf. Özturk and Ertamay, 2019), the wine label is actually a multimodal text that contains verbal elements as well as complex codes and symbols, such as a barcode with numbers, the serial number of the bottle, embossed protrusions on the label, etc.

Considering the function that the wine label has, namely to attract the consumers' attention and provide information about the content of the bottle itself, i.e. about the wine, including the overall knowledge and understanding of the world of both the producer and the consumer, it can be stated that the wine label is a specific text genre.

Legal framework for wine labeling

According to Art. 9 of the EU Regulation 1169/2011, the horizontal labeling rules include the following mandatory particulars: name of the food, the list and quantity of ingredients, any ingredient causing allergies or intolerances, the date of minimum durability or the 'use by' date, any special storage conditions and/or conditions of use, the name or business name and address of the food business operator, the country of origin or place of provenance, the instructions for use where it would be difficult to make appropriate use of the food in the absence of such instructions, with respect to beverages containing more than 1,2% by volume of alcohol, the actual alcoholic strength by volume and a nutrition declaration. The data shall be indicated in words and numbers, and may also be indicated by pictograms or symbols.

Mandatory food information must be marked in a conspicuous place in such a way as to be easily visible and clearly legible, in characters using a font size where the x-height is equal to or greater than 1.2 mm, as defined in Annex IV of the aforementioned Regulation, and in the case of packaging with a surface area of less than 80 cm^2, the x-height of the font size must be equal to or greater than 0.9 mm. Furthermore, it is stipulated that the mandatory information on food must be written in a language easily understood by consumers in the Member State where the food is placed on the market and that the name, quantity and actual alcoholic strength by volume must be in the same field of vision (EU Regulation 1169/2011). It is also possible to deviate from the mandatory information on the label, and, in the case of žlahtina, it states, among other things, that the list of ingredients and the nutrition declaration on the label are not mandatory for drinks with an alcohol content of more than 1.2% vol.

Furthermore, according to the specific provisions for the wine labeling (EU Regulation 1308/2013; Official Gazette 26/2013), the compulsory particulars for the labeling and presentation of wine, relevant to žlahtina, include the following:
(a) the designation for the category of the grapevine product;
(b) the indication "protected designation of origin" or "protected geographical indication" and the name of the protected designation of origin or protected geographical indication;
(c) the actual alcoholic strength by volume;
(d) an indication of provenance;
(e) an indication of the bottler or the name of the producer or vendor;
(f) batch or lot indication.

According to the same Regulation, optional information that can be contained on the label of a žlahtina wine bottle are:
(a) the harvest year;
(b) the name of the wine grape variety;
(c) traditional terms in accordance with point (b) of Article 112;
(d) the Union symbol indicating the protected designation of origin or the protected geographical indication;
(e) expressions referring to specific production methods;
(f) the name of another geographical unit smaller or larger than the area on which the designation of origin or indication of geographical origin is based.

Wine bottle labels

The packaging or external appearance of the product is the first step in the communication between the producer and the consumer and significantly influences the consumer's intention to buy a particular product (Özturk and Ertamay, 2019). As stated by Leskinen (2022), the appearance of the product is an element that significantly influences the consumers' purchasing decisions, including the shape, color and materials of the product. When buying wine, the most striking elements of the wine bottle design are the type of closure, the color of the glass, the label, but visual elements such as the colors used, images (or pictograms), the font and even the volume of the bottle or the location of the producer's logo are also mentioned. Consumers' purchasing decisions are influenced by the information on the label itself, and authenticity and traditional signs such as grapes or castles also strongly influence consumers, even more than, for example, the grape variety or the origin of the wine itself (Özturk and Ertamay, 2019). Furthermore, the same authors state that the label design is an important factor in consumers' choice of wine and that the label is an indicator of the quality of the wine in the bottle. In addition, the colors used on the label influence consumers' expectations regarding the taste of the wine, which ultimately affects the purchase of the wine. Since consumers usually cannot taste wine before buying it, it is precisely the appearance of the bottle and label that initially attracts a potential buyer (Özturk and Ertamay, 2019).

In order for wine producers to place their products on the market, they must comply not only with the rules and regulations of their country, but also those of the European Union. As mentioned in the previous section, the labeling of wine is quite strictly regulated and there is information that must be provided on each label, including those on the wine bottles. However, the appearance and arrangement of all this information on the label itself is not prescribed. What is noticeable about wine bottles is that they usually have two labels – a front and a back label, or in a few cases, one label that surrounds the entire bottle. However, due to the shape of the bottle itself, it is clear that both sides of the bottle, and therefore the label, cannot be in the same field of vision at the same time, and as mentioned before, there is information that legally must appear in the same field of vision. In order to comply with all legal requirements, but also to place their products on the market as successfully as possible, producers use various marketing and design strategies to attract the attention of consumers (Barbierato et al., 2023; Burger, 2005) and persuade them to buy their wine. Therefore, the main focus of producers is on the front label, which contains various visual elements as well as pictorial and verbal

signs that convey different messages (Sušac, 2022). In this chapter, both the front and back labels of žlahtina wine bottles are analyzed on the linguistic and semiotic level in order to identify the žlahtina producers' intention and idea that is conveyed by a particular wine label.

ANALYSIS OF THE TEXT *GENRE WINE LABEL*

As already mentioned, nine producers of žlahtina, i.e. nine labels of their wine bottles, were used as the corpus for the study, as shown in Figure 1. Both the back and the front labels were analyzed to determine whether there are common elements, especially on the front labels, among the žlahtina producers.

Back label

The starting point of the analysis is the back label, as it contains slightly more uniform elements in terms of the content. All analyzed labels contain all the legally required information in the same field of vision, but these elements are arranged and listed differently on the label. Since most of the information is the same but arranged differently, only some of the back labels are shown in Figure 2, which can be considered as prototypical examples for the description. On the communication-pragmatic level, it can be established that the intention of all senders, i.e. producers, is to convey information about their product, which indicates that the basic and therefore dominant communication function of all back labels is the informative one. Therefore, in terms of functional text types, the back wine label can be categorized as an assertive, subtype informative, because they express how things are, or more specifically, its basic function is to inform the recipient. However, the appearance of the back label and the arrangement of the mandatory and optional elements on the label are different. The most noticeable differences lie in the shape and color of the label. The labels of Vinarija Šipun, Katunar Estate Vinery, Gospoja and Tohoraj stand out due to its shape: these are actually one-piece labels and are a continuation of the front label. They are glued around the entire bottle and the ends of the label "join" on the back of the bottle. The difference lies in the direction in which the text is printed: on the labels of Vinarija Šipun, Gospoja and Tohoraj the text is horizontal, and that of the Katunar Estate Vinery (Figure 2, label 1) is vertical, so that the consumer has to turn the bottle to read the content of the back label. In addition to the shape, the color of the label itself, which is either white or black, is also striking. Frajona (Figure 2, label 4), Katunar Estate Vinery (Figure 2, label 1), Kuća vina Ivan Katunar (Figure 2, label 2), Vinarija Nada, Vinarija Šipun and Vinska kuća Pavlomir have a white label with dark lettering, while Gospoja (Figure 2, label 3), PZ Vrbnik and Tohoraj have black labels with white lettering.

Figure 2 Back labels of some žlahtina producers
Source: created by the author, photos taken from the manufacturers'/distributors' websites

On the thematic level, all the examples analyzed show the same thing - information about žlahtina is presented. As mentioned above, EU Regulations 1169/2011 and 1308/2013 require information to be provided on the label, in the same field of vision. These are:

(I) the name and designation of the category of the wine product - all producers indicate the name of the variety – žlahtina – and describe below what type of wine it is, e.g. "Kvalitetno suho bijelo vino kzp", "Kvalitetno vino KZP ", "KVALITETNO SUHO BIJELO VINO S KZP", "KVALITETNO BIJELO SUHO VINO S KZP" or "Kvalitetno suho vino KZP"[26].
(II) Net quantity and actual alcoholic strength by volume - there are examples of the net quantity "0.75 l", "0.75 L" and "1 l". The actual alcoholic strength is between 11 and 12% vol. and is indicated in the same way by all producers.
(III) Indication and name of the protected designation of origin and the geographical indication - some producers explicitly state the words "protected designation of origin", others use the Croatian abbreviation "ZOI", and you can even find an example with no indication of the protected designation of origin, and only the designation of protected geographical indication is given: "ZOI Hrvatsko primorje. Proizvedeno u Hrvatskoj", "ZOI Hrvatsko primorje", "Hrvatsko primorje. Zaštićena oznaka izvornosti. Vino iz Hrvatske", "Primorska Hrvatska - Vrbnik. Vino iz Hrvatske", "Hrvatsko primorje. Vino iz Hrvatske. Vinogorje Krk" or "ZOI Hrvatsko primorje / Vinogorje Krk / Otok Krk / Hrvatska"[27]. By not explicitly emphasizing the protected mark of authenticity, the impression of autochthonousness, authenticity, guarantee of quality, and, logically, originality is certainly diminished among potential consumers, which may also affect the sale of a certain producer product.
(IV) Label of the producer/bottler - all labels show the name of the company or trade that produces and bottles the wine. They also all give the address (street and house number and town), and on some labels the postal code and the country and even the continent can be found. The most commonly used form of indication is: "Proizvodi i puni:", although there is also the example: "Proizvođač i punitelj"[28].
(V) Serial number of production - it is a combination of numbers and letters to identify the product, for example: "L 73024", "LOT: L00824", "LOT: 1201802", " Lot: L6-22", "LOT Ž072018", "LŽ0819" and similar.
(VI) Ingredients that cause allergies or intolerances - in the case of žlahtina it is sulfites, and all analyzed labels have the same element, namely: "sadrži sulfite"[29].
Optional elements on the label include the year of harvest: "Berba 2023"[30] or "Žlahtina 2018.", then the serving temperature: "10 - 12 ^{0} C" or the energy value: "Energetska vrijednost na 100 ml: 259 kJ/62 kcal"[31].

As far as the language is concerned, the information must be written in the language of the Member State in which the product is placed on the market in accordance with EU Regulation 1169/2011, so in the case of žlahtina it is Croatian. However, on some back labels there are examples of the use of English, although this is not a mandatory

[26] Quality dry white wine pgi, Quality wine PGI, QUALITY DRY WHITE WINE FROM PGI, QUALITY WHITE DRY WINE FROM PGI, Quality dry wine PGI.
[27] PGI Hrvatsko primorje. Made in Croatia, PGI Hrvatsko primorje, Hrvatsko primorje. Protected mark of authenticity. Wine from Croatia, Primorska Hrvatska - Vrbnik. Wine from Croatia, Hrvatsko primorje. Wine from Croatia. Vineyard Krk, "PGI Hrvatsko primorje / Vineyard Krk / Island of Krk / Croatia.
[28] Produced and bottled by:, Producer and bottler.
[29] Contains sulphites.
[30] Harvest 2023.
[31] Energy value per 100 ml: 259 kJ/62 kcal.

element. There are examples such as:
(I) *Croatian island product*
(II) *System certification SGS*, a mark that only one of the wines analyzed has (Figure 2, label 3)
(III) the abbreviation *Alc.* instead of the Croatian alk. for the indication of the actual alcoholic strength
(IV) when indicating the producer and the bottler, the name of the producer, street, postal code and town are written in Croatian, and the following is written in English: *Croatia, Europe*.
In addition, one of the producers also offers a bilingual version of certain elements of the back label, namely:
(I) temperatura posluživanja/ *Serving temperature* and
(II) sadrži sulfite / *Contain*[32] *sulfites.*
Another interesting example is the Gospoja label (Figure 2, label 3), which, when stating the mandatory element of the product name, writes the name "žlahtina" in Glagolitic script and in gold letters in the very first line of the back label. Such a choice certainly contributes to the image of the producer as an original producer from the island of Krk, where the Glagolitic script originates from, which gives the consumer an impression of the authenticity, originality and tradition of the wine in the bottle.

The use of different fonts, i.e. the size of the letters on the back label, is also noticeable. A minimum font size of 1.2 mm is prescribed for certain elements, which has been discussed previously. However, it is interesting to note that for some producers the same element is written in capital letters, while for others it is written in lowercase, perhaps indicating that the producer wants to emphasize such an element more than other elements on the label because they consider it to be more important for consumers. Furthermore, two back labels are written entirely in uppercase and the only difference is the size of the letters, suggesting that it is the most important information for the producer that is emphasized in this way.

In addition, most manufacturers prefer the label in bullet point form, i.e. they do not give the information on the back label in complete sentences and usually do not use punctuation. In two examples, however, the full text can also be found. In one example (Figure 2, label 4), information about the tradition and description of žlahtina is given, as well as the serving temperature and the dish with which it is served. Tohoraj, on the other hand, describes the history and locations, gives a description of žlahtina and suggests which dishes pair best with it. This text is rich in positively loaded words that suggest a certain level of secrecy and mysticism in the whole process of žlahtina production, e.g. "experience **the mystique**", "in an **enchanting** basin", "holds **the title of** one of **the most favorable** locations in Vrbnik", "we have **revived** its **magic**", "**enriched by** constant air currents", "grapes **of exceptional** quality with **an irresistible** taste" or "**perfectly** balanced wine". This approach can have a positive effect on a potential customer, however, the question is whether all consumers will read the whole text and experience some of the atmosphere that the text is trying to convey, or will they shake their heads

[32] The mark * indicates a spelling error in the original document and is not an error by the author in the transcription of the example.

because of the large amount of text in a small font.

In addition to the text elements just described, the semiotic aspect of the back label also plays an important role. Thus, various symbols and pictograms can be found on all the labels analyzed. All labels have a barcode and a "return fee" symbol to indicate that it is a returnable package. Most of the examples have the older marking of a rectangle with two arrows, on which, under the text inscription "return fee", "50 lp" is written. It is therefore a symbol that was used before the introduction of the euro as the official currency in the Republic of Croatia. Only one of the examples has a new refund label with a checkerboard symbol, while the other symbols are the same as before. It is a new label in use from the 2023 harvest. This new label also has a QR code, above which is the inscription "Ingredients:" is written, which allows consumers to see all the ingredients contained in the wine.

Most of the back labels analyzed have a circular arrow indicating to the fact that it is a packaging that can be processed and reused, and such a circular shape represents the self-sustainability of the recycling process (Regional Center of Clean Environment, 2021). In addition to this symbol, some labels also bear the Möbius loop symbol, the international symbol for recycling, which indicates that the material can be recycled after use. Below the symbol are the letters "GL", an abbreviation for the material from which the packaging is made, namely glass. Inside the loop the number "71" is written, indicating that it is green glass (Zgradonačelnik.hr, 2021).

Furthermore, "advisory" symbols on the labels can also be found. For example, some labels show a symbol of a silhouette of a pregnant woman with a glass in her hand in a crossed circle, which indicates that pregnant women should not consume alcohol because it could harm the child. An example of a thermometer with the digits 10 - 12 ^{0} C was also found, advising in this way the consumption of wine at the temperature indicated.

However, the red square symbol with the white letter Q in it, which symbolizes the designation "Croatian Island Product" (HOP – Hrvatski otočni proizvod), should be emphasized. An example was also found in which the English version of the name can be found next to the symbol. According to the Regulation on the HOP designation (OG 139/2021), the designation is awarded by the Ministry of Regional Development and EU Funds in order to preserve the island's tradition and identity. It can be awarded to products that are manufactured or produced on the island and that "comply with all applicable regulations and requirements of other laws, procedures and standards relating to the production, storage, distribution, placing on the market, safety, health protection, environmental protection and consumer protection, as well as all other prescribed requirements relating to that product". The mark "Croatian island product" is a guarantee of the island's identity and product quality and can bring numerous benefits related to the promotion and recognition of the product, which can also lead to greater consumer interest in products with the HOP mark, and it should be in the producer’s interest to acquire and use this mark. Also, in addition to the HOP mark, one of the labels also bears the mark "System Certification SGS", i.e. it is the system certification mark of SGS (Société Générale de Surveillance SA), the world's leading company in product

testing, inspection and certification.

Front label

The front label is certainly the most interesting and attractive part of a wine bottle for the consumer. The front label has become an important marketing tool for wine producers as it mainly contains elements that sell the wine and attract customers' attention (Özturk and Ertamay, 2019; Chamorro et al., 2020). Recent trends show that logos, colors and images are being changed for the purpose of wine branding. In addition, the number of words related to agriculture is decreasing, being replaced by abstract or emotive words (Chamorro et al., 2020), underlining the importance of the wine label design.

Several aspects of the front label of wine bottles can be analyzed from a text-linguistic perspective. At the communication-pragmatic level, the wine producer's intention is defined, which is to attract consumers' attention and interest them in buying a particular bottle of wine. The aim of the producer is therefore to animate consumers, i.e. to persuade them to buy a particular wine. The front label is one of the text genres whose basic function is to "tell" the recipient (i.e. the consumer) what he should do, i.e. to induce him to take a certain action (the purchase of wine), whereby the consumer then decides for himself whether he really wants to do this or not. These are therefore categorized as directives, whose illocutionary intention is to induce other people to take an action (Ivanetić 2003). In certain elements of the front label, elements of assertive text types, i.e. subtype of animatives can be found, because the aim of the producer is also to give the consumer certain information about the wine (e.g. harvest year or type of wine), which influences the consumer's opinion and attitude towards the wine and thus potentially encourages the purchase of this particular wine (cf. Ivanetić, 2003; Ježić, 2024).

Several elements should be considered in the graphic design of the front label. What is noticed at first are the position of the label on the bottle and its shape. Of the nine žlahtina labels analyzed shown in Figure 1, five have a rectangular shape (bottles 1, 4, 5, 8 and 9), three are square (2, 3 and 6), and one label is diagonally positioned (7). Furthermore, the background color of the label and its contrast in relation to the color of the bottle are also important factors in attracting the attention of potential customers (de Mello and Pires 2009). Most of the bottles have a dominant white background color, while two labels have a black background (Figure 1, bottles 4 and 9) and one bottle has a green label (Figure 1, bottle 5). Of the other colors, golden yellow dominates, which is also the color of the žlahtina itself. Therefore, many producers use golden, golden yellow or yellow letters on their labels, as well as elements of the logo or part of the image. This indicates sophistication and elegance and guarantees the quality of their product. Black or grey letters on white labels are common, and there are also red elements such as a rose and an embossed seal.

When analyzing the relationship between the pictorial elements and the text part of the front label, it becomes clear that all labels contain both elements, with the pictorial element dominating in the majority of cases. The most important visual element is the depiction of the town of Vrbnik - five of the eight labels of the žlahtina producers from the island of Krk show Vrbnik - a steep rock above the sea, on the

cliff of which the town of Vrbnik, with a characteristic church tower is located (Figure 1, bottles 1, 3, 5, 7 and 9). Some labels show only the outline of a rock and a town, while others contain the traditional windstorm *bura* with slanting trees and a surging sea. Among other pictorial elements, there is a seal embossed in red on the Pavlomir wine label (Figure 1, bottle 7), which refers to tradition and the Law code of Vinodol[33], but also to the guarantee of quality, which is confirmed by the seal. There is also an element in gold that resembles the coat of arms of the Republic of Croatia, and at the same time it resembles the grape (Figure 1, bottle 4), which confirms that it is a Croatian product of high quality, but also indicates a connection with the wine sector. Another such front label that has only the wine symbol on its front label is the one of Vinarija Nada (Figure 1, bottle 6), which has a grey bottle opener on the right edge. There is only one example of an abstract front label (Figure 1, bottle 2) which, probably, has the dorsal fin of a fish as a symbol. Inside there are various colorful elements that are not explicitly linked to the town of Vrbnik or the wine sector. Also interesting is the example (Figure 1, bottle 5), where there is a printed medal under the silhouette of the town of Vrbnik, which states that 150 families were involved in the cooperative and thus contributed to the creation of the žlahtina, but also to the tradition of production on the island of Krk. The Croatian Island Product designation can only be found on one front label (as already mentioned, most producers show this symbol on the back label).

As for the text part of the front label, some examples are very sparse with text elements, while in some examples even parts from the Vrbnik (or Krk) Statute can be found. The labels with the least amount of text have only two elements, namely the name of the wine variety – *Žlahtina* and the name of the producer, and there are even three such examples (Figure 1, bottles 2, 4 and 7). The other text elements that can be found on the labels are the name of the place or region of origin: three labels bear the name of the town of Vrbnik (Figure 1, bottles 3, 5 and 6), one bears the inscription *Krčko vinogorje* (Figure 1, bottle 9), while on one the location *of Valis Vinearia* is written (Figure 1, bottle 8). The harvest year also appears, on some labels only the year is indicated, while on other examples the word *harvest* is indicated together with the year itself. Furthermore, some labels indicate the type of wine, so on two examples "kvalitetno bijelo vino" and "kvalitetno vino žlahtina – bijelo suho vino"[34] can be found.

It is interesting to point out the examples of front labels with a slightly larger number of words in the text element. The first example has already been mentioned, because it is a printed medal with the number 150 in the middle, and the text inside the medal is written in English and reads: "Heritage · Tradition · Quality" in the upper part of the circle, then "150 families" in the middle, and "PZ Vrbnik - Krk Island" in the lower part of the circle (Figure 1, bottle 5), which certainly indicates that it is a traditional product in the creation of which 150 families from Krk were involved. Another similar example (Figure 1, bottle 6) has a text in Croatian on the left edge of the label that reads: "Ki godi človik bude otel držat tovernu, imaj vzet od

[33] One of the oldest law texts in Croatia.
[34] quality white wine, quality wine žlahtina - white dry wine

sudca meru, a ima dati sudcu mali vina.[35]" This is a fragment of the Vrbnik Statute from 1388, which was originally written in Glagolitic script, and this legal document governed the conditions primarily in the town of Vrbnik and thus also on the entire island of Krk (Džaja et al. 2015). The fact that it is a quotation from this very document is noted on the label at the bottom right: "From the Vrbnik Statute 1388." This choice for the front label may indicate a connection to tradition and additionally emphasizes the origin of žlahtina, and the content of the text itself is directly related to the wine trade. The analysis on the linguistic and stylistic level revealed the absolute dominance of nouns and noun structures, and verbs do not occur at all (except in the example of the quotation from the Vrbnik Statute). All noun structures are in the nominative case and indicate the presentation of facts and information about wine. Adjectives that appear next to nouns on the front label mostly describe the type of wine (quality wine, white wine, dry wine) or its origin (Vrbnička žlahtina, Krčko Vinogorje).

CONCLUSION

The wine label is one of the first elements that a potential buyer notices on a bottle of wine, and it certainly serves to ensure that the producer presents himself and his wine in the best possible light. Basically, every wine label consists of two parts – the front and the back label, which can be considered as a specific text genre according to the principles of text linguistics. In fact, the wine label fulfils all the above standards of textuality, and in view of the multiple communication functions that the wine label has, this chapter demonstrates that it is a text genre. The two main functions of the text genre *wine label* are to attract consumers and persuade them to buy that particular product and to inform them about the contents of the bottle itself, i.e. the wine. The wine label is a multimodal text, as it contains various visual codes and symbols in addition to text elements.

A total of nine front and back wine bottle labels of žlahtina, an autochthonous Croatian white wine variety produced in the Hrvatsko primorje region, were analyzed by means of a text-linguistic analysis on the communication-pragmatic, thematic and linguistic-stylistic levels. The producers of eight of the nine analyzed labels are located on the island of Krk, while one producer is from the Vinodol valley. The analysis has shown that the back wine label can be characterized as a product description containing information about the wine itself, which includes both mandatory and optional information and elements. The mandatory information is legally strict and clearly defined by Croatian laws and European regulations. The back wine label contains information about the name and category of the wine, the net quantity and actual alcohol strength, the protected designation of origin, the producer and the serial number of production. The mandatory information is written in Croatian, although there are also examples of the use of English, especially on the designation "Original Island Product". Furthermore, in addition to symbols and visual codes, elliptical sentences are preferred and creativity in linguistic formulations is limited.

[35] Any man that wants to have a tavern, he must take a measure from the judge, and he must give the judge a little wine

On the other hand, flexibility and creativity are allowed on the front wine label. It is characteristic of the front label that it can be linked to marketing elements and can be considered as an advertisement for the wine itself. The analysis has shown that the aim of the front label is to attract consumers, primarily through the use of visual elements and codes and only then through text elements. Therefore, the text genre *wine label*, apart from being an informative text type (back label), can be classified primarily as a directive, and partly also as an animative (front label). Most front labels have a rectangular shape and the dominant background color is white. The label itself is dominated by a golden yellow color, i.e. the color of the žlahtina wine, which also gives the consumer the impression of sophistication and product quality. All the labels analyzed contain both pictorial and text elements, with the pictorial element on the label predominating. Most labels contain between two and four text elements, including the name of the variety (žlahtina) and the name of the producer, as well as the place and year of harvest. The basic visual element of the pictorial part is certainly the motif of the town of Vrbnik, which can be found on five of the eight front labels from the island of Krk.

Wine labels are recognizable to a wide audience, i.e. consumers, and it is the front label that attracts their attention and tries to persuade consumers to buy. Although the labels of all žlahtina producers were analyzed, the limitation of this research is that the labels do not refer to the same bottling year and many producers even completely changed the design of their labels in a period of only a few years (e.g. Gospoja). The appearance of the closure and packaging can also be included in the analysis, which can also contribute to influencing consumer preferences. This text-linguistic analysis has revealed the basic elements of wine labels of žlahtina bottles, and future research should address an analysis of other Croatian autochthonous varieties in order to encourage their recognition and promotion on the market through text linguistics.

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SUSTAINABILITY TRENDS IN WINE PRODUCT DEVELOPMENT AND LABELLING

CHAPTER 24.

Ivana First Komen *

ABSTRACT

This chapter aims to analyse the sustainability trends in wine product development and labelling. Methodologically, the research was approached through a review of scientific literature, assuming that the literature reflects real-life phenomena, i.e., investigates sustainability trends that are relevant for winemakers and consumers. The advantage of this methodological approach lies in gaining insight into globally significant trends that could not be identified through empirical research in just one or a few markets. The following sustainability trends were identified: organic wines, sustainable wines, local wines, wines from specific regions, natural wines, and wines with lower or no alcohol content. These trends first attracted researchers' interest about fifteen years ago, with the currently highest interest in organic and sustainable wines. The results also show that all identified sustainability trends are predominantly studied in Europe, particularly in Italy. Finally, the contributions of studies on these trends are mostly within three research areas: consumer perception and behaviour, tourism, and wine industry management. The scientific contribution of this research, i.e., the identification and analysis of sustainability trends in wine product development and labelling, helps enhance the effectiveness of future efforts by winemakers and researchers.

Keywords: *wine, sustainability, consumer trends, sustainable wine, organic wine*

INTRODUCTION

Ethical, environmental, and health concerns are increasingly driving sustainable consumption, which is evident in wine selection as well (D'Amico et al., 2016; Ghvanidze et al., 2019). Producers respond to these consumer preferences by increasingly adopting responsible and sustainable production practices (Capitello et al., 2021; Rabadan & Bernabeu, 2021), which they also emphasize in their communication. Cozzio et al. (2020) argue that three types of ethical positioning dominate the food product market: local, organic, and fair/socially sustainable. At the same time, the range of labels and claims that can be found on products within these three positioning categories is infinite. According to a study by First Komen et al. (2021), Croatian consumers in the context of sustainable production and the preservation of natural and traditional resources, apart from natural and traditional products suggested by the researchers' questions also appreciate products that are

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First Komen, I. (2025). Sustainability Trends in Wine Product Development and Labelling, in book Katunar, J., Vretenar, N., Jardas Antonić, J. (eds), Agriculture Through Sustainability Perspectives, University of Rijeka, Faculty of Economics and Business, Croatia.

organic/ecological, handmade, domestic/homemade, and from specific regions known for particular foods (e.g., Neretva mandarins or Istrian prosciutto).

Wine shares many characteristics with food and under the Croatian Wine Law of 2003 (NN 96/2003) was defined as food until 2019 (NN 32/2019). However, there are several reasons to believe that consumer responses and preferences for wines with various sustainability labels and claims differ from those for typical food products. Firstly, food products are often purchased and consumed for utilitarian purposes, while wine, especially high quality and premium, is consumed hedonically (Christian & Wang, 2022). This distinction is important as even sustainability-oriented consumers may feel entitled to disregard sustainability considerations during hedonic consumption (Cozzio et al., 2020). Additionally, when selecting wine, consumers consider a wider range of information compared to selecting many other products (Schäufele & Hamm, 2017), including details on wine category, grape variety, winemaker, vineyard region, price, and similar. According to Goncalves et al. (2020), this represents a significant cognitive load, meaning that consumers may give less importance to additional information such as responsible or sustainable production. Lastly, under the Croatian Wine Law (32/2019), wine can be advertised only if it carries a protected designation of origin (PDO) or protected geographical indication (PGI) label. Such regulation motivates winemakers to focus on these quality enhancements and voluntary labelling, potentially discouraging then from other labelling options. Given all the presented, it is important to determine the role that sustainability and social responsibility play in wine production and consumption.

Therefore, the aim of this chapter is to analyse sustainability trends in wine product development and labelling. This is approached by identifying wine types (e.g., local wine, organic wine) studied in scientific research in marketing and analysing the insights from that research. Relying on scientific literature as a source of consumer trend insights assumes that research interest focuses on real-world phenomena, i. e., trends that are relevant to winemakers and consumers. At the same time, using scientific literature as a methodological approach in this study has an advantage of gaining insights into globally relevant trends related to the types of wines produced and consumed, which cannot be achieved through empirical research in one or a few markets. The research findings thus contribute to the study of sustainability trends in the wine industry, providing a basis for future efforts by winemakers and researchers. For winemakers, the results offer guidance for further business development, while for researchers, they highlight sustainability trends that require additional empirical exploration on market readiness to adopt these trends in the future. While the research aims to contribute to the development of Croatian winemaking, the insights are general and applicable across various markets.

METHODOLOGY

As mentioned in the introduction, to achieve the research aim, a scientific literature analysis was conducted. Given that the primary goal of the research was to determine which types of wines (sustainability trends) have been studied and which of them the most, the initial search of relevant articles did not focus on predefined

trends such as *natural*, *local*, or *organic wine*. Instead, the search for articles was conducted in two rounds. In the first, inductive round, articles containing the words *wine*/*wines* and *consumer** in the title were collected. These search parameters ensured capturing the broadest range of results in terms of consumer trends in wine production and consumption. The guidelines proposed by Paul and Criado (2020) were followed to select relevant studies. According to them, a systematic literature review should cover a period of at least ten years. Recognizing that consumer preferences in today's digital age evolve faster than ever, the search in this round was limited to the past ten years to include the most relevant and current studies, i.e., articles published between 2013 and 2022. The search was conducted within the Web of Science (WOS) platform, specifically the SSCI index as it is most relevant for social sciences. Additionally, only articles and review articles published in English were included in the search parameters.

The search with these parameters yielded 159 scientific papers. The titles and abstracts of these chapters were manually coded using MAXQDA software, and the coding was done inductively, meaning that the codes emerged from the data. A three-stage coding was applied, as recommended by Kalpokaite and Radivojevic (2019). Specifically, the word *wine* was systematically searched for in the collected titles and abstracts. If the words surrounding the word *wine* specified the type of wine in any way, they were included in the codebook. At this lowest level of coding, the so-called open coding (Miles et al., 2014), primary codes included types of wines as described in the abstracts and titles, regardless of how specific they were, e.g., “natural wine” or “wine produced on land confiscated from a criminal organization.” At the second level of coding, primary codes were grouped into thematic codes, representing conceptual types of wine. Finally, at the third level, thematic codes were divided into two categories (types of wines related to sustainability trends and other types of wine). This categorization was based on the definition provided by the International Organisation of Vine and Wine (OIV 2004; OIV 2016), which defines sustainable vitiviniculture as “a global strategy on the scale of the grape production and processing systems, incorporating at the same time the economic sustainability of structures and territories, producing quality products, considering requirements of precision in sustainable viticulture, risks to the environment, products safety and consumer health and valuing of heritage, historical, cultural, ecological and landscape aspects”.

After the first-round analysis identified the types of wines representing sustainability trends, a second round of article search was conducted to determine the significance and development of the currently relevant trends over twenty years, from 2003 to 2022. The search parameters for each trend included all associated primary codes, and in order to maximize coverage, occurrences were sought not only in titles but also in abstracts and keywords. For example, the search parameters for the organic wine trend in the second round was: TS = "*organic wine**" OR TS = "*biodynamic wine**" OR TS = "*wine* that is organic*" OR TS = "*wine* that are organic*"... Other search parameters remained the same as in the first round (WOS, SSCI index, articles or review articles, English language).

Finally, in the last part of the research, a content analysis of the abstracts of papers identified in the second round of the research and published in the last five years

was conducted. The aim was to determine the main research areas and findings for each identified sustainability trend. Additionally, in this phase, journals (and thus scientific fields - WOS categories) and geographic areas where research has been conducted were identified for each sustainability trend. Most papers mention the geographic area of research, but for a few geographic area was defined based on the authors' affiliations and other information in the paper, such as laws or institutions of a specific country, wines from a particular country, and similar indicators.

RESULTS

Relevant Trends in Wine Product Development and Labelling

In the first round of research, as mentioned earlier, two categories of wine were identified. The first category includes types of wine associated with sustainability trends, and the second includes other types of wine. Although the purpose of the first search round was not to determine the frequency of various wine types, frequencies are presented in Table 1. As shown, the wine types in the first category, listed by frequency of occurrence, are: organic wines, sustainable wines, local wines, natural wines, wines from specific regions, wines with lower or no alcohol content, and other wines (which include a few rarely mentioned types). For each type of wine different papers, use different terms, and all of them are listed in their original form in the table, ordered by the number of papers they are mentioned in. For the most frequent terms within each wine type, and any term that appear more than twice, the number of papers they appear in is also noted in parentheses. Among all terms, "organic wine" is the most frequently studied (18 times), followed by "sustainable wine" (8 times), "local wine" (6 times), and "natural wine" (5 times).

Tertiary Category Codes: Trends or Not	**Secondary Thematic Codes: Types of Wine (N)**	**Primary Codes: Terms Used (N)**
Types of wine related to sustainability trends	**Organic Wines (26)**	organic (18), biodynamic (3), that is organic, deriving from organically grown grapes, non-sulfited, organically produced, eco-certified
	Sustainable Wines (21)	sustainable (8), fairtrade, made from sustainably farmed grapes, environmentally sustainable, environmentally friendly, vegan, carbon neutral, canned, with sustainability characteristic, produced on land confiscated from a criminal organization, devolving money to African AIDS-combating institutions, "Sustainable irrigation" labelled
	Local Wines (12)	local (6), domestic (3), from domestic production, locally produced, that is local
	Natural Wines (9)	natural (5), produced from grapes grown using minimal pesticides, made from naturally farmed grapes, naturally resveratrol-enhanced, untreated
	Wines from Specific Regions (6)	PDO (2), protected designation of origin, regional, from a delimited geographical area, original
	Wines with lower or no alcohol content (6)	low-alcohol (2), alcohol-free, light, alcohol-reduced, with reduced alcohol content

	Other Wines (6)	healthier (2), with potential healthenhancing characteristics, from hand-harvested grapes, historical, nano
Other types of wine	**Wines by Basic Characteristics (30)**	red (19), sparkling (5), white (4), rosé, dry, semi-dry, sweet, blended, single varietal
	Wines by Country of Origin (15)	Australian (4), New World (3), Old World, Italian, Spanish, Greek, French, U.S.
	"Conventional" Wines (12)	conventional (7), commercial, standard, deriving from conventionally grown grapes, standardized
	Wines by Quality (12)	quality (4), fine (3), high-end, premium quality, table
	Wines by Grape Variety (11)	Shiraz (2), Chardonnay (2), Cabernet Sauvignon (2), Riesling, Chianti, Pinot Noir, Sauvignon Blanc, Sangiovese
	Wines by Region of Origin (10)	Bordeaux (2), Colorado, Tennessee, Canary Island, Nova Scotia, Moravian, Castile-La Mancha, Valpolicella, Samos
	Imported Wines (7)	imported (5), from traditional producing countries, foreign
	Other Wines (3)	labelled (1), astringent, special-occasion

Table 1 Identified Wine Types
Source: Author

The second category of wine, named "other types of wine," is not the focus of this research, so the types of wine within this category did not enter the second phase of the study. Only a few key insights related to this category will be presented here. This category includes wine types defined by basic characteristics (e.g., red, white, sparkling), by country of origin (e.g., Australian), by quality (e.g., quality), by grape variety (e.g., Shiraz, Chardonnay), and by region of origin (e.g., Bordeaux). This category also includes three other types of wines that do not represent sustainability trends: imported wines, often studied in the context of China or Asia in general; conventional wines, typically used as a control group for wines associated with sustainability trends; and other wines. As with the first category, terms used are ordered by occurrence frequency, with the number of articles in which each term appears indicated in parentheses. As shown in Table 1, the most frequently studied terms in this category are "red wine" (19 times), "conventional wine" (7 times), "sparkling wine" (5 times), and "imported wine" (5 times).

Dynamics of Sustainability Trends in Wine Product Development and Labelling

The results of the second round of the research are presented in the following two figures. Figure 1 shows how research trend on each type of wine in the sustainability-related category changed over the past twenty years, in five-year intervals. Some papers addressed two or more types of wine (e.g., organic and natural), and in that case the paper was assigned to each trend.

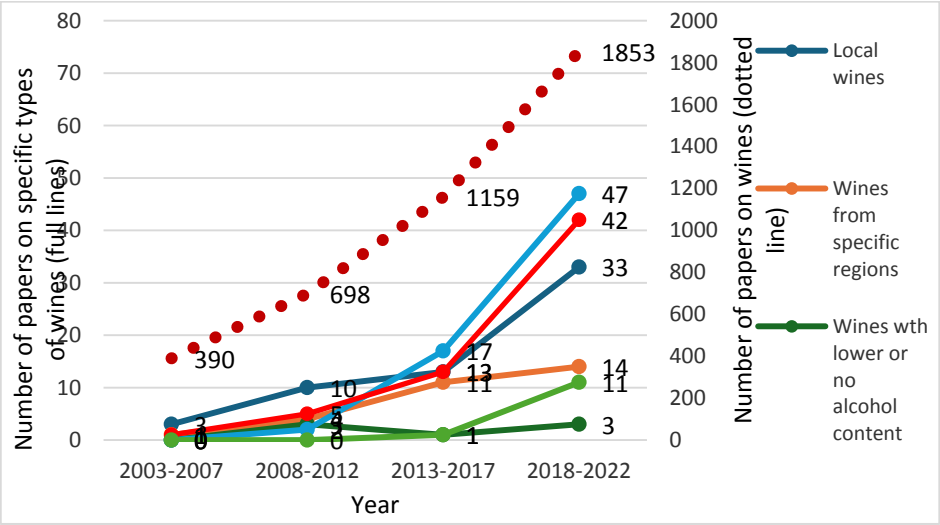

Figure 1 Trends in Research Interest for Different Types of Wine, i.e., Sustainability Trends (2003–2022)
Source: Author

It is evident that the volume of wine-related research has consistently grown, and so has the research interest for all sustainability trends identified in Table 1. However, these trends have not evolved in exactly the same pattern. Surprisingly from today's perspective, none of the currently relevant types of wine associated with sustainability trends attracted research interest between 2003 and 2007. During that period, only three studies on local wines, one on sustainable wine, and one on wine from a specific region were conducted. The number of studies on almost all identified types of wine increased over the next five years, and local wines still led with ten identified studies. The third period, from 2013 to 2017, saw a further increase in research on nearly all identified types of wine. In this period, organic wines experienced a significant increase in researcher interest, taking the lead over local wines, wines from specific regions, and sustainable wines, which had until then been more frequently studied. Finally, in the fourth period, from 2018 to 2022, certain types of wine emerged clearly as major focuses for researchers: organic and sustainable wines, with local wines following at the third place. However, while over the last fifteen years, interest in organic wines increased from 2 to 47 studies, and for sustainable wines from 5 to 42, interest in local wines saw a smaller rise from 10 to 33, aligning roughly with the general increase in wine research. Also, although natural wines appear in fewer studies, it is noteworthy that they appeared first time in studies during the third observed period, with the number of studies increasing from 1 in the third period to 11 in the fourth. "Other wines" within types of wine related to sustainability trends are not included in Figure 1 or Figure 2, as they do not represent a conceptually defined trend, and the total number of studies on this types of wine is negligible, increasing from zero in the first period to five in the last.

Given the significant global crises and rapid technological changes in recent years, thus also rapid shifts in consumer behaviour, the changes in the identified trends over the past five years are broken down by year in Figure 2. The figure shows that research on wine saw substantial growth in the first part of the 2018–2020 period,

peaking in 2020 before beginning to decline, and reaching a level in 2022 similar to that in 2018. This pattern is very similar for studies on each type of wine, i.e., sustainability trend.

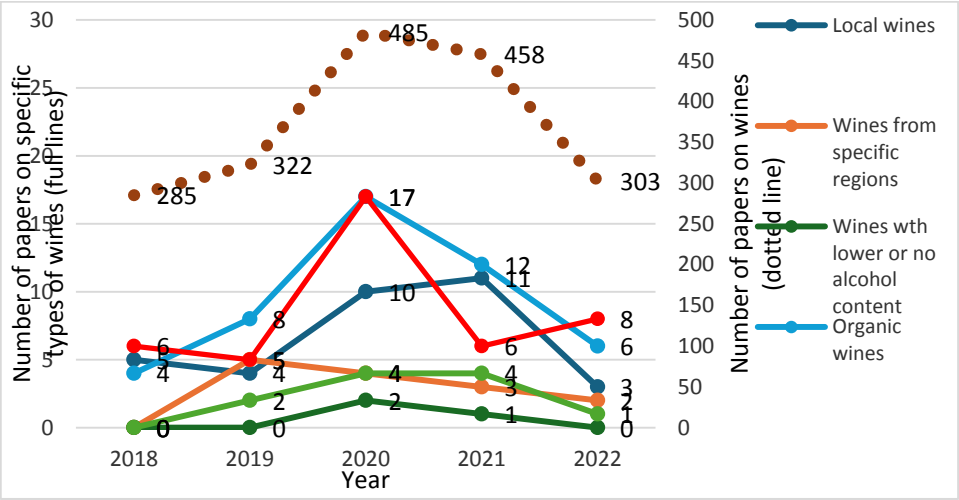

Figure 2 Trends in Research Interest for Different Types of Wine, i.e., Sustainability Trends (2018–2022)
Source: Author

In the following two subchapters, each sustainability trend will be discussed in terms of: (a) the journals that serve as platforms for discussions on the trend and the geographic areas where the trend attracts researcher attention, and (b) the key findings of the conducted research. This analysis is based on studies collected in the second phase of research, published between 2018 and 2022.

Scientific Journals and Geographic Areas of Research on Sustainability Trends in Wine Product Development and Labelling

Table 2 shows the distribution of journals that publish studies on wine types associated with sustainability trends. Over two-thirds of the studies on sustainable and organic wines were published in just four journals: *Sustainability*, *Journal of Cleaner Production*, *Food Quality and Preference*, and *British Food Journal*. For local wines, which along with organic and sustainable wines is the only type with a sufficient number of studies to expect concentration of papers within specific journals, a different pattern emerges. There is no noticeable concentration within a few journals, but rather 33 studies were published across 24 different journals. Still the *Journal of Wine Economics* (not relevant for sustainable and organic wines) and *Sustainability* dominate. For the remaining three types of wine, the results show that the studies were published across a wide variety of journals.

Type of wine	**No of studies**	**No of journals**	**Journals with More Than Two Analysed Papers Published and the Number of Papers in Each**
Organic	47	18	Sustainability[1] – 13; Food Quality and Preference[2] – 7; Journal of Cleaner

			Production[3] – 6; British Food Journal[4] – 5
Sustainable	42	13	Sustainability[1] – 15; Journal of Cleaner Production[3] – 7; British Food Journal[4] – 5; Food Quality and Preference[2] – 4
Local	33	24	Journal of Wine Economics[5] – 4; Sustainability[1] – 3
From specific regions	14	12	
Natural	11	10	
With lower or no alcohol content	3	3	

Table 2. Distribution of Studies Investigating Sustainability Trends in Wine by Journal

[1] WOS categories: Environmental Sciences; Environmental Studies; Green & Sustainable Science & Technology

[2] WOS categories: Food Science & Technology

[3] WOS categories: Environmental Sciences; Engineering-Environmental; Green & Sustainable Science & Technology

[4] WOS categories: Agricultural Economics & Policy; Food Science & Technology

[5] WOS categories: Agricultural Economics & Policy; Economics; Food Science & Technology

Source: Author

Table 3 demonstrates that by far the biggest number of the scientific papers from the past five years investigating sustainability trends are based on research conducted in Europe, predominantly in Italy. Although Table 3 lists all countries from which more than two papers within the same sustainability trend originate, only a few countries are mentioned. For example, organic wines, in addition to Italy, have attracted substantial research interest in Germany and France, while sustainable wines in Germany. The table also highlights the only study conducted in Croatia.

Types of wine	Europe	North America	South America	Asia	Oceania	Africa
Organic	39 (Italy – 15; Germany - 9; France – 7: Spain – 3)	4 (USA – 4)	1	2	2	1
Sustainable	32 (Italy – 21; Germany – 6)	4 (USA – 4)	3 (Chile – 3)	0	7 (New Zealand – 4; Australia – 3)	0
Local	23 (Italy – 7; Spain – 3; Croatia - 1)	4 (USA - 3)	1	4	1	0
From specific regions	10	0	1	1	2	1
Natural	9 (Italy – 7)	2	0	0	2	0
With lower or no alcohol content	1	0	0	0	2	0

Table 3 Geographical Distribution of Papers Investigating Sustainability Trends in Wine

Source: Author

Scientific Insights on Sustainability Trends in Wine Product Development and Labelling

In the last five years, studies on organic wines have predominantly focused on determining how important organic labels are to consumers and how much they are willing to pay for them. Generally, consumers express positive attitudes towards organic wines, and despite the gap between attitudes and actual purchasing behaviour (Schäufele et al., 2018; Taghikhah et al., 2020), experimental studies show that consumers are willing to pay a higher price for organic wines (Wang et al., 2022; Scozzafava et al., 2021; Migliore et al., 2020). However, several studies have found

that willingness to pay a premium depends on the consumer profile (Di Vita et al., 2019; Jorge et al., 2020) and the availability of other information on the wine (Lim & Reed, 2020; Schäufele & Hamm, 2020). Interestingly, in studies comparing biodynamic and organic wines, where biodynamic production involves more rigorous production methods, consumers respond better to organic wines, for which they are willing to pay more than for biodynamic wines (Scozzafava et al., 2021), even when the producer self-declares the wine as organic (Fanasch & Frick, 2020). Still, not everything is rosy for organic wines, and according to Delmas & Gergaud (2021), self-declared organic production is not a good signal to wine experts and raises concerns about greenwashing. Moreover, some studies emphasize that consumers are not sufficiently familiar with the term organic wine (Hauck & Szolnoki, 2020), and that demand is more often driven by expected health benefits than environmental ones, although the essence of organic certification is environmental protection (Raineau et al., 2023). Finally, researchers agree that the organic label is not the most important information on a wine (Peres et al., 2020; Janssen et al., 2020), while Boncinelli et al. (2021) show that the organic label matters only to a niche market, while the majority ignores it.

The second group of studies, or the second sustainability trend, are studies on sustainable wines. There are two equally represented research areas. The first is based on research on consumer preference and behaviour (often methodologically set up as a choice experiment), while the second is based on research of winemaking practices (often methodologically grounded in interviews or case studies). Within the first research area, certain studies already analysed above in the context of organic wines (e.g., Scozzafava et al., 2021; Migliore et al., 2020; Lim & Reed, 2020; Raineau et al., 2023) have shown that consumers (at least some) are willing to pay a higher price for both organic and sustainable wines. However, despite the positive attitude towards such wines, when sustainability requires a change in behavioural patterns, the results are mixed. For example, consumers are not inclined to purchase wine packaged in more sustainable packaging, such as cans (Ferrara et al., 2020), but at the same time, most are willing to return bottles to wineries for refilling (Kelley et al., 2019). In research on winemaking practices, results show that wineries are aware of the importance of sustainable and socially responsible business practices (Pizzol et al., 2021) and implement many components of green infrastructure (McWilliam & Wesener, 2021). Their motives, challenges, and the degree of their shift towards sustainable winemaking culture were also studied (Pucci et al., 2020; Ferrer et al., 2022; Sautier et al., 2018).

Studies that mention local wines are mostly related to tourism. These studies establish the importance of local wines for the development of tourism and the economy in rural and island regions (Serra-Cantallops et al., 2021); but also, the reverse, the importance of tourism for the development of the wine industry (Wittwer & Anderson, 2021). These studies also argue that local wines are an important part of the tourist offering as they make it authentic (Skinner et al., 2020; Jeziorska-Biel et al., 2021) and emphasize the importance of wine routes (Xu et al., 2020; Festa et al., 2020). Additionally, several studies on local wines discuss factors contributing to market success and mostly prove the importance of networking and cluster cooperation (de Clercq et al., 2018; Basso et al., 2020; Maghssudipour et al., 2020). Moggi et al. (2022) go a step further, presenting cooperation within the

entrepreneurial wine ecosystem as a driver of success for involved businesses, as well as an improvement in the quality of life for the local community and the protection of natural resources. Finally, studies have found that local wine is interesting not only to tourists but also to domestic consumers (Palmieri & Perito, 2020), especially those who are ethnocentric (Maksan et al., 2019; del Castillo et al., 2021) and older (Balenovic et al., 2021).

As Figures 1 and 2 show, wines from specific regions, natural wines, and wines with lower or no alcohol content are less researched, but there are still some identified research directions. When it comes to research on wines from specific regions, similar to research on local wines, expectedly, a significant portion of the studies focuses on wine tourism. In that regards research investigates what matters to consumers in wine tourism (Kruger & Viljoen, 2021; Brochado et al., 2021) and how winemakers reconcile tradition and authenticity with innovation (Fountain et al., 2021). Besides tourism, studies based on wineries explore the drivers and consequences of the internationalization of regional wines (Lessoua et al., 2020; Felzensztein et al., 2019), while those based on consumers explore satisfaction and willingness to pay for wines with indication of a region or PDO label (Tejedor et al., 2019; Petrontino et al., 2022). In research on natural wines, studies examine how familiar consumers are with the meaning of the term "natural" and for which consumer profiles is that claim stimulating to make a purchase (Pappalardo et al., 2020) and pay a premium price (Galati et al., 2019; Migliore et al., 2020). As for wines with lower or no alcohol content, it seems that consumers show little interest in them (Stanco et al., 2020; Bucher et al., 2020).

DISCUSSION AND CONCLUSION

The aim of this chapter was to analyse sustainability trends in the wine product development and labelling. Several trends were identified, including: organic wines, sustainable wines, local wines, wines from specific regions, natural wines, and wines with lower or no alcohol content. It was also established that none of these types of wine had been studied until about fifteen years ago. While local wines first sparked researchers' interest, research today is mainly focused on organic and sustainable wines. In light of the fact that consumers, when discussing sustainable consumption in general, value attributes such as traditional, handmade, domestic/homemade, etc. (First Komen et al., 2021), it is important to highlight that these attributes were not identified in the wine context in this study. This emphasizes the importance of researching sustainability trends in wines as a separate product category. Furthermore, during 2020, the previously rapidly growing interest in wine research slowed down and started to decline. Likewise, interest in researching all identified sustainability trends in wine decreased. However, the relationship among these trends was not changed, i.e., none of the identified trends saw a sudden rise or decline, opposed to other trends. The decline in interest in wine research after 2020 is likely linked to the COVID-19 pandemic, through two mechanisms. First, researchers across all scientific fields turned their focus on topics related to the pandemic. Second, the circumstances of the pandemic distanced life, and thus research, from products like wine that are linked to hedonic consumption (Christian

& Wang, 2022) and are often consumed in tourism or social settings (Wittwer & Anderson, 2021).

Furthermore, results show that sustainability trends in wine are predominantly studied in Europe, especially in Italy. While the topic of sustainability is generally most promoted and regulated in Europe, i.e., within the European Union, such a dominance of European research was not expected, as for example, natural products are much more researched in the United States than in Europe (First Komen & Grguric Cop, 2022). Furthermore, although Italy is one of the largest wine-producing countries, a lot of wine is produced in other European and non-European countries as well (Wine production worldwide in 2023, by country, accessed August 23, 2024). Therefore, it is surprising that research on wines related to sustainability trends in these countries is much rarer, even so rare that some countries which are among the top ten wine producers in 2023 according to the source mentioned above, are not even mentioned in Table 3. The reasons for the dominance of Italian research are not fully clear, but it is possible that Italy encourages and finances research on sustainability trends in wine more than other countries. This hypothesis needs to be validated in the future.

Finally, the results show differences in terms of research areas among trends. Three identified areas of research were: consumer perception and behaviour, tourism, and management in winemaking. Within the consumer perception and behaviour, all sustainability trends are researched, but almost all papers on natural and organic wines, as well as wines with lower or no alcohol, fall under this research area. On the other hand, tourism is strongly linked to research on local wines and wines from specific regions, while in winemaking management, research is largely related to sustainable wines, but also to local wines and wines from specific regions. Although no assumptions were made for which research areas would be covered in the research on sustainability trends, but rather the study was conducted inductively, the results are not surprising. Namely, tourism is largely motivated by the desire to experience what is authentic and specific to the destination (Skinner et al., 2020), so in the context of this study, this refers to local wines and wines from specific regions. As for winemaking management, given that the concept of sustainable production is broader than that of organic and natural products, and involves more comprehensive changes in operations (Bangsa & Schlegelmilch, 2020), it is not surprising that winemaking management is a more important research area for sustainable wines than for natural and organic ones.

The results of this research are useful for winemakers and other stakeholders in the wine industry, both in Croatia and in other markets. The results suggest that it is important to focus business efforts on positioning wines primarily as organic and sustainable. Additionally, if the wine is produced in a region that is a tourist destination, it makes sense to market it locally through own or partner restaurants/hotels and position it as local wine or wine from a specific region. Furthermore, natural wines are a phenomenon for which interest has recently been growing, so this is also a direction worth considering. In contrast, the results do not indicate desirability to position wines as domestic/homemade, traditional, or handmade, although these sustainability trends are relevant for some other product categories.

Guidelines for further research are primarily linked to the limitations of the current. For example, the SSCI database indexes more than 3,000 articles and review articles in English that research wine in the last ten years. In order to inductively identify relevant sustainability trends, in this study was necessary to reduce this number, so articles containing the word consumer in the title along with the word wine were selected. This way, the focus was put on articles related to marketing, i.e., wines described in a way relevant to consumers. In the future, it would be good to expand the initial database to include more articles. Also, when grouping codes at the second level (thematic codes, half of which are categorized as sustainability trends), it was important to group them into logical units that are broad enough to avoid having too many codes, yet narrow enough to retain conceptual meaning. In the future, it will be necessary to monitor whether conceptually different sub-trends will emerge, especially for trends that will develop the most, so each can be observed separately. For example, sustainable wines may eventually be divided into those related to environmental sustainability and those related to social justice. Currently, most studies do not distinguish these two sub-trends but speak generally about sustainable wines. Finally, given the time frame of the study (papers published until the end of 2022), the short-term effect of the COVID-19 pandemic on development of any of the identified or new trends related to sustainability was not established. However, it can be assumed that the pandemic had an effect in this sense, which will be reflected in the coming period. Therefore, future studies should focus on examining changes in the importance of individual trends after the pandemic. The suggestion is to do it through empirical research in relevant wine markets, as changes in consumer preferences and winemaker practices will be first discovered in that way.

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INCREASING COMPETITIVENESS THROUGH STRATEGIC ASSOCIATION OF KVARNER WINEMAKERS

CHAPTER 25

Žarko Stilin *

ABSTRACT

In competitive business conditions, small business entities find it difficult to maintain competitiveness in the market. One of the ways to increase competitiveness is a strategic association with other business entities. Every business entity faces challenges such as limited resources, lack of specialized knowledge, difficult access to new markets and high marketing costs. Associating with other businesses through formal or informal alliances enables small business entities to overcome these obstacles and achieve sustainable growth and development. The chapter analyses the strategic association of Kvarner winemakers. Ten member entities of the Kvarner Wines Cooperative participated in the research. The primary objective of the research is to determine whether the competitiveness of wineries increases through strategic association. The Association is mostly engaged in promotional activities, such as joint marketing campaigns, attendance at fairs, organization of tastings and participation in wine events. The conclusion of the research is that strategic association through the Kvarner Wines Cooperative achieves a synergistic effect that leads to greater competitiveness. The results can serve as a basis for further development of the association of the mentioned wineries, but also as an idea for the joint performance of all wineries and producers of agricultural products in a certain area.

Keywords: *marketing, competitiveness, association, wine tourism, Kvarner region*

INTRODUCTION

Modern business conditions are characterized by globalization influences that permeate all levels of a company's business. Today, the key problem is to create a product or offer a service at as low a cost as possible and, ultimately, market it. In competitive business conditions that are the foundation of capitalism and free trade, it is necessary to invest in innovation, further research, improvement of production processes and the end product. Each business entity should determine the vision, mission and goals from which the strategy is formulated, which implies certain activities such as analysis, planning, consideration of opportunities and choices in order to achieve the set goals.

The strategy of a company is a game plan that management uses to grow its business, gain a market position, attract and please customers, successfully compete, manage its operations and achieve the desired goals (Thompson, Strickland Gamble,

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2008: 3). Simply put, the strategy describes the way in which a business entity competes in the market in relation to its competition. When choosing a business strategy, the business entity defines a number of factors such as resources, competition, price, marketing, etc. Due to trade liberalization, small business entities find it difficult to maintain competitiveness in the market. The trend of globalization with liberalization requires great attention in solving the problem of effective management of market and other financial risks. Today's business is based on increasing risks, lack of resources and increasingly fierce competition. One way to increase competitiveness is by strategically associating with other business entities. Thus, more broadly, a strategic association can be defined as a connection with a competitor, supplier or customer in which, by combining the advantages and strengths of partners, a better competitive position is achieved in the global market (Previšić and Ozretić Došen, 1999: 399).

This chapter explores the increase of competitiveness through the strategic association of Kvarner winemakers. The research questions are:

1. Has the association of winemakers in the Kvarner Wines Cooperative increased their competitiveness in the market?
2. By strategically joining the Kvarner Wines Cooperative, have the members increased their profits?

The owners and managers of wineries in the Kvarner region recognized the potential of wine tourism, and in April 2021, they founded the Kvarner Wines Cooperative, which brings together wine growers and wine producers from the Kvarner wine-growing region, which includes the vineyards of Opatija – Rijeka – Vinodol, Krk, Rab, Cres – Lošinj and Pag. The aim of the association is a strategic appearance on the market of wine and wine tourism. Before the association, there were individual offers of certain wineries that failed to position themselves in the market of wine tourism and tourism in general. The chapter is based on the analysis of primary data resulting from the survey of members of the strategic association of Kvarner wineries in the Primorje-Gorski Kotar County. Secondary sources of information were used for the theoretical and practical framework of the chapter. Empirical research was conducted by survey, after which the analysis and synthesis methods, comparative method, and compilation method were used to analyze the results. The aim is to conclude whether association of entities brings advantages in business or not. In practice, it often happens that joint associated action and cooperation do not bring significant benefits due to a small number of interested entities and a low level of awareness of the meaning and possibilities of joint cooperation (Vlahov, 2014: 53). As in any partnership, it all depends on the participants and their efforts. For wineries representing one region, association is, according to all assumptions, imposed as an excellent strategic decision for the satisfaction of all members of the association.

STRATEGIC ASSOCIATION OF KVARNER WINEMAKERS

Strategic association is one of the key tools for improving the business of small business entities in an increasingly complex and competitive global market. In the modern business environment, small business entities face numerous challenges,

such as limited resources, lack of specialized knowledge and difficult access to new markets. In business practices present on the Croatian market, the common and most frequently used term for numerous expressions describing the relationship between business entities is association, which, in the broadest sense, implies a larger number of persons associated for a common business or a common goal (Anić, 2006: 1649). Associating with other business entities through formal or informal alliances allows small business entities to overcome these obstacles and achieve sustainable growth and development.

The positive effects of strategic association are reflected in various aspects of business. Above all, association of entities enables better use of resources such as capital, technology and human resources, thus achieving greater efficiency and productivity. In addition, cooperation with other business entities provides access to new markets and customers, which contributes to increasing revenue and market share. Also, association of entities reduces business risk because it is then shared between partners, and innovation increases through the exchange of ideas and knowledge. The author Dunning (1992: 34) defines the association as "any long-term cooperation that is not integration, in which two or more economic entities possess a sufficient percentage of capital ownership for an appropriate degree of control, i.e., influence on key areas of business and business decision-making". Simply put, each entity retains autonomy, but cooperates with the aim of creating a synergistic effect. A joint venture can also be defined as a form of cooperation between two or more companies that, by pooling their resources, create a new entity that is independent in legal and business terms (Ćenan, 2006: 17).

This part of the chapter presents the theoretical part of the Kvarner Wines Cooperative's strategic association, as well as the results of the conducted research. The fundamental question is whether wineries are satisfied with the association, and whether they have increased competitiveness and thus the profit of business on the basis of the association.

Strategic association

Strategic association refers to cooperation between two or more business entities with the aim of achieving common goals and benefits. This collaboration can take various forms, including joint ventures, alliances, franchises, licenses, and partnership agreements. For small business entities, strategic association represents an opportunity to overcome resource, knowledge and market access constraints.

Strategic association in the relevant references is often found under the term '*joint venture*'. The very definition of the term is not unambiguous, i.e., there are more definitions provided by different foreign and domestic authors, which indicates its complexity. This form of business combination includes different contents between the contractual relationship and the integration of two companies that have different areas of engagement, types of activities and goals that lead to their connection. Below are some of the definitions:

- *A joint venture* is an agreement by which two or more persons pool their assets and/or work for the purpose of realizing a predetermined business

venture, and which are unjointed after its fulfilment, with the contracting parties sharing the profit and bearing the loss in proportion to their share or agreement. (Gorenc, 1997: 63).

- *A joint venture* is an association of companies or individuals formed to undertake specific business projects. It is similar to a partnership but limited to a specific project (such as the production of a specific product or for the purposes of research in a specific area) (Khemani and Shapiro, 1993: 22).
- A *joint venture* can also be defined as a form of cooperation between two or more companies that, by pooling their resources, create a new entity that is independent in legal and business terms (Ćenan, 2006: 17).

Nevertheless, one comprehensive definition was set by the Working Group of Accounting Experts working within the United Nations. According to it, *a joint venture* is a contractual arrangement by which two or more parties pool their resources for the purpose of participating in the venture, its joint control, all with the purpose of achieving common goals (Pecotić, 2005: 36). Unlike mergers and integrations where one of the two companies ceases to exist, joint ventures and investments result in the formation of a new business entity. The overall business concept of the joint venture is based on the joint solidarity bearing of all positive and negative effects and risks in the ratio determined by the agreement: most often according to the partners' investment ratio. According to Malenica (2011: 24), there are a number of reasons that represent motives for the joint venture decision. Some of them are:

- Facilitated entry into foreign markets – various markets are characterized by diversity in terms of culture, market openness, government regulations, etc. Therefore, different markets can bring a number of opportunities to a company, but also different degrees of risk. It is precisely the obstacles that a company may encounter when entering new markets that motivate companies to enter into a kind of strategic partnership.
- Sharing of financial investments – a common motive for the decision to jointly invest is the lack of financial resources of one of the partners. Given that *joint venture* implies capital contributions of all parties, it is often the only option for companies with insufficient funds to realize a business venture.
- Political reasons – most often these are government regulations regarding ownership requirements. Namely, it often happens that governments, especially in developing countries, are not in favour of foreign subsidiaries owned by multinational companies. The strategy of entering the foreign market is dictated, i.e., the foreign companies are forced to establish joint ownership, which means that if some governments are not in favour of foreign subsidiaries, they condition foreign entrepreneurs to enter the domestic market by forcing them to cooperate through joint investment.
- Reducing the degree of risk – each business venture carries with it a certain degree of risk, political and/or financial in nature. If a business project is too demanding in terms of the level of investment of financial resources, associating with a partner or partners reduces financial risk. Associating with a partner from politically unstable country or countries hostile to

foreign companies and investors can greatly reduce political risk, or divide it.

- Increasing the level of competitiveness – all participants in the joint venture gain a competitive advantage based on different strengths. Merging the strengths of two or more companies can achieve an enviably better position in the market.

In addition to the above, according to Čudina (2014: 59), from the aspect of business planning, the reasons for the joint venture can also be the following:

- the project is too large for the company to carry it independently
- the project is too risky for the company to carry it out independently
- insufficient skills and experience to carry out the project independently
- the new project does not fit into the business image of the previous work
- joint venture should only serve as a form of business expansion with the acquisition of partners from the joint venture
- joint venture is to defend against a hostile takeover of the company
- joint venture will eliminate certain weaknesses in the business.

Resources as a motive for joint investments relate to the acquisition and retention of strategic resources, financial resources, raw materials and facilities, technology and knowledge, and profitable exploitation of by-products. Market and managerial motives relate to economies of scale, cost reduction, overcoming market barriers of market entry, restructuring of the product line in the maturity phase, diversification into the new product market, increasing barriers to entry of new competitors, and international mergers. Risks as motives for joint ventures relate to reducing risks by reducing costs.

Despite the fact that the interests of all partners are initially compatible, there is often disagreement. This is especially true for profit sharing. Disagreements also occur when partners have a different vision of the future of the company. While joint ventures are a business model commonly used by large and medium-sized enterprises, more and more small enterprises are also opting for joint ventures with larger enterprises or with more small enterprises as partners. Small enterprises that enter into a joint venture do so with the basic intention of acquiring experience and knowledge in order to improve the company's business, improve financial and management skills, expand basic business capabilities, and enrich technical skills within the company. In addition, through strategic association and joint venture, small enterprises expand their business through access to greater financial resources, a wider range of services, increased credibility, and greater access to markets. When forming contractual joint ventures, there is a convergence of the method of formation and the legal form of the joint venture. There are two methods of forming a contractual joint venture: the contracting method (consortium) and the method of joint venture administration contract (Grubišić, 2007).

The contracting method is used in the formation of a joint venture for the execution of certain goals, with each partner in charge of its own business segment. It is often used in jointly controlled activities. The method of *joint venture administration contract* precisely determines the mutual division of management powers between partners and defines for which parts of the business is each partner responsible.

This method is used for jointly controlled assets. The similarities of the aforementioned methods are reflected in the fact that the partners do not pay the initial share capital, but stipulate mutual rights and obligations by means of a contract (Grubišić, 2007: 15). It should be emphasized that business entities optimize resources by associating. This includes financial resources, technology, human resources and infrastructure.

Through association, entities can reduce costs and increase business efficiency. Moreover, perhaps the biggest advantage is access to new markets. Partners can thus use their existing market channels and networks to expand their presence and increase revenues. In addition to these advantages, cooperation with other business entities encourages the exchange of ideas and knowledge, which can lead to increased innovation.
Partners can jointly develop new products and services, improve existing processes and technologies, and respond faster to changes in market conditions. One of the benefits of any partnership is risk reduction. By associating, business entities can share business risks. This is especially important for small entities that may not have sufficient capacity to cope with high risks on their own. Risk sharing reduces the potential negative consequences for individual partners. It should be pointed out that the motives for joint venture and association can be diverse, but they must be compatible for it to succeed.

The joint strategic association and venture agreement is the primary, and often the only document defining the ownership and management rights of the *joint venture* company's partners, especially when it comes to the contractual form. Once the joint venture agreement is concluded, a general consensus of the partners on all important issues of the joint venture has been reached, and after its conclusion, it remains only to establish *a joint venture* company. Today, very few cases of joint ventures are known in Croatia, while in the world there is a very significant and often applied way of associating with other companies. Before a company decides to joint venture, it should have a clear vision of expectations regarding such a relationship. Also, the partner's expectations should be clear, otherwise the expected outcome may go in the opposite direction, thus disrupting the relationship arising from the joint venture. It is necessary to understand how each partner will contribute in such a relationship and what this contribution will result in. Once this has been achieved, it can be said that it is cost-effective to enter into a relationship through a joint venture, and that this will contribute to faster growth of the company without the need for loans, increasing market share without the need for excessive advertising and profit growth with the provision of better services.

Kvarner Wines Cooperative

Kvarner, located between the Istrian coast and the Dalmatian regions, is one of the most interesting and diverse wine-growing areas in Croatia. Its unique geographical position, combination of marine climate and mountain influences, and rich cultural heritage create ideal conditions for the production of high-quality wines. Within this wine-growing region, the Kvarner Wines Cooperative's operations take place, which an organization that brings together local winegrowers and winemakers with the aim of promoting, preserving and improving the wine tradition of this area. The

reason for the strategic association was the untapped potential of wine tourism and the promotion of wines of indigenous Kvarner wine varieties with the promotion of the wineries themselves.

The most famous indigenous Kvarner wine varieties are: *žlahtina*, *belica*, *jarbola*, *gegić*, *sansigot* and *trojščina*. According to the data from the Croatian Food Agency, more than 200 hectares of vineyards were planted in the Kvarner region, of which about 150 hectares were planted with the *žlahtina* variety.
Annual production is estimated at more than two million litres of wine. Strategic association in the Kvarner Wines Cooperative arises as a response to the challenges of the modern market. The members are:

- Ružić Family Run Farm
- Plovanić vina Family Run Farm
- Eko selo Selce d. o. o. – Grand Village Estate
- Pavlomir d. o. o. – Pavlomir Wine House
- Estate Winery d. o. o. – Vinarija Katunar
- Gospoja p. z. – Gospoja
- Kuća vina Ivan Katunar Family Run Farm
- Šipun Wine and Nursery Craft – Vinarija Šipun
- Vrbnik Agricultural Cooperative
- "Nada" Vrbnik Hospitality and Trade
- Cissa d. o. o. – Boškinac.

The strategic association was inspired by cooperatives that operated in past centuries. Today, the Cooperative has become a key player in the development of the Kvarner wine culture.
It has provided its members with access to education, modern equipment and a common market presence. The winemakers of Kvarner are particularly proud of their sparkling wines, which have become a trademark of the region in recent years. The combination of the traditional method of sparkling wine production and indigenous varieties results in wines that win over wine lovers around the world. One of the key activities of the Kvarner Wines Cooperative is the education of members and the general public. Workshops, seminars, festivals, fairs and courses are regularly organized covering various aspects of viticulture and winemaking, from vine cultivation to marketing and wine sales. Also, the Cooperative actively participates in wine fairs, exhibitions and events, promoting Kvarner wines and their unique quality.

It should be pointed out that the Kvarner Wines Cooperative is a symbol of togetherness and solidarity of the local community. Through cooperation and mutual support, members strengthen their business and contribute to the economic development of the region. The goal of the Cooperative is to continue improving the production and promotion of Kvarner wines on the domestic and international market, and to preserve the rich wine tradition of Kvarner for future generations. Owing to the strategic association of Kvarner winemakers, Kvarner has become a recognizable wine region that attracts an increasing number of wine lovers and enologists with its diverse wines and unique approach. Tradition, innovation and togetherness are the fundamental values that the Kvarner Wines Cooperative

cherishes and emanates in their joint action. The foundation of success is a quality product, destination, gastronomy and strategic marketing.

If the Kvarner Wines Cooperative is compared with the theoretical part of the *joint venture*, it is evident that a new legal entity has been established to represent the set goals of the members. Each winery retains its independence. The Cooperative focuses on the promotion of wines and wineries, but encompasses a much wider range of activities. According to the business plan of the Kvarner Wines Cooperative, in addition to promotion, the association will also deal with education on table culture, i.e., wine tasting, organizing round tables, lectures and scientific conferences, and promoting products from the Kvarner wine subregion. Various collaborations have been established (Primorje-Gorski Kotar County, Lika-Senj County, Zadar County, Kvarner Tourist Board, Lika-Senj County Tourist Board, Zadar County Tourist Board, Centre for Agriculture and Rural Development of Primorje-Gorski Kotar County or Kašetica Primorje-Gorski Kotar Promotional Centre, City of Rijeka and Rijeka Tourist Board) through which the promotion and achievement of the set goals take place.

One of the long-term plans is to include other producers of Kvarner food and agricultural products, primarily those that are protected, such as olive oil from Krk and Cres, Krk *prosciutto*, Krk and Grobnik cheese, Bakar *baškot* pastry and Gorski Kotar liqueurs. The wineries primarily decided on a strategic association due to their joint appearance at fairs and events, but also due to the formation of a tourist product. Certain wineries offered a tour of vineyards and wine cellars in their range of services, but the product was underdeveloped. The goal is to create a complete product that will become part of the tourist offer throughout the year and achieve numerous advantages arising from the synergistic effect. Synergy refers to a situation in which the joint action of several elements produces a greater result than each individual element could achieve independently. Strategic pooling has enabled members to share resources that are not just related to marketing. Procurement of raw materials, equipment and technology at lower prices, owing to wholesale purchases, enables smaller wineries to access high-quality resources that they would otherwise find difficult to afford. Also, winemakers can consult on any problem in wine production and business with a member who has more experience or better technology.

It is positive that the Cooperative continuously organizes various trainings for its members, which improves the overall quality of wine and business. Through the sharing of knowledge and experience, Cooperative members adopt new technologies and innovations faster, which enables them to remain competitive in the market. Collective investment in the research of new varieties, cultivation methods and processing technologies contribute to the improvement of the products of each winery. The joint appearance on the market enables wineries within the Cooperative to achieve greater visibility and recognition. Associated wineries can afford professional marketing campaigns, participation in international fairs and exhibitions, and the use of various promotional channels. In addition, the Cooperative has greater bargaining power over suppliers and distributors, which can result in more favourable sales conditions and higher market share.

The synergistic effect of the association of wineries within the Kvarner Wines Cooperative is reflected in the increase in efficiency, quality, competitiveness and marketing activities. Through the sharing of resources, knowledge and experience and joint appearance on the market, the associated wineries achieve results that would be difficult to achieve individually. This collective approach not only strengthens the position of each individual member, but also contributes to the development of the entire wine-growing region. The next chapter will present the results of the research on increasing competitiveness through the strategic association of Kvarner winemakers.

Exploring the increasing competitiveness through strategic association of Kvarner winemakers

The research used a survey method, and an online survey was designed as a research instrument to collect data. The survey was targeted to members of the Kvarner Wines Cooperative, but the answers are anonymous, which allows participants to freely express their opinions and views without fear of condemnation or consequences, which increases the honesty of the answers and the reliability of the collected data. Also, the anonymity of the response encourages a higher number of respondents because they feel more secure and protected in terms of their privacy, which leads to a more representative sample and better-quality research results. All members of the Kvarner Wines Cooperative were surveyed. The research instrument contained eighteen questions. The four questions were open-ended in order to get additional ideas for quality cooperation with the aim of describing the advantages and disadvantages of the association. Other questions had answers offered. The concept of the questions is tailored to their business and the situations they encounter in their work. One of the authors is an active member of the Cooperative, which simplified the research process.
The research questions are:

1 Has the association of winemakers in the Kvarner Wines Cooperative increased their competitiveness in the market?

2 By strategically joining the Kvarner Wines Cooperative, have the members increased their profits?

Members of the Kvarner Wines Cooperative who participated in the research:

1. Vinarija Kapič
2. Kuća vina Ivan Katunar
3. Gospoja Family Agricultural Cooperative
4. Vinarija Plovinac
5. Ružić Family Run Farm
6. Nada Vrbnik Winery
7. Estate Winery Katunar
8. Vrbnik Agricultural Cooperative
9. Vinarija Šipun
10. Pavlomir Wine House

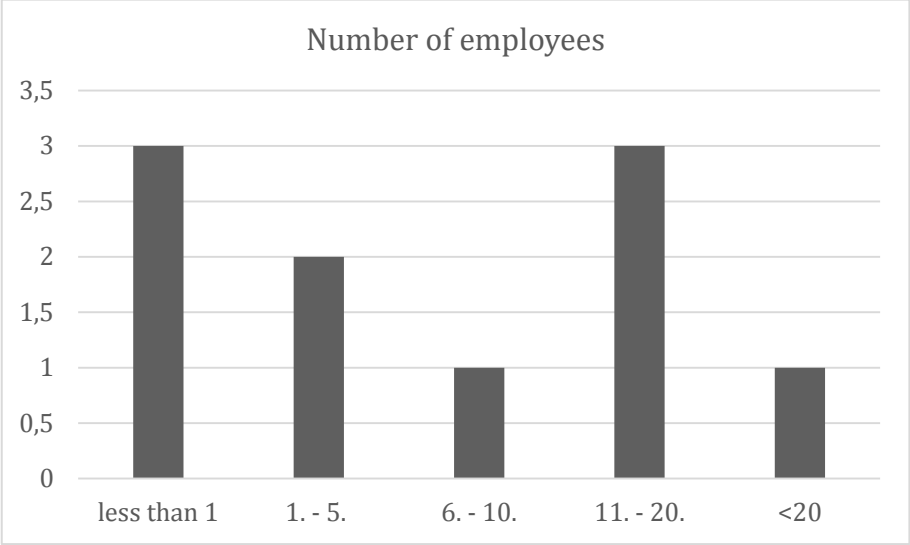

Figure 1 Number of employees
Source: created by the author

Figure 1 shows the responses about the number of employees in the surveyed wineries. It is evident that 6 out of 10 respondents have less than 11 employees. From the above, it is concluded that the respondents do not have enough employees for all market requirements. Of course, the number of employees is not related to the fulfilment of market requirements and the competitiveness of the business. It all depends on the industry in which the business entity competes. One of the authors is in constant contact with wineries and is familiar with the challenges of the mission. Almost all employees and owners of the surveyed wineries perform tasks of multiple business functions. They point out that they perform different tasks, which empowers them to learn quickly and respond effectively to business challenges. These functions are dynamic, but sometimes small business entities neglect certain aspects of business due to performing multiple functions. By strategically joining the Kvarner Wines Cooperative, wineries ensure a joint appearance on the market and can focus on product improvement and leave a certain part of the business to the Kvarner Wines Cooperative. A relatively small number of employees does not have time to perform all functions with the same quality. In a period when the focus is on harvesting and taking care of the vineyard, all employees are involved in the production process and neglect other activities. For these reasons, association is an ideal concept for the marketing activities of each winery.

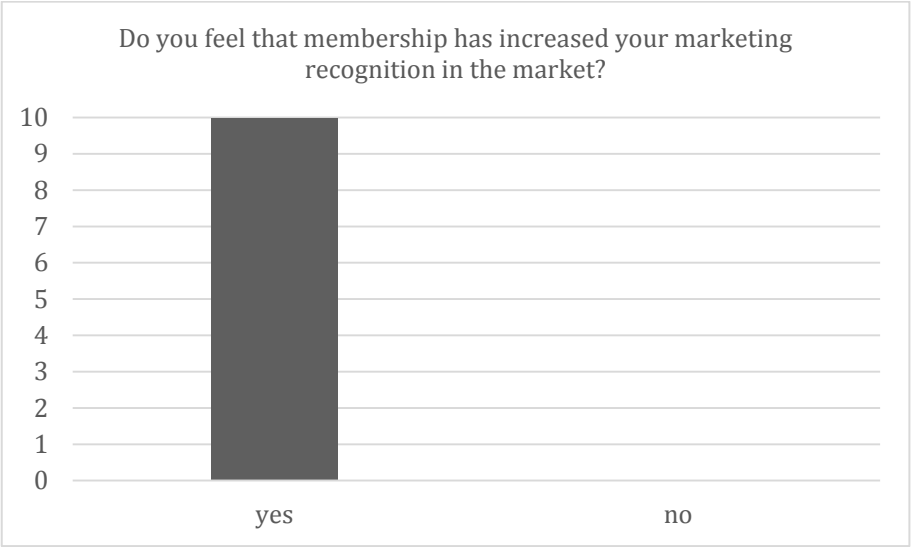

Figure 2 Marketing recognition on the market
Source: created by the author

Figure 2 shows the responses to the questions whether wineries believe that their membership in the Kvarner Wines Cooperative has increased their marketing recognition on the market. All respondents confirmed that their membership has increased their marketing recognition. Marketing is the foundation of competitiveness. It helps businesses build a brand that puts them in an advantage in the market. It also allows businesses to communicate effectively about the benefits of their products or services. Through various marketing channels, business entities can educate the market on why their products are better than the competition, which encourages sales. It should be emphasized that the foundation of the strategic association of the Kvarner Wines Cooperative is marketing, i.e., joint market appearance. A positive response to these questions is confirmed by the first research question "The association of winemakers in the Kvarner Wines Cooperative has increased their competitiveness in the market". By responding to this question, all respondents confirm their satisfaction with the cooperation, which means that the importance of the association will only grow from year to year.

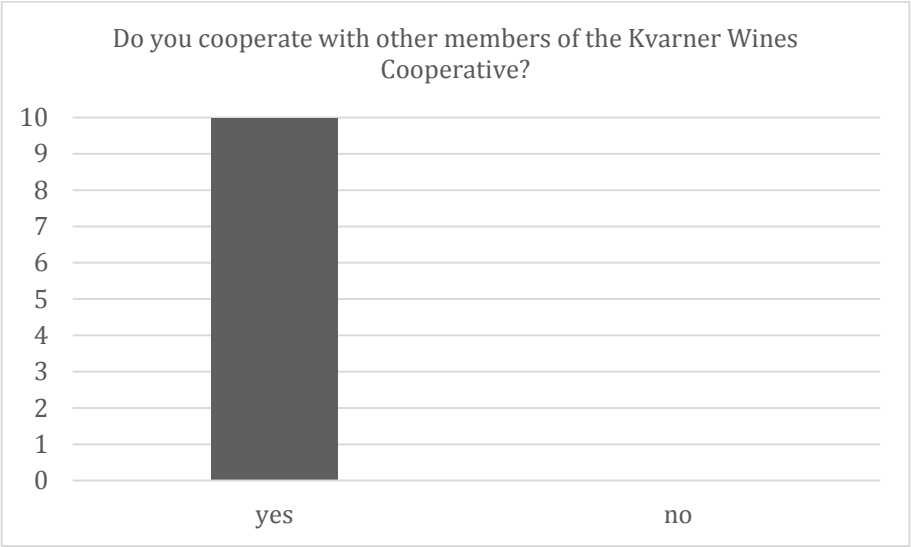

Figure 3 Cooperation with other members of the Cooperative
Source: created by the author

All respondents point out that they cooperate with other members of the Kvarner Wines Cooperative, which also confirms the first research question of the chapter. Cooperation increases competitiveness and resolves business situations more effectively, leading to a synergistic effect.

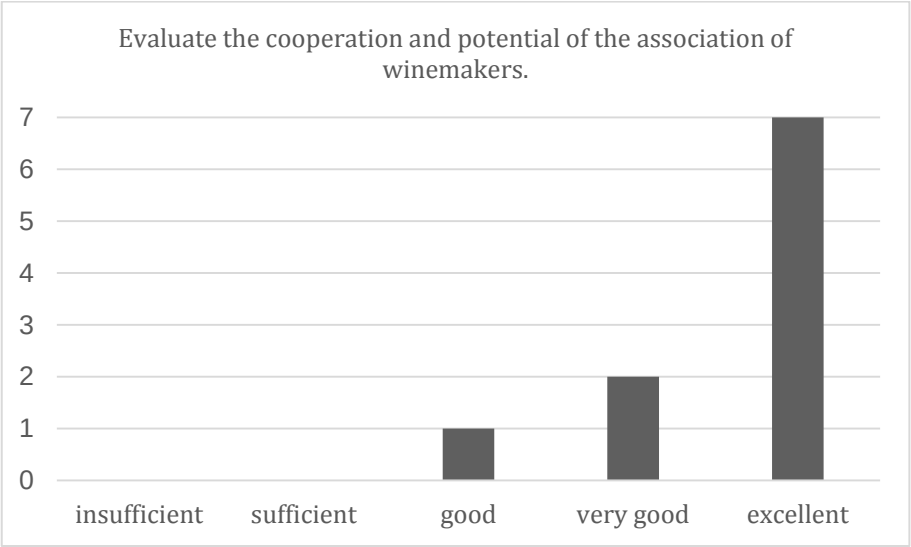

Figure 4 Evaluation of cooperation and potential of association of winemakers
Source: created by the author

Figure 4 shows the assessment of cooperation and the potential for association of the surveyed wineries. The average score is 4.6, which means that wineries consider cooperation and the potential of strategic association to be at an extremely high level. Wineries themselves must create a good product, but they must create a competitive product in the wine and tourism market through strategic cooperation.

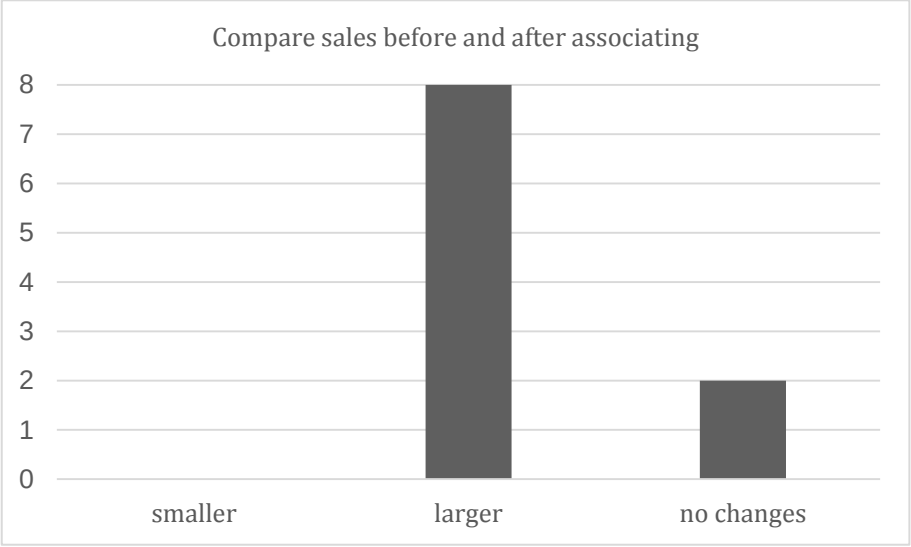

Figure 5 Comparison of sales before and after associating
Source: created by the author

The next set of questions examined financial indicators related to revenue, expenses and profit. Graph 5 shows the responses to the comparison of sales before and after the strategic association. Eight out of ten wineries increased sales, which confirms that strategic association has increased the competitiveness and profit of the business. Sales are the basis of business and profit because they represent the main source of revenue for the winery and every business entity. Without sales, a business entity cannot generate the revenue necessary to cover operating costs and make a profit. Sales also enable a business entity to reinvest in its operations, expand its market share and innovate its products or services. Ultimately, a successful sale creates a stable financial foundation that is crucial to the long-term growth and sustainability of the business entity. Two wineries that did not increase sales by strategically associating would have to analyse their business and communicate with other wineries about why this is the case. Associating is great for success because through conversation and cooperation, each member can learn and grow their business. The market is large enough and members are not seen as competitors, but as partners, which will lead to mutual success and positioning in the market in the long run.

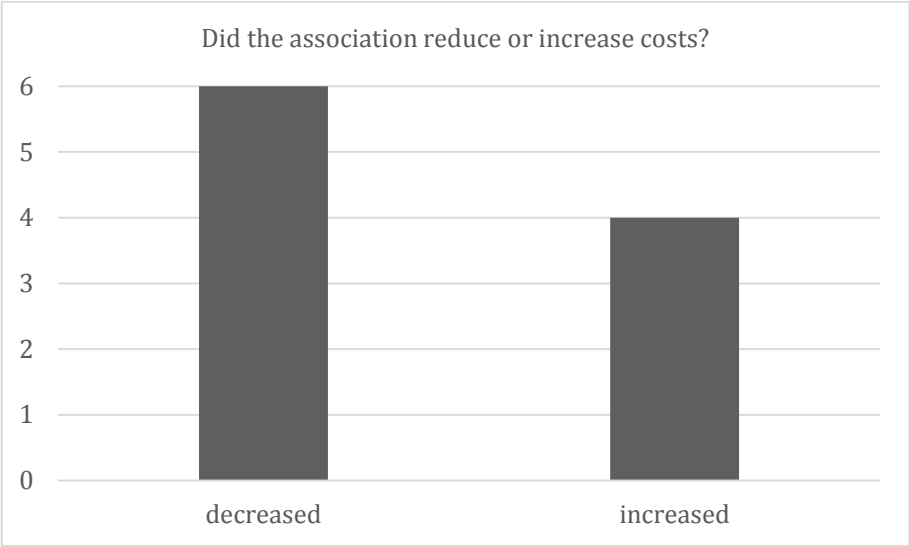

Figure 6 Comparison of costs before and after associating
Source: created by the author

Six wineries point out that the association reduced their costs, while four wineries point out that their costs increased. These answers require additional cost and business analysis. All member's marketing costs should have decreased due to joint association and appearance at fairs and other marketing channels.

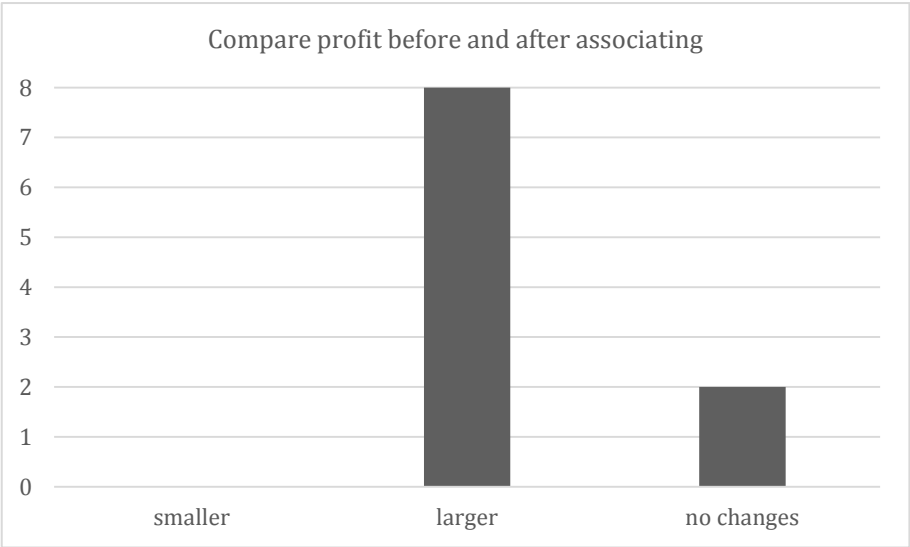

Figure 7 Comparison of profit before and after associating
Source: created by the author

Figure 7 shows the responses to the questions about the comparison of profit before and after entering in the Kvarner Wines Cooperative. Eight wineries point out that

their profits increased, while only two wineries did not have a change in profits before and after associating. The increase in profit for eight out of ten wineries is confirmed by the second research question of the chapter: "Have the members increased their profits by strategically joining the Kvarner Wines Cooperative?" It is positive that the positive results of the strategic association have proven to be extremely fast, which will further motivate wineries to work together, as well as motivate the growth and development of cooperation.

CONCLUSION

A joint venture is an agreement between two or more business entities that pool their resources for the purpose of participating in the venture, its joint control, all with the purpose of achieving common goals. Co-investment motives can be varied, but they must be compatible for them to succeed. Some of the most common motives are facilitating entry into foreign markets, sharing financial resources, political reasons, reducing the level of risk, increasing the level of competitiveness… The joint venture agreement is the primary and often the only document defining the rights and obligations of the partner, especially when it comes to the contractual form. Once a joint venture agreement has been entered into, consensus has been reached between the partners on all important issues of the joint venture.

Wineries are motivated to enter into a strategic association because by doing so, they increase their competitiveness. The biggest benefits are increased sales, new business collaborations, increased promotional activities, cost reduction and attracting new markets. This chapter explores the increase of competitiveness through the strategic association of Kvarner winemakers. The research included Kapić Winery, Kuća vina Ivan Katunar, Gospoja Family Agricultural Cooperative, Vinarija Plovinac, Ružić Family Run Farm, Nada Vrbnik Winery, Estate Winery Katunar, Vrbnik Agricultural Cooperative, Vinarija Šipun and Pavlomir Wine House. The research questions asked are confirmed. The association of winemakers in the Kvarner Wines Cooperative increased their competitiveness on the market and wineries increased profits by strategically joining the Kvarner Wines Cooperative. The future of strategic association brings new projects with more intensive cooperation, which will further positively affect the competitiveness, but also the cooperation of wineries. The basis of cooperation is marketing and joint appearance on the market. Kvarner wineries have great potential due to the superior product and the fact that they have realized the importance of strategic association, which brings a synergistic effect in business to everyone.

The research results can be used for the purpose of improving the joint action of business entities from the same or similar activity, but also serve as a framework for further research. It is recommended to conduct identical research in similar strategic associations in order to draw conclusions and define action guidelines. The fact is that the Kvarner Wines Cooperative meets the set goals to the satisfaction of its members, which does not mean that every association brings success in business. This research will be sent to all respondents and members of the Kvarner Wines Cooperative. It is recommended to conduct an identical survey at the end of each year in order for the association to monitor the wishes and needs of its members.

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SLOVAKIAN EXPERIENCE WITH THE PRESERVATION OF AUTOCHTHONOUS AGRICULTURAL VARIETIES

CHAPTER 26

Petra Medveďová *

ABSTRACT

At the beginning of the 18th century, the area of vineyards in the territory of today's Slovakia was approximately 57,000 ha, at the end of the 20th century approximately 38,000 ha, and in 2023 it was just over 13,000 ha. The aim of the chapter is to map the situation of grapevine cultivation in Slovakia in the period from 2019 to 2023, when the National Support Program was implemented within the joint organization of the wine market. The chapter focuses on must grape varieties grown in wine-growing areas with an emphasis on the registered vineyard areas for traditional varieties and the perspective of new registered varieties. It turns out that in the conditions of the Slovak Republic, the restructuring of vineyards is a priority, as vineyards are not only productive, but also a cultural and landscape-forming element. It is necessary to invest primarily in vineyards by changing the varietal composition of the vineyard in order to plant high-quality varieties and varieties traditional for the given region, by changing the vines of the vineyard in order to plant a new vineyard with a changed vine and moving the vineyards to higher quality areas while maintaining the original area of the production vineyard. The quality of vineyard production, the share of wines with protected designation of origin and protected geographical indication, and also the competitiveness of Slovak wines should be increased.

Keywords: *agriculture, varietal composition, vineyards, viticulture, wine, winemaking.*

INTRODUCTION

Viticulture and winemaking in Slovakia are among the most important traditional industries, and in recent years, their wines often make unexpected breakthroughs in the world of exclusive wines. Although Slovakia is a small wine-growing country, its wines and wine-growing regions deserve the attention of visitors who want to get to know the local wine, gastronomy, nature, culture and history.

Consumer preferences when choosing wines take several factors into account (e.g. pleasant color, taste and aroma, ecological production, guaranteed origin and quality). The price of wine is related to its product and quality (Karabagias et al., 2021). The composition of the wine depends on the grape variety, origin, vintage conditions, production. The vine can be affected by different effects of climate change, but also by the variety and location (Chacón-Vozmediano et al., 2021). We

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assume that the quality of the wine should be comparable within the same variety, but it can be affected by different factors such as their origin production, which is important from the consumer's side. Our wines are increasingly attracting the attention of consumers. Regional products, which can be awarded a Protected Designation of Origin (PDO) or a Protected Geographical Indication (PGI), are products whose quality is linked to their place of origin and local production practices. In Slovakia, the production of quality varietal wines with "designation of origin" or "geographical indication" has recently increased (Fikselová et al., 2021). In general, the designation of origin is one of the most important attributes when choosing a wine. For example, Skuras and Vakrou (2002) estimate that consumers are willing to pay almost twice as much for a certified product compared to a non-certified product. In Spain, Bernabéu et al. (2005) and in Italy Lai et al. (2006) show that the certification of origin is the most important attribute in wine choice orientation. Martinez-Carrasco et al. (2006) and Mtimet and Albisu (2006) also reached the same conclusions and emphasized that regardless of the type of designation (PGI, PDO) it is always in the first place among the criteria of consumer choice. The aim is to produce wine with a more international flavor and increase the potential market. Given the rather strict production specifications, the possibility of differentiating products by introducing new grape varieties could actually prove to be one of the possible strategies to promote the image of the viticulturist and to win over the consumer. Increasing knowledge of consumer preferences regarding typicity and wine is not only relevant for wine producers, but given increasing economic sustainability (Casini et al., 2014) is crucial for rural development. The development of traditional wine production can be seen as an opportunity to revive mature markets and support the sustainability of the production site. Valorizing the link between traditional production and the territory of origin could indeed bring potential benefits in terms of economic opportunities, environmental and social benefits (Thomé da Cruz and Menasche, 2014; Bernetti et al., 2013). The decrease in the area of vineyards, the reduction of the number of business entities in the industry and, consequently, the number of employees leads to an irreversible loss of viticultural and winemaking competences (Sokolić, 2023).

This contribution examines the situation of grape vine cultivation in Slovakia in the period from 2019 to 2023, when the National Support Program was implemented within the joint organization of the wine market. It describes special support measures to help the viticulture and winemaking sector in Slovakia, which are included in the National Support Program. It focuses on cider grape varieties grown in wine-growing areas with an emphasis on the registered area of vineyards for traditional varieties and the perspective of new registered varieties.

MARKET REGULATORY AND SUPPORT POLICY

The system of joint organization of the wine market is governed by European Union legislation (regulations) and national legislation (laws, regulations and decrees). Regulation of the European Parliament and the Council (EU) no. 1308/2013 of December 17, 2013 creates a common organization of markets for agricultural products and also establishes rules governing the allocation of Union funds to member states and their use by member states through five-year National Support

Programs. The Member States are responsible for the National Support Programmes, which serve to finance specific support measures to help the viticulture and winemaking sector. In accordance with Act no. 280/2017 Coll., the institution that implements the support program in Slovakia for the years 2014-2018 and 2019-2023 is the Economic Payment Agency. In 2018, the European Commission approved the National Support Program for the Slovak Republic for the period 2019 – 2023. From 15 April 2017, the Regulation of the Government of the Slovak Republic No. 83/2017 on the conditions for providing support within the framework of the joint organization of the wine market. The aforementioned regulation regulates the conditions for providing support from EU funds for the following measures:

- promotion
    - in a member state of the European Union,
    - in other than a member state of the European Union,
- restructuring of the vineyard,
- crop insurance,
- investments.

The promotion measure in a member state of the European Union is aimed at providing information to consumers with regard to the Union system relating to protected designations of origin and protected geographical indications, especially conditions and effects, in connection with the special quality, reputation or other characteristic features of wine resulting from a specific geographical environment or origin; on the responsible consumption of wine and on the risks associated with the consumption of alcohol through:

- information campaigns,
- participation in events, fairs and exhibitions at national or EU level held on the territory of the Slovak Republic or the territory of another EU member country.

The amount of the investment is at least € 10,000 and at most € 100,000. The rate of support represents 50% of the actual costs incurred.

The promotion measure in a country other than a member state of the European Union is aimed at:

- establishing relations with the public in the form of promotion or advertising and further developing awareness of target groups, promotional sales events, quality information materials;
- participation in events, fairs or exhibitions of international importance, tastings for distributors and journalists, meetings with traders and distributors, press releases and conferences;
- information campaigns aimed at Community systems relating to designation of origin, geographical indication and organic production, aimed at emphasizing originality;
- surveys of new markets necessary for the expansion of outlets.

The investment amount is at least € 3,000 in all four cases, no more than € 30,000 in the second case, no more than € 10,000 in all other cases. The rate of support represents 50% of the costs actually incurred.

The restructuring measure of vineyards is aimed at:

- change of varieties for the purpose of planting high-quality varieties and varieties traditional for the given region, while preserving the original area of the production vineyard; the measure can be combined with the measure of changing the clip, moving the vineyard or uprooting;
- changing the vineyard plot for the purpose of planting a new vineyard with a changed plot while maintaining the original area of the production vineyard; the measure can be combined with the measure of changing varieties, moving the vineyard or uprooting;
- transfer of vineyards to higher quality areas, higher quality regions and to slopes while maintaining the original area of the production vineyard; the measure must be combined with the grubbing-up measure, and at the same time it can be combined with the change of varieties measure and the measure of changing the clip;
- grubbing, which includes the removal of all vine trusses and supporting structures from the vineyard; the measure must be combined with the change of varieties, change of vines or transfer of the vineyard, which must be implemented within two years from the date of termination of grubbing.

The amount of support for the implementation of measures in the Bratislava region was determined to correspond to 50% of the average costs, and the amount of support for the implementation of measures in the other regions was determined to correspond to 75% of the average costs. In the case of measures to change varieties, change the vine or move the vineyard, three levels of support were determined, depending on the average planting density. The minimum planting density is 4,000 newly planted vine plants per hectare. The amount of total support per hectare is fixed. The amount of support for the restructuring of the vineyard is processed in Table 1.

Average number of vines per hectare	Measure: Change of varieties, change of vines or transfer of vineyard		Activity: Planting itself	
	Bratislava region	Other regions of Slovakia	Bratislava region	Other regions of Slovakia
4 000 to 5 000	14 878	22 316	8 403,50	12 604,25
5 001 to 5 682	15 985	23 977	9 510,50	14 265,25
5 683 and over	16 907	25 361	10 432,50	15 649,25

Table 1 The amount of support in the restructuring of the vineyard (€/ha)
Source: MPRV SR

During the restructuring of the vineyard, financial support is also paid for the activity of pre-planting preparation and for the measure of grubbing when combined with the measure of changing varieties, changing the vine or moving the vineyard without simultaneous planting. Support is set in €/ha. The amount of financial support is processed separately for the Bratislava Region and other regions of the Slovak Republic in Table 2.

Measure: grubbing-up when combined with the measure change of varieties, change of cluster or transfer of vineyard		Activity: Pre-planting preparation	
Bratislava region	Other regions of Slovakia	Bratislava region	Other regions of Slovakia
1 712	2 568	2 050,00	3 075,00

Table 2 The amount of support in the framework of the restructuring of the vineyard - addition (€/ha)
Source: ÚKSÚP Bratislava

By combining the measure of grubbing with the measure of changing varieties, changing the vine or moving the vineyard, the vintner can claim compensation for the loss of income of 550 €/ha. Compensation for loss of income is paid as a lump sum only once after the planting of the vineyard has been completed.
The crop insurance measure is aimed at providing support for insurance against:

- natural disasters,
- adverse weather events,
- losses caused by animals,
- occurrence of vine diseases,
- pest infestation.

Support for crop insurance can be provided in the amount of no more than 80% of the paid annual insurance premium, if the subject of the insurance contract is crop insurance against crop damage caused by an adverse weather event that can be compared to a natural disaster, or 50% of the paid annual insurance premium, if the subject of the insurance contract is crop insurance against damage to the crop caused by another adverse weather event that can be compared to a natural disaster, animals, vine disease, or pest infestation.

The measure of investment in wine enterprises includes:

- purchase of new barrels or containers that are made of wood, intended for storing or maturing wine, leading to the improvement of existing technology,
- investments in the labeling of wine products with new labels with a two-dimensional QR code used to quickly decode information about the origin of the wine (QR code).

The amount of the investment in the first case is at least € 5,000 and at most € 35,000, for the measure in the second case at least € 5,000 and at most € 50,000. Support will be provided in the amount of no more than 40% of eligible costs for investment in a business operated in the Bratislava region and 50% of eligible costs for investment in a business operated in the territory of other regions of the Slovak Republic.
Table 3 shows the provided financial support from EU funds for all measures within the National Support Program for the years 2019-2023.

Measure	2019/2020	2020/2021	2021/2022	2022/2023
Restructuring of vineyards	4 781 228	3 903 742	4 190 477	3 243 378
Vineyard harvest insurance	348 864	408 343	340 499	0
Promotion in a non-EU member state	36 254	51 341	6 787	19 763
Promotion in EU member states	23 467	50 000	100 000	50 000
Investments in wine businesses	406 928	288 039	309 483	385 001
Sum	5 596 742	4 701 466	4 947 248	3 698 143

Table 3 Supports of the common organization of the wine market paid from European sources in wine years (€)
Source: authors´ work based on PPA

The data in Table 3 shows that the financial support for all measures has decreased by 34% over the entire observed period, which corresponds to an average annual decrease of 13%. The largest financial resources were allocated to the measure of restructuring vineyards. In the future, Slovakia should endeavour to increase financial support in the area of viticulture, not only from EU sources, but also from its own sources, so that the support measures are more effective.

VINEYARD REGIONS IN SLOVAKIA

The Slovak wine-growing region is located along the southern border of the country and, according to the legal classification, it is divided into six wine-growing regions: Malokarpatská, Južnoslovenská, Nitrianska, Stredoslovenská, Východoslovenská and Tokaj. These viticultural areas are defined as geographical areas with different climatic conditions for viticulture (ÚKSÚP, 2022). In terms of wine, the largest of them is Malokarpatská, where viticulture today is tied to the south-eastern slopes of the Little Carpathians, around Hlohovec and Skalica. The smallest and most exclusive is Tokajská, which is closely related to the area of the same name in Hungary and is limited to only a few municipalities. The Tokaj vineyard region has precisely defined conditions for growing vines and producing wines.

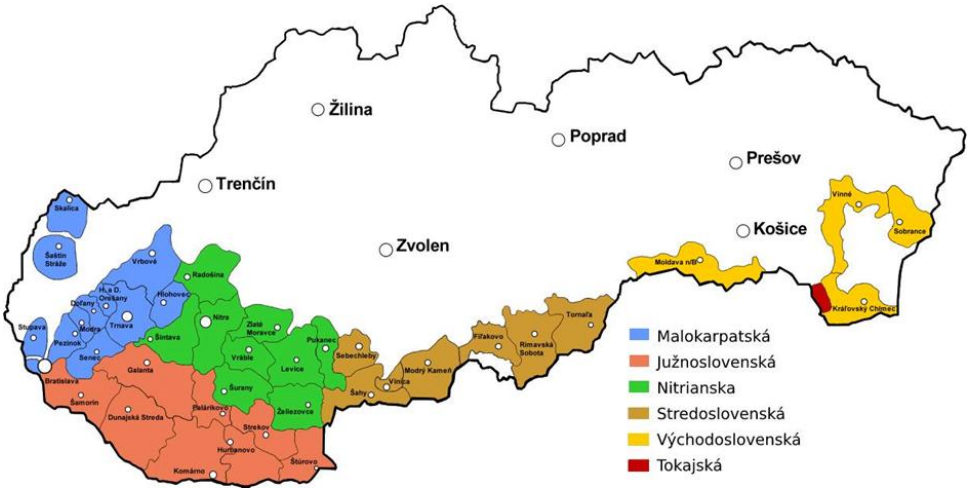

Figure 1 Wine-growing regions in Slovakia
Source: MPRV SR

According to the Vineyard Register of the Slovak Republic, the total area of vineyards in wine-growing areas is based on Act no. 313/2009 Coll. on viticulture and winemaking registered on July 31 of the relevant year. The economic wine year lasts from August 1. of the previous year until 31.7. of the respective year. However, the area of Slovak vineyards is decreasing year by year. According to the Vineyard Register of the Slovak Republic, as of 31 July 2023, the total area of vineyards registered was 13,199.43 ha. An overview of the registered total area in hectares (ha) divided into the area of bearing vineyards, non-bearing vineyards within three years and uncultivated vineyards is presented in Table 4.

Year	Total area	Bearing vineyards	Non-bearing vineyards	Uncultivated vineyards
2020	15 080	11 090	1 131	2 859
2021	14 641	10 452	858	3 331
2022	14 364	10 570	1 442	2 352
2023	13 199	11 952	664	583

Table 4 Registered total area of vineyards as of 31.7. of the respective year (ha)
Source: ŠÚ SR

The trend of the decrease in vineyard areas, which has been ongoing since 2013, continues even in the period of implementation of support measures in the years 2019 to 2023. During the observed period, the total area of vineyards decreases, the areas of uncultivated vineyards and barren vineyards up to 3 years of age also decrease, but there is an overall increase in productive vineyards. The overall reduction in uncultivated and unproductive vineyard areas can also be influenced by the financial resources from the support programme, with most of the financial

resources being allocated specifically to the measure of restructuring vineyards. The impact of the decrease in areas for the cultivation of cider grape varieties in the monitored period did not have a downward trend for wine producers. Despite the fact that Slovakia is not self-sufficient in wine production, the overall number of wine producers has increased. It is likely that domestic wine consumption has increased due to the corona crisis. Due to the fact that the gastro segment was closed and also the winemakers' own stores, wine stocks remained in the cellars. The largest number of registered wine producers in the observed period is in the Small Carpathian wine-growing region. Only the Východoslovenská wine-growing region registered a slight decrease in wine producers.
As of 31/07/2023, 802 active winemakers were registered in the register, which was the most since 2020. The number of producers of wine products in the monitored years by winegrowing region is processed in Table 5.

Wine-growing region	2020	2021	2022	2023
Južnoslovenská	125	125	127	133
Malokarpatská	319	321	383	407
Nitrianska	119	118	125	131
Stredoslovenská	39	39	40	42
Východoslovenská	35	35	32	33
Tokaj	38	38	36	39
Outside the vineyard area	14	16	26	17
Sum	689	692	769	802

Table 5 Number of producers of wine products by viticultural regions in Slovakia as of 31.7. of the respective year
Source: authors´ work based on ÚKSÚP

The highest representation of 51% is for wine producers in the second largest wine-growing region, which is the Malokarpatská wine-growing region. In the Južnoslovenská wine-growing region, which is the largest wine-growing region in Slovakia by area, 17% of producers produce wine. The Tokaj winegrowing region is the smallest in terms of area, but due to its exclusive wine production, it has a representation of up to 5% of the total number of wine producers. The smallest 4% share is held by the Východoslovenská wine-growing region, where there is a slight downward trend in wine producers.

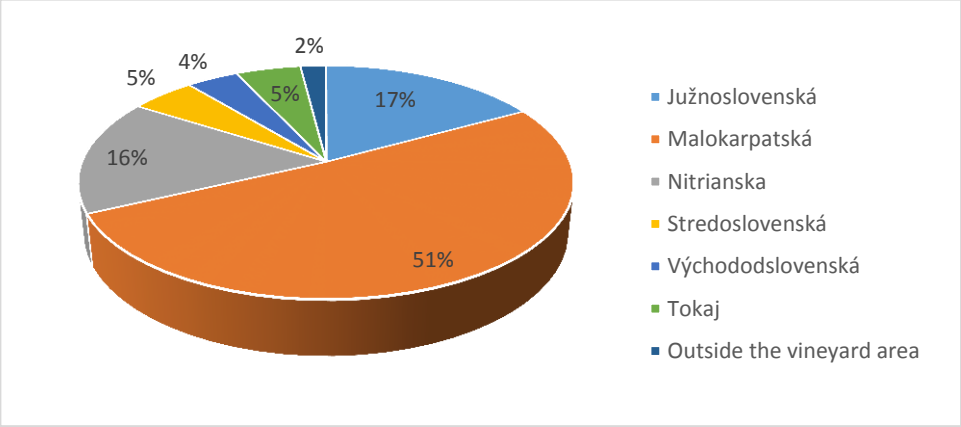

Figure 2 Representation of wine producers within the regions as of 7/31/2023
Source: authors´ work based on ÚKSÚP

VARIETAL COMPOSITION OF SLOVAK VINEYARDS

The Ministry of Agriculture and Rural Development of the Slovak Republic annually publishes the List of Registered Varieties, which lists the varieties subject to mandatory registration. Vine is included among other types of agricultural crops. Varieties that can be used for wine production according to the Act on Viticulture and Winery are registered in the deed, and their names can appear on bottle labels. The list of registered varieties for the year 2023 was compiled by the Central Control and Testing Institute of Agriculture in Bratislava as of June 30, 2023. All registered varieties of grape vine (Vitis) are suitable for the production of standard propagating material. There are 50 must grape varieties registered in this list for 2023 (of which 30 white musts, 3 Tokaj musts and 17 blue musts), 21 table varieties and 10 rootstock varieties for vines. The oldest varieties were registered in 1941, the others in 2011, 2016 and 2018. The oldest varieties were registered in 1941: Cider white (Müller-Thurgau, Neuburg, Riesling Rýnsky, Riesling Vlašský, Pinot Blanc, Pinot Gris, Silvan Green, Tramin red, Veltliner green), Cider Tokaj (Muscat yellow), Cider blue (Frankovka blue, Portugal blue, Pinot noir, St. Lawrence), table grape varieties (Chrupka white, Chrupka red). In 2011, the white cider varieties Breslava, Hetera, the blue cider varieties Hron, Nitria, Rimava, Rosa, Rudava, Torysa, Váh and the table varieties Bezsemenka, Heliotrop, Luna, Premier, Rhea were registered. The most recently registered varieties were only cider white, in 2016 Rothgipfler, Silvaner Roth, Zierfahndler Roth and in 2018 Hossa and Rizling Ritual (Ministry of Agriculture and Rural Development of the Slovak Republic, 2023).

Of the currently recognized 50 varieties of Vitis vinifera, it is permitted to produce high-quality wine. In Slovakia, the white varieties Veltlínské zelené and Riesling Vlašský dominate, while Frankovka blue and Svätovavrinecké dominate the blue varieties. Here we can meet the varieties that are planted all over the world Chardonnay, Pinots - blanc, noir, gris known in our country as Pinot Blanc, Blue and

Grey, Sauvignon, Tramín Red, Cabernet Sauvignon, Alibernet, Svätovavrinecké, Zweigeltrebe. In Slovakia, we can find varieties typical for Central Europe - Wallachian and Rhenish Rieslings, Pálava, Moravian Muscat, Müller-Thurgau, Irsai, Aurelius, Bouvier's grapes, Dievčie grapes, Feteasca regala, Neuburg, Veltlin red early, Veltlin green. From the blue varieties, they are André, Frankovka blue – a so far suppressed gem among blue varieties, but also Neronet. We can compare them with the wines of neighboring countries – Austria, the Czech Republic, Hungary – and discover the character of this Central European region – freshness, sparkle, harmony, zest for life. The real pearls are the varieties bred exclusively for us. In their taste, we present a piece of the country and at the same time a piece of our skill and heart - Devín, Milia, Noria, Dunaj, Silvanské zelené, Hron, Váh, Nitra. These are varieties that you will not meet anywhere else in the world. Tokaj varieties can also be added to them - Furmint, Lipovina, Yellow Muscat, whose unique cultivation and processing gives exceptional wines.
We are interested in the distribution of vineyard area for cider grape varieties. The distribution of the area of the varietal composition for selected white must varieties as of 31.7.2023 is in Figure 2. The Figure shows the dominant varieties Veltlínske Grüner and Riesling Vlašský, which are among the original varieties in Slovakia.

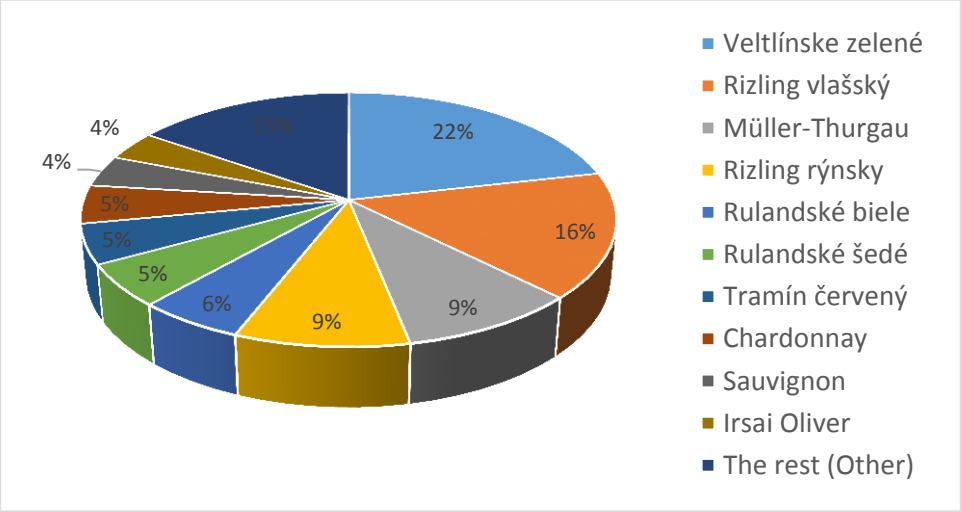

Figure 3 Areas of vineyards cider white variety as of 7/31/2023
Source: authors´ work based on ÚKSÚP

The variety composition for blue cider varieties is dominated by Frankovka blue, Svätovavrinecké and Cabernet Sauvignon, which are among the original varieties in Slovakia. The distribution of the area of the varietal composition for selected blue cider varieties as of 31.7.2023 is in Figure 3. The Figure also shows new varieties in Slovakia such as Dunaj and Hron, which were bred only for Slovakia.

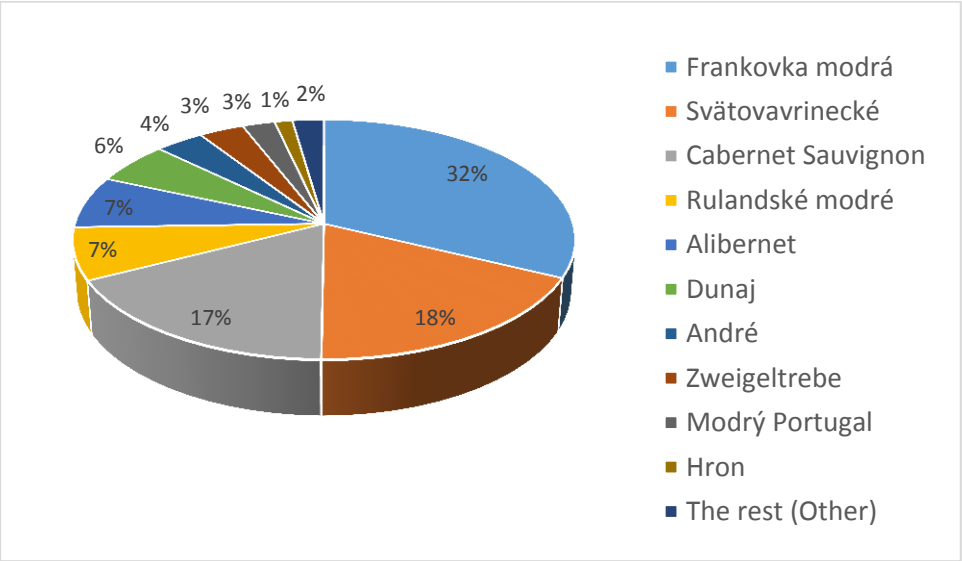

Figure 4 Areas of vineyards cider blue variety as of 7/31/2023
Source: authors´ work based on ÚKSÚP

For the overview of the varietal composition and area of the vineyards, we selected three white cider varieties - Rhenish Riesling, Wallachian Riesling, Grüner Veltliner, three Tokajské - Furmint, Lipovina, Yellow Muscat and three blue cider varieties - Dunaj, Frankovka blue, Svätovavrinecké. These varieties are the most represented in wine certification in the monitored period of 2020 to 2023. The total area in hectares (ha) is divided into the area of fruiting vineyards, non-fruiting vineyards up to three years and uncultivated vineyards. The varietal composition and surface area for musty white varieties in the monitored period of 2020 to 2023 is processed in Table 6. In the overview for white varieties, we see that the area under vines with a harvest for all selected varieties increased overall during the observed period, although the total area under vines for all observed varieties shows a downward trend. In the overview for musty white varieties, we can see that the trend of the decline in vineyard areas continues only for the Grüner Veltliner variety.

Year	Cider white variety	Total area	Bearing vineyards	Non-bearing vineyards up to 3 years	Uncultivated vineyards
2020	Rizling rýnsky	784,9	550,0	76,8	158,2
	Rizling vlašský	1685,4	1196,0	55,0	434,4
	Veltlínske zelené	2194,3	1609,7	61,1	523,5
2021	Rizling rýnsky	761,5	545,9	36,5	179,1
	Rizling vlašský	1620,5	1126,0	34,2	460,3
	Veltlínske zelené	2036,5	1042,4	23,7	970,4
2022	Rizling rýnsky	721,3	595,2	59,4	66,7
	Rizling vlašský	1462,0	1096,4	76,8	288,8

	Veltlínske zelené	1926,6	892,2	64,5	970,0
2023	Rizling rýnsky	762,9	699,0	27,0	36,9
	Rizling vlašský	1332,1	1257,2	42,1	32,8
	Veltlínske zelené	1793,6	1677,1	30,7	85,9

Table 6 Varietal composition and surface area of registered vineyards (white cider) in the Slovak Republic as of 31.7. of the respective year (ha)
Source: authors´ work based on ÚKSÚP

The exclusive and at the same time the most developing area is the Tokaj wine-growing area. It has the status of a special wine-growing area with a precisely declared territory of seven wine-growing municipalities, with a prescribed varietal composition and a special wine-making technology with stony and gravelly soils. The varietal composition and surface area for Tokaj cider varieties in the monitored period of 2020 to 2023 is processed in Table 7. In the overview for Furmint, Lipovina and Yellow Muscat, we can see that the trend of the decrease in vineyard areas for Furmint and Lipovina continues.

Year	Tokaj cider variety	Total area	Bearing vineyards	Non-bearing vineyards up to 3 years	Uncultivated vineyards
2020	Furmint	369,2	322,3	41,7	5,2
	Lipovina	212,5	188,0	20,5	3,9
	Muškát žltý	163,3	113,6	45,7	3,9
2021	Furmint	359,4	338,6	5,3	15,4
	Lipovina	208,5	189,0	7,7	11,8
	Muškát žltý	173,0	152,5	19,6	0,8
2022	Furmint	310,2	303,2	2,6	4,4
	Lipovina	196,3	177,6	16,6	2,1
	Muškát žltý	185,2	148,5	36,6	0,2
2023	Furmint	291,4	274,6	10,6	6,2
	Lipovina	166,9	157,5	7,3	2,2
	Muškát žltý	189,0	168,2	20,8	0,0

Table 7 Varietal composition of registered vineyards (Tokaj cider) in Slovakia as of 31.7. of the respective year (ha)
Source: authors´ work based on ÚKSÚP

The varietal composition and acreage for the three selected blue varieties, which are the most represented in the wine certification of the seventeen blue must varieties, is processed in Table 8. Two varieties Frankovka blue, Svätovavrinecké belong to the original varieties in Slovakia. The third Dunaj variety is a newly bred variety for Slovakia. In the overview for cider blue varieties, we can see the growth trend of fruiting vineyards for the Dunaj variety.

Year	Cider blue variety	Total area	Bearing vineyards	Non-bearing vineyards up to 3 years	Uncultivated vineyards
2020	Dunaj	155,6	122,7	29,3	3,6
	Frankovka modrá	1260,4	1045,0	54,4	161,1
	Svätovavrinecké	815,7	701,2	5,1	109,4
2021	Dunaj	175,8	133,1	39,1	3,6
	Frankovka modrá	1181,5	909,4	56,3	215,8
	Svätovavrinecké	772,8	643,4	3,9	125,5
2022	Dunaj	220,8	136,3	80,9	3,6
	Frankovka modrá	1257,5	1101,5	91,5	64,5
	Svätovavrinecké	805,5	735,8	10,0	59,7
2023	Dunaj	198,1	150,7	47,4	0,0
	Frankovka modrá	1131,0	1070,2	38,5	22,4
	Svätovavrinecké	632,6	620,1	7,5	5,0

Table 8 Varietal composition of registered vineyards (mustové blue) in Slovakia as of 31.7. of the respective year (ha)
Source: authors´ work based on ÚKSÚP

In the monitored period of the wine years 2019 to 2023, we processed the area of vineyards for all cider varieties from the registered area of vineyards according to the Vineyard Register of the Slovak Republic. From the overview, we can see a decrease in fruiting areas for cider whites between 2020 and 2022, but an increase in vineyard areas in 2023. There was an overall decline in the area under vines of Tokaj varieties between 2020 and 2023. There was a slight overall increase in the area under vines for red wine varieties. The largest overall decline was recorded for uncultivated vineyards, especially for white wine varieties.The total area of registered vineyards for cider varieties is in Table 9.

Year	Variety	Total area	Bearing vineyards	Non-bearing vineyards up to 3 years	Uncultivated vineyards
2020	Cider white	9 593,0	6921,0	737,2	1934,8
	Tokaj cider	745,0	624,0	108,0	13,0
	Cider blue	3825,6	3225,9	264,9	334,7
2021	Cider white	9310,1	6348,5	570,9	2390,6
	Tokaj cider	740,8	680,1	32,7	28,0
	Cider blue	3722,2	3051,8	250,4	420,0
2022	Cider white	8950,3	6169,3	954,4	1826,6

	Tokaj cider	691,7	629,2	55,9	6,6
	Cider blue	3960,4	3377,9	411,2	171,4
2023	Cider white	8355,9	7692,2	421,9	241,7
	Tokaj cider	647,4	600,3	38,7	8,4
	Cider blue	3517,1	3291,7	195,8	29,5

Table 9 Area of registered vineyards for cider varieties in Slovakia as of 31.7. of the respective year (ha)
Source: authors´ work based on ÚKSÚP

CONCLUSION

The aim of the work was to map the situation of grape vine cultivation in Slovakia in the period from 2019 to 2023, when the National Support Program was implemented within the joint organization of the wine market. We paid attention to the measures of the National Support Program, namely promotion in member states and non-member states of the European Union, vineyard restructuring, crop insurance and investments in wine enterprises. The total financial support from European Union funds for all measures has decreased by 34% over the period observed, which corresponds to an average annual decrease of 13%. The largest financial resources were allocated to the measure for the restructuring of vineyards. In the future, Slovakia should endeavour to increase financial support in the area of viticulture, not only from European Union funds, but also from its own resources, so that the support measures are more effective.

The total wine-growing area had a decreasing trend, it decreased by 12% in the observed period, the areas of non-cultivated vineyards and non-productive vineyards also decreased within 3 years, but the total area of vineyards in harvest increased by 8% in the observed period. The area of uncultivated vineyards recorded an overall decline of up to 80%. The overall decline in uncultivated and unproductive vineyards can also be influenced by the financial resources from the support programme, whereby most of the financial resources are provided specifically for the measure of restructuring vineyards. Slovak winegrowers should continue to focus on the restructuring of vineyards, as the funding provided has helped to reduce uncultivated vineyards and increase productive vineyards in the future.

The total area of vineyards had a downward trend, during the monitored period they decreased by 12%, but the total area of fruiting vineyards increased by 8% during the monitored period. The number of producers of wine products had an increasing trend, it increased by 16% during the monitored period. The highest increase in the number of producers of wine products was recorded in the Malokarpatska wine-growing region, where there is also the highest representation of wine producers, up to 51%.

The work was focused on cider grape varieties grown in wine-growing areas with an emphasis on the registered area of vineyards for traditional varieties and the perspective of new registered varieties. The varietal composition for white cider varieties is dominated by Grüner Veltliner, Riesling Vlašský, for blue cider varieties Frankovka blue, Svätovavrinecké and Cabernet Sauvignon, which are among the original varieties in Slovakia. For white cider varieties, there was a decrease in the total area of vineyards, but there was an increase in the fruiting areas of vineyards for all the monitored varieties. For Tokaj ciders, only Yellow Muscat has an increasing trend in both the total area and the area of fruiting vineyards. For the musty blue varieties, we can see the growth trend of fruiting vineyards for the Dunaj variety.

It turns out that the restructuring of vineyards is a priority in the conditions of the Slovak Republic. It is necessary to invest primarily in vineyards by changing the varietal composition of the vineyard in order to plant high-quality varieties and varieties traditional for the given region, by changing the vines of the vineyard in order to plant a new vineyard with a changed vine and moving the vineyards to higher quality areas while maintaining the original area of the production vineyard. This should increase the quality of vineyard production, the share of wines with protected designation of origin and protected geographical indication, as well as the competitiveness of Slovak wines.

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NOVELTIES IN WINE PROTECTION BY GEOGRAPHICAL INDICATIONS PURSUANT TO REGULATION (EU) 2024/1143 OF 11 APRIL 2024

CHAPTER 27.

Ivana Kunda *

ABSTRACT

Among the quality labels there are those that serve to protect various agricultural products, including wine. The legal framework governing the introduction and use of these labels reflects broader public policies - economic, health, cultural, and otherwise - within specific regions. The EU's Common Agricultural Policy has, for several decades, sought to enhance the protection of product quality while ensuring competitive advantages for a diverse range of agricultural goods. Due to its unique characteristics, wine has been subject to a distinct legal regime, which has evolved significantly over the past decade and was recently further strengthened by the adoption of the Regulation (EU) 2024/1143. The chapter provides an analysis of the new legislative provisions, it situates them within their broader context, and assesses their potential benefits and drawbacks.

Keywords: *agricultural products, wine, law, geographical indications, European Union*

INTRODUCTION

Croatian wine tradition

Since ancient times, people have recognised the quality of products, and manufacturers, right from the early stages of product exchange, marked their products to convey their quality to customers. Evidence of such practices, for example, from workshops producing amphorae in the Mediterranean, has also been recorded in our region (Starac, 2016). The contents stored in these amphorae, such as wine or olive oil, have been valued for their quality since antiquity (Dalby, 1996: 96 et seq.). This practice is closely linked to the fact that wine in ancient Greece and Rome represented a symbol of wealth and social prestige. It was enjoyed on festive occasions as well as during everyday meals, serving not only the basic function of quenching thirst but also bringing joy, pleasure and comfort. As one of the key elements of all Mediterranean cultures to this day, wine continues to hold a central place in contemporary gastronomy and oenology. Over the centuries, it has maintained its status as a symbol of cultural heritage, combining tradition, rituals and the enjoyment of taste, making it an essential part of the Mediterranean way of life. Croatia is also part of this living tradition, which includes the cultivation of vines

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Kunda, I. (2025). Novelties in Wine Protection by Geographical Indications Pursuant to Regulation (EU) 2024/1143 OF 11 April 2024, in book Katunar, J., Vretenar, N., Jardas Antonić, J. (eds), Agriculture Through Sustainability Perspectives, University of Rijeka, Faculty of Economics and Business, Croatia.

and wine production (Gašparec-Skočić, 2015; Baran, 2024). Today, Croatian wine tradition faces a number of new challenges, given that it is becoming increasingly difficult to attract customers on the global market, who are not only confronted with a more diverse offer but are also more enlightened and require more complete health, nutritional and geographical information about wine. Many countries have responded to this by introducing additional mandatory information.

Global wine market

The global wine market is subject to seasonal trends and the influence of various factors, including demand, economic growth, policies, regulations and safety standards, as well as crises and generational shifts. It is estimated that in 2023, the global revenue of the wine industry amounted to more than 330 billion US dollars and shows a growth trend (Statista, 2024), with the share of the Old World, particularly the trio of France, Spain and Italy, still unsurpassed despite the rise in production in New World countries. Recent research shows that consumers and wine producers from the Old World are facing a gradual decline in wine consumption and production. In contrast, in New World countries, some of the largest wine-consuming nations are experiencing strong and significant increases in wine consumption, while new wine-producing markets are showing rapid growth trends. Around 80% of countries belong to the group with a growing trend in wine imports, indicating the influence of globalization on the wine market and the growing demand for foreign wines (Ohana-Levi, Netzer, 2023).

The above, as well as the fact of declining global per capita wine consumption, suggest that it is becoming increasingly difficult to attract and retain consumers, making the focus on wine quality more important for its successful placement. A widely quoted thought from the early millennium is still highly relevant: "In the current competitive universe, the definition of quality and the information on qualities are from now on at the heart of the competitive strategies of economic actors" (Sauvée, Valceschini, 2003). Faced with fierce competition from wine regions around the world, the Croatian wine industry must continuously innovate and adapt to new trends. Consumers are becoming more demanding, seeking products that not only offer high quality but also provide a unique experience, a connection to the local terroir, and authenticity. In such an environment, winemakers must invest in the development of specific geographical indications, sustainable production, and effectively communicate the value of their heritage to stand out and gain the favour of the global audience.

Discussion plan

Therefore, before analysing legal issues, and without the intention of being exhaustive, a brief overview is given of the basic roles that quality marks, particularly geographical indications, have in light of the fierce global competition in the wine market. The effectiveness of the wine protection system through geographical indications established by legal regulations at the international and European levels largely determines how these indications will be used in practice and what benefits they will bring. The next part of this chapter is dedicated to the development of these regulations. After that, new legislative solutions at the EU level

will be subject to detailed analysis in order to identify changes and outline the contours of new parts of the legal framework for geographical indications for wine.

FUNCTIONS OF GEOGRAPHICAL INDICATIONS AND NECESSITY FOR THEIR REGULATION

Quality marks, especially geographical indications, have multiple functions when it comes to the success of product placement in the market. In general, the market for agricultural products, including wine, shows significant differences in quality. This market condition contributes to informational asymmetry because producers are the only ones who know the quality of the product in advance, while consumers risk buying a lower-quality product. This leads to negative selection and moral hazard, as observed in the used car market (Akerlof, 1970). As is well known, informational asymmetry negatively affects the market: consumers cannot distinguish between levels of quality, which discourages the production of high-quality products, while producers of low-quality products exploit this situation by selling their products at the same price as those of higher quality. Ultimately, higher-quality products are driven out of the market, resulting in an overall decline in quality, and the ability of consumers to satisfy their preferences is largely hindered. To address this problem, producers invest in quality labelling and reputation building, while consumers develop strategies such as repeated purchases and loyalty to a label or brand (e.g., Belletti, 1999).

Possible solutions for transmitting information to consumers about the properties of food products they trust can be adopted at the producer level or the legislative level (Loader, Hobbs, 1999). Producers regularly brand their products, which includes marking them with a stamp as an individual sign of origin, quality and lifestyle aura (Kunda, 2018: 1752–1755). However, in the European Union (EU), this has long been considered insufficient, and the legislator has recognised the role of geographical indications, which are granted in accordance with regulations through procedures in which competent authorities verify the fulfilment of certain criteria. Above all, geographical indications enable the protection and promotion of specific traditional products whose special characteristics are linked to, for example, their geographical origin, traditional production methods or unique excellence (Hasić, Rački Marinković, 2022: 115, 123). Legal protection of geographical indications allows the producer of such a product to turn higher production costs (as a result of specific and labour-intensive production processes) into greater income, while avoiding the exploitation by others of investment in their quality (Van Caenegem, 2003: 711). These indications also protect the product names from unfair trade practices such as imitation or exploiting reputation, thereby enabling consumers to more effectively recognise and build trust in the product they purchase. Furthermore, they provide a dual guarantee: the product's origin from a specific geographical area and the quality of the product (Van Caenegem, 2003: 709). The literature particularly emphasises that it is in the public interest for the consumer to know the origin and characteristics of the product they are purchasing (Martínez Gutiérrez, 2003; Von Mülhlendhal, 2008). As a form of intellectual property rights (and industrial property rights, as a subtype of intellectual property rights), geographical indications are collective and tied to the object of protection, rather

than to the holder, as is the case with other intellectual property rights, meaning they cannot be transferred or otherwise traded in legal transactions (Rački Marinković, 2015; Matanovac, Rački Marinković, 2006: 186). This, together with registration and monitoring procedures, reduces the risk of quality fluctuations and ensures a higher level of consumer trust. Finally, geographical indications can impact the sustainability of production in certain areas (e.g., in local and rural environments or family farms), ensuring fairer competition among producers and more even development within a certain state area (Bamley, Bienabe, Kirsten, 2009: 109–110; Vincek, Ljubišić, 2009: 221).

DEVELOPMENT OF INTERNATIONAL AND EUROPEAN LEGAL FRAMEWORK FOR GEOGRAPHICAL INDICATIONS FOR WINES

Through international agreements, states have attempted to respond to the need for mutual protection of geographical indications recognised in their national territories, but their economic interests have often diverged. As a result, many issues remained within the domains of national legislation. Although initially national labels, geographical indications have nevertheless taken on international and European dimensions, shaped by the activities of international organizations and the EU. Legal regulations and elements of the quality marking system, including geographical indications, have changed at the international and European levels in parallel with economic changes, so the initial part of this chapter is dedicated to this development. Given that both Croatia and the EU are bound by international law, the basic aspects of international protection of geographical indications are highlighted at the beginning. The legal framework for the protection of these indications in the EU is then analysed.

International legal protection of geographical indications

The Paris Convention for the Protection of Industrial Property from 1883 (NN-MU nos. 12/93 and 3/99) is the first multilateral international convention in the field of industrial property law that mentions geographical indications (Article 1, paragraph 2), but fails to define them. It specifically prohibits the use of marks that would falsely indicate the geographical origin of products (Article 10, paragraph 1). In addition to these false indications, deceptive indications are also prohibited as stipulated by the Madrid Agreement Concerning the International Registration of Marks from 1891 (NN-MU nos. 12/93, 3/99 and 12/08), followed by the 1989 Protocol (NN-MU nos. 13/03, 18/03 and 12/08).

The Lisbon Agreement for the Protection of Appellations of Origin and their International Registration from 1985 defined these indications (Article 4) and the acts of infringement (Article 5). This agreement applies only to appellations of origin (i.e., direct indications of origin that contain the name of a geographical area, such as a country, region or place). The subsequent Geneva Act of 2015 extended protection to all signs, both direct and indirect, including appellations of origin and geographical indications (Hasić, Rački Marinković, 2022). Protection is provided within the Lisbon Union for signs that are protected by the competent authority in the country of origin and registered in the international register of the World

Intellectual Property Organization (WIPO). Although Croatia has not acceded to the Lisbon Agreement or the Geneva Act, it is important to note that the EU acceded to the Geneva Act in 2019 (Official Journal L 271, 24 October 2019, pp. 15–29). This has dual consequences for all EU Member States from 2020 onwards. In the EU, all geographical indications registered in the WIPO international register are protected, except for those that have been rejected within one year in the territory of a particular Lisbon Union country. Also, all geographical indications registered at the EU level can be entered in the WIPO international register and enjoy absolute protection in all other state areas within the entire Lisbon Union. Therefore, for EU countries that are also Old World countries, it is crucial not only to develop their mechanisms to protect the reputation of traditional products but also to join international systems that allow for such protection (Ricolfi, 2009: 239), such as the one created by the Geneva Act. This has been confirmed by the recent accession of countries such as the Russian Federation and some African countries. Thereby the area of the Lisbon Union has been expanded, allowing the EU to extend the influence of its geographical indication protection policy (Rački Marinković, 2015: 672) to products other than wines or spirits, which are significantly more strongly protected under the TRIPS Agreement.

The overarching multilateral instrument specifically regulating geographical indications is the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement), in force since 1 January 1995, and in Croatia since 30 November 2000 (NN-MU no. 13/2000; Official Journal L 336, 23 December 1994, pp. 214–247, special edition in Croatian language, Chapter 11, Volume 74). This agreement sets minimum standards for the protection of geographical indications and additional protection for wines and spirits, as types of products requiring special regulatory treatment. It also requires World Trade Organization (WTO) members to provide legal mechanisms to prevent the use of geographical indications that would mislead the public regarding the geographical origin of goods or would constitute unfair trading. Although this agreement does not specifically detail how countries should do this, for wines and spirits, Article 23 provides that countries must ensure absolute protection regardless of the potential to mislead consumers. Interested parties must have access to legal remedies to prevent the use of geographical indications that identify wines for wines not originating in the place indicated by the geographical indication in question, even when the correct place of origin is indicated or when the geographical indication is used in translation or accompanied by terms like "type", "style", "imitation" and similar. A trademark registration for wines, containing or consisting of a geographical indication identifying wines, will be refused or invalidated for wines that do not have that origin. In the case of homonymous geographical indications for wines, each indication enjoys protection, and countries are responsible for establishing practical conditions for distinguishing these indications from one another, considering the need for equitable treatment of producers and protection of consumers from being misled. To facilitate the protection of geographical indications for wines, countries should agree to establish a multilateral system for the registration and recording of these indications.

Legal regulation of geographical indications in EU

From the very beginning, wine labelling in the EU was associated with special procedures and exceptions. The first EU regulation that addressed product labelling, the Council Directive 79/112/EEC of 18 December 1978 provided for a special procedure for the legal regulation of these matters, where the Council, on the proposal of the Commission, was to set rules for labelling ingredients. However, the Council never adopted such rules, despite the Commission's proposals. A similar situation continued with the adoption of the FIC Regulation (Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers, Official Journal L 304, 22.11.2011, pp. 18–63), since ingredient labelling requirements did not apply to beverages containing more than 1.2% alcohol by volume (Article 16, paragraph 4), except for the requirement to indicate the actual alcoholic strength by volume (Article 9). Member States were free to set additional labelling requirements for alcoholic beverages, including wines, which many did, resulting in a fragmented EU market in this area. Just as wine and spirits producers were inclined towards minimising health and nutritional information on product packaging, they were also keen to have stronger and stricter regulation of geographical indications in order to protect the reputational potential of wines and spirits linked to a specific geographical area, whether through climate or tradition. This is clearly evident from the analysis of regulations concerning geographical indications, where exceptions were foreseen for certain products to ensure stricter conditions and a higher level of protection, thereby granting a market advantage for products with authentic and traditional characteristics.

The functioning and development of the EU's common agricultural market was accompanied by the Common Agricultural Policy (CAP) (see Giuliani, A., Baron, H., 2023), which notably included the common organization of agricultural markets (COM) in various ways, depending on the type of product. After the establishment of the CAP in 1962, the Council adopted 21 COMs for particular product or group of products, each regulated by a specific basic regulation of the Council. Additionally, the Council adopted three regulations with special rules for certain agricultural products, but did not establish COMs for those products. Among the regulations that established a COM was Council Regulation (EC) No 1493/1999 of 17 May 1999 on the common organization of the market in wine (Official Journal L 179, 14.7.1999, p. 1), which has been amended multiple times over the years to adjust to emerging circumstances or to address identified shortcomings in existing measures. This regulation, among other things, prescribed rules for labelling wines, including origin labels in the EU.

Regulatory fragmentation by sectors resulted in the above-mentioned basic regulations having the same structure and many common provisions, but sometimes containing different solutions for the same or similar problems. With this in mind, as part of broader measures to simplify the regulatory environment of the CAP, a new regulation established a horizontal legal framework for the aforementioned basic regulations. The rules of the basic regulations were consolidated into a single legal instrument, with the sectoral approach replaced by a horizontal one, to the extent possible. This was achieved with the adoption of Council Regulation (EC) No

1234/2007 of 22 October 2007 establishing a common organisation of agricultural markets and on specific provisions for certain agricultural products (Single CMO Regulation) (Official Journal L 299, 16. 11. 2007, pp. 1–149). This regulation was amended in 2009 to include provisions on geographical indications and wine labelling in Chapter I, Section II, Part II, by inserting Section Ia on Designations of origin, geographical indications and traditional terms in the wine sector, and Section Ib on Labelling and presentation in the wine sector (see point 11 of Council Regulation (EC) No 491/2009 of 25 May 2009 amending Regulation (EC) No 1234/2007 (Official Journal L 154, 17.6.2009, pp. 1–56)).

The adoption of entirely new regulations, instead of simple amendments, proved necessary due to the scope of the regulatory reform, which was generally proposed in the European Commission's Communication to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions titled "The CAP towards 2020: Meeting the food, natural resources and territorial challenges of the future" (European Commission, 2010). In this communication, the Commission outlined potential challenges, goals and directions for the then CAP, but did not specifically mention geographical indications. However, this was addressed by the European Parliament, which emphasised that the development of food quality policy, including in terms of geographical indications, must be a priority aspect of the CAP and must be deepened and strengthened for the EU to retain a leading position in this field. It clarified that for these high-quality products, original instruments for governance, protection and promotion should be allowed, enabling them to develop in a harmonious manner and continue to contribute significantly to sustainable growth and the competitiveness of European agriculture (European Parliament 2011, paragraph 11).

Following this, Regulation (EC) No 1234/2007 was in effect until 31 December 2013, and was replaced on 1 January 2014 by Regulation (EU) No 1308/2013 of the European Parliament and of the Council of 17 December 2013 establishing a common organisation of the markets in agricultural products and repealing Council Regulations (EEC) No 922/72, (EEC) No 234/79, (EC) No 1037/2001 and (EC) No 1234/2007 (Official Journal L 347, 20.12.2013, pp. 671–854). This regulation applies to the wine sector, unlike some other products that are covered by Regulation (EU) No 1151/2012 of the European Parliament and of the Council of 21 November 2012 on quality schemes for agricultural products and foodstuffs (Official Journal L 343, 14.12.2012, pp. 1–29). Regulation (EU) No 1151/2012 was adopted to facilitate the realisation of greater benefits from quality schemes for the aforementioned types of products. However, it excluded strong alcoholic beverages, flavoured wines and wine products listed in Annex XIb of Regulation 1234/2007, except for wine vinegar (Article 2, paragraph 2). Therefore, geographical indications for the wine sector were subject to the previously mentioned Regulation 1308/2013.

By Regulation (EU) 2024/1143 of the European Parliament and of the Council of 11 April 2024 on geographical indications for wine, spirit drinks and agricultural products, as well as traditional specialities guaranteed and optional quality terms for agricultural products (Official Journal L 2024/1143, 23.4.2024), Regulations 1308/2013, 2019/787, and 2019/1753 were amended, and Regulation 1151/2012 was repealed. This new regulation, effective as of 13 May 2024, aims to improve the

protection of the agricultural sector by consolidating into a single, comprehensive framework previously regulated procedures, which were dispersed across separate legal instruments. This should, primarily, simplify the process of registering geographical indications.

NOVELTIES IN PROTECTION OF GEOGRAPHICAL INDICATIONS IN EU

At the beginning of this chapter, there is an overview of the types and characteristics of geographical indications for wines, followed by an analysis of the elements with an emphasis on the procedure for the registration of geographical indications for wines.

Types and basic characteristics of geographical indications

Although there are no changes in this segment following the new regulation, it seems appropriate to briefly mention the types and key features of geographical indications for wines that are recognised at the EU level. For completeness, it should be noted that for the purposes of EU Regulation 2024/1143, wine includes the forms listed in Annex VII of Part II of EU Regulation 1308/2013, including the following: 1. wine, 3. liqueur wine, 4. sparkling wine, 5. quality sparkling wine, 6. quality aromatic sparkling wine, 8. pearl wine, 9. carbonated pearl wine, 11. partially fermented must, 15. wine from dried grapes, and 16. wine from overripe grapes.

There are two types of geographical indications applicable to wines: protected designation of origin (PDO) and protected geographical indication (PGI). PDO indicates wine: i. whose quality or characteristics essentially or exclusively result from the influence of specific natural and human factors of a particular geographical environment; ii. originating from a specific place, region, or, in exceptional cases, a country; iii. produced from grapes exclusively from that geographical area; iv. produced within that geographical area; and v. obtained from grapevine varieties belonging to the species *Vitis vinifera* or from the crossing of *Vitis vinifera* with other species from the *Vitis* genus (Article 93, paragraph 1, subparagraph (a) of Regulation (EU) 1308/2013). This, among other things, means that all stages of wine production, i.e., any step in the production (including raw materials) or processing, preparation, or aging, up to the point at which the product is ready for market (Article 2, paragraph, 1, subparagraph (d) of Regulation (EU) 2024/1143), must be carried out in the specific area (region, locality, etc.). This applies to the cultivation of grapes and individual stages in wine production and treatment, such that all characteristics of the wine as the final product are directly related to that particular geographical area. It is important to mention that the Wine Act in Croatia stipulates that PDO is recognized at the level of the viticultural subregion, vineyard, and one or more vineyard sites (Article 30).

According to the amended definition, PGI indicates wine: i. whose specific quality, reputation or other characteristics can be attributed to its geographical origin; ii. originating from a specific place, region or country; iii. where at least 85% of the grapes used for its production come exclusively from that geographical area; iv. produced within that geographical area; and v. obtained from grapevine varieties

belonging to the species *Vitis vinifera* or from the crossing of *Vitis vinifera* with other species from the *Vitis* genus (Article 93, paragraph 1, subparagraph (b) of Regulation (EU) 1308/2013, as amended by Article 84 of Regulation (EU) 2024/1143). Thus, PGI for wine, among other, presupposes that at least one stage of production takes place in a particular area, and therefore, the quality, reputation or other characteristics of the wine can be attributed to that area. The production process, as defined in Article 93, paragraph 1, subparagraph (a), indent (iv) and subparagraph (b), indent (iv), includes all activities from the grape harvest to the completion of the wine production process, except for the harvest of grapes that do not come from the geographical area as defined in Article 93, paragraph 1, subparagraph (b), indent (iii), and excluding any post-production processes (Article 93, paragraph 4 of Regulation (EU) 1308/2013). Therefore, due to the difference between PDO and PGI, PGI is recognised for Croatia only at the level of the viticultural region (Article 30 of the Wine Act).

Wines for which a PDO or PGI has been registered must carry the appropriate label on their bottles so that consumers can easily recognise products that enjoy this protection, namely: i. the expression "Protected Designation of Origin" or "Protected Geographical Indication" and ii. the name of the PDO or PGI (Article 119, paragraph 1, subparagraph (b) of Regulation (EU) 1308/2013). For example, "Protected Designation of Origin", "DINGAČ".

Figure 1 Symbols for geographical indications for wines
Source: Ruralno,eu, https://ruralno.eu/files/sites/3/zoizozp.jpeg, photo by: Ministry of Agriculture and European Commission

What about the symbols that are increasingly visible on food products? The EU symbols presented above are designed to be easily recognisable by consumers and indicate a specific type of protection through geographical indications due to the special quality associated with the respective geographical area. The mandatory use

of the EU symbol on packaging and in advertising for agricultural products labelled with a geographical indication aims to help consumers become better acquainted with this category of products and the guarantees associated with them, as well as to enable easier identification of these products on the market, thus facilitating examinations.

However, when it comes to wines, there is no obligation to display the symbol and acronym; their use is optional. The labelling rules related to PDOs and PGIs in the wine sector remain the same after the adoption of Regulation (EU) 2024/1143, as they were in Regulation (EU) 1308/2013, but with the clarification that PDO and PGI acronyms can also be added to the label. Specifically, the optional inclusion of the EU symbol indicating either PDO or PGI is listed, and the new legislative intervention added the PDO and PGI acronyms to the list (Article 120, paragraph 1, subparagraphs (e) and (h) of Regulation (EU) 1308/2013).

The new Regulation explicitly prohibits the registration of generic terms as geographical indications (Article 28 of Regulation (EU) 2024/1143), while also stipulating that indications registered under the Regulation will not become generic within the EU (Article 26, paragraph 6). Additionally, in Article 29, the protection concerning homonymous geographical indications has been extended. It is specified that geographical indications will not be registered if they are submitted after a wholly or partially homonymous geographical indication has already been registered or applied for in the EU. An exception to this is allowed if there is a sufficient distinction in practice between the conditions of local and long-established usage and the presentation of the two wholly or partially homonymous indications, taking into account the need to ensure equitable treatment of the producers concerned and that consumers are not misled as to the true identity or geographical origin of the products. Furthermore, a wholly or partially homonymous geographical indication will not be registered if it would mislead consumers into believing the products come from another area, even if the name of the actual region or place of origin of the products is correct.

Procedure upon the application for the registration

In order for the status of PDO or PGI to be recognised for a specific wine produced in the EU, producers must come together and jointly submit an application for the registration of the geographical indication for that wine. The authorised party for submitting this application is only the "group of producers making the application" (see more in Articles 32–24 of Regulation (EU) 2024/1143), while other parties, such as public authorities, can only provide support in this process (Article 9 of Regulation (EU) 2024/1143). Exceptionally, the applicant may be a single producer (Article 9, paragraph 3 of Regulation (EU) 2024/1143).

This gathering of producers may be straightforward, or it could pose an initial barrier to submitting the application because producers of the same products often see each other as competitors, and it is not always easy to establish mutual cooperation. The main part of their cooperation consists of agreeing on the content of the specification (Article 49 of Regulation (EU) 2024/1143). It is important to understand that the specification does not represent a "final recipe" for uniform

action by all producers, but rather contains minimum standards that producers need to meet or frameworks within which they should operate (Rački Marinković, 2015: 675).

The application is first examined at the national level and then at the EU level. In the national phase of the process, which in Croatia is carried out by the ministry responsible for agriculture (Article 31 of the Wine Act, Official Gazette 32/19), the application for registration is examined to verify whether it meets the conditions for registration set out in the relevant provisions for wine, and a national opposition procedure is carried out (Article 10, paragraphs 1–5 of Regulation (EU) 2024/1143 and Articles 33–35 of the Wine Act). When the ministry considers that the conditions of Regulation (EU) 2024/1143 are met, it makes a positive decision and submits the application for registration to the European Commission (Article 10, paragraph 6 of Regulation (EU) 2024/1143), electronically, through the digital system (Article 14 of Regulation (EU) 2024/1143).

In the European phase of the process, the Commission examines the application for registration, taking into account the outcome of the national phase. Following the examination, the Commission publishes a single document in the Official Journal of the EU, and authorised persons may challenge the application or submit a notice of challenge or opposition (Articles 16–19 of Regulation (EU) 2024/1143). The examination should not last longer than six months from the date the application is received. If the Commission requests additional information or a modification of the application, the examination period should not last longer than five months from the date the Commission receives the applicant's response. In the event of delays, the Commission has a duty to inform the applicant in writing about the reasons for the delay and provide an estimate of the time for completing the examination within the following month (Article 15, paragraphs 2 and 3 of Regulation (EU) 2024/1143). This new regulation aims to expedite the procedure before the Commission, given the excessively long procedures in the past. However, it remains to be seen whether this goal will be achieved, as the proposed deadlines are only instructive in nature, and exceeding them does not lead to sanctions. The length of the procedures is partly mitigated by the transitional national protection, which Croatia provides in accordance with Article 11 of Regulation (EU) 2024/1143, during the period between the positive decision of the ministry and the decision of the Commission (Articles 36–37 of the Wine Act).

EU geographical indications register

After the Commission's approval, the geographical indication for the wine is protected and registered in the EU register. Although the Commission initially proposed a range of administrative responsibilities for the European Union Intellectual Property Office (EUIPO), Regulation (EU) 2024/1143 designates it as the competent body that will manage the EU geographical indications register starting from 1 December 2025. At that time, EUIPO will take over this responsibility from the Commission, which will remain in charge of its management until then (Article 11 of Regulation (EU) 1151/2012). All data will be transferred to the new register to maintain continuity of registrations (Article 93 of Regulation (EU) 2024/1143).

The current Register of Protected Designations of Origin and Protected Geographical Indications for Agricultural Products is available on the Commission's website under the name eAmbrosia (https://ec.europa.eu/agriculture/eambrosia/geographical-indications-register/) and contains separate segment for registered geographical indications for wines.

On 22 September 2024, this segment of the Register included 18 PDOs for Croatian wines, with the first entry in 2013 and the last in 2021. For comparison, on the same date, the total number of PDOs and PGIs across the entire EU is 1,636, with 1,191 PDOs and 445 PGIs. The Register also includes protected traditional terms, with 6 such terms for the Croatian area, in accordance with Articles 112 and 113 of Regulation (EU) 1308/2013 and the procedures established by Regulations (EU) 2019/33 and 2019/34.

In addition to being responsible for the Register, EUIPO has long been involved in other aspects of the protection of geographical indications for agricultural products, such as creating and maintaining the GIview database (https://www.tmdn.org/giview/), the most comprehensive searchable database for geographical indications, which will soon also include geographical indications for craft and industrial products.

Permitted and prohibited use of registered geographical indication

Since geographical indications are a collective right, all eligible producers in a designated area who wish to comply with the product specification can use them. Producers who meet the requirements of the protection specification have the exclusive right to use the protected names (Article 36 of Regulation (EU) 2024/1143), while others who may produce comparable products but do not meet the specification cannot use the protected designation.

Protected geographical indications for wines compete against other labels or signs in order to protect consumers from deception and prevent various abuses, including imitations and evocations. Furthermore, in relation to the TRIPS Agreement, EU law allows for the protection of protected geographical indications not only for identical and similar products but also for entirely different ones, provided that it is proven that the reputation of the protected designation is being exploited (Resinek 2007: 449). Specifically, geographical indications registered in the EU Geographical Indication Register are protected from: (a) any direct or indirect commercial use of the geographical indication in respect of products not covered by the registration, where those products are comparable to the products registered under that name or where use of that geographical indication for any product or any service exploits, weakens, dilutes, or is detrimental to the reputation of, the protected name, including when those products are used as an ingredient (with the exception in Article 27); (b) any misuse, imitation or evocation, even if the true origin of the products or services is indicated or if the protected name is translated, transcribed or transliterated or accompanied by an expression such as "style", "type", "method", "as produced in", "imitation", "flavour", "like" or similar, including when those products are used as an ingredient; (c) any other false or misleading indication as to the provenance, origin, nature or essential qualities of the product that is used on

the inner or outer packaging, on advertising material, in documents or information provided on online interfaces relating to the product concerned, and the packing of the product in a container liable to convey a false impression as to its origin; (d) any other practice liable to mislead the consumer as to the true origin of the product (Article 26, paragraph 1 of Regulation (EU) 2024/1143).

Protection applies to goods on the EU market or intended for it, including: (a) goods entering the customs territory of the EU but not yet released for free circulation within that area; (b) goods sold remotely, such as in electronic commerce; and (c) goods intended for export to third countries, with customs protection also available to producer groups, individual producers, and inspection bodies and authorities responsible for geographical indications (in Croatia, the ministry responsible for agriculture) (Article 26, paragraphs 3 and 4 of Regulation (EU) 2024/1143 in connection with Article 3, paragraph 1, subparagraph (d) of Regulation (EU) No 608/2013 of the European Parliament and of the Council of 12 June 2013 concerning customs enforcement of intellectual property rights and repealing Council Regulation (EC) No 1383/2003 (OJ L 181, 29.06.2013, pp. 15-34)).

New provisions also establish the responsibility of online market service providers under Article 43 of Regulation (EU) 2024/1143. Specifically, any information related to the advertising, promotion, and sale of products available to individuals or businesses in the EU that conflicts with the protection of geographical indications as stipulated in Articles 26 and 27 of this Regulation is considered illegal content under Article 3, paragraph (h) of Regulation (EU) 2022/2065 of the European Parliament and of the Council of 19 October 2022 on a Single Market For Digital Services and amending Directive 2000/31/EC (Digital Services Act) (OJ L 277, 27.10.2022, pp. 1-102). Thus, geographical indications are covered by the additional legal regime established by the latter regulation. Accordingly, the relevant national judicial or administrative bodies of Member States may, in accordance with Article 9 of Regulation (EU) 2022/2065, issue an order to remove such illegal content, and under Article 16 of Regulation (EU) 2022/2065, any person can notify hosting service providers about the presence of illegal content that infringes a protected geographical indication, triggering user protection mechanisms with all the associated duties and responsibilities of the service providers.

Additionally, special rules governing the relationship between registered geographical indications and trademarks (Articles 30 and 31 of Regulation (EU) 2024/1143) now also address relationships with domain names (Article 26, paragraph 2 and Article 35 of Regulation (EU) 2024/1143) and with national rules regarding names used for agricultural products, wines and spirits, which must not cause confusion with registered geographical indications (Article 26, paragraph 3 of Regulation (EU) 2024/1143). Therefore, under the alternative dispute resolution systems concerning national top-level domain names in the EU, protected geographical indications must now be recognised as rights that can be invoked for the deletion or other action related to a specific domain name.

Cooperation in enforcement and control of compliance

While the procedure upon the application for registration is divided into national and European phases, the subsequent enforcement and control of compliance with the rules of the specification for a given geographical indication by producers and the authenticity of the respective products belong within the responsibility of the Member State of origin of that designation. Given the increasing need for cooperation, collaboration between administrative bodies is foreseen for enforcement and control in accordance with Chapter IV of Regulation (EU) 2017/625 of 15 March 2017 on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products (OJ L 95, 7.4.2017, pp. 1–142). Furthermore, under Article 76 of Regulation (EU) 2024/1143, the Commission may adopt an implementing act on the nature and type of information exchanged by the Member States and the methods of exchange to combat illegal practices with cross-border effects. The new Regulation establishes controls only for spirits and agricultural products, while specific provisions for controlling wines remain unchanged in Regulation (EU) 1308/2013.

CONCLUDING REMARKS

At all levels of legislation and in all geographical indication systems, one constant is observed: the special status that wines enjoy. This privileged position arises from the deep historical and cultural importance of wine production and consumption, especially in traditional wine-growing regions. Given this rich heritage, it is not surprising that winemakers are strongly interested in preserving, and often further strengthening, their position in the market and ensuring attractiveness to consumers. The protective measures and legal frameworks developed for geographical indications for wines not only reflect this tradition but also aim to preserve the economic and reputational interests of winemakers in an increasingly competitive global market.

The EU's efforts in this regard are reflected in the continuous updating of regulations to respond to the challenges of the changing wine market and to ensure the implementation of new sectoral as well as horizontal policies. Regulation (EU) 2024/1143 introduces certain novelties regarding geographical indications, particularly in terms of the persons authorised to submit applications for protection, the procedure for handling applications, the register, infringements, the online environment, and cooperation in enforcement and compliance controls. In these aspects, the new Regulation has established a higher level of legal certainty and strengthened the legal position of winemakers in the protection of their geographical indications. While this should also ensure economic benefits for them and the regions in which they operate, the assessment can only be made in the future.

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NEW GRAPE VARIETIES FOR A NEW VITICULTURE AND WINEMAKING

CHAPTER 28

Tomislav Pavlešić *

ABSTRACT

The grapevine belongs to the longest cultivated plant species in the world. It is very polymorphic and within the species there is a large number of varieties (5,000-8,000). Most of it was created by ancient spontaneous crossbreeding, and they differ in numerous properties. However, they are all susceptible to downy mildew (Plasmopara viticola), gray mold (Botrytis cinerea), powdery mildew (Erysiphe necator) and the pest phylloxera (Daktulosphaira vitifoliae). In Europe in the middle of the 19th century, these diseases and pests did not exist. To this day, researchers and scientists have been trying to create ways to control these diseases and pests. The innovation of varieties has long been contributing to the progress of agriculture, and thus, new varieties - new hybrids may be a potential solution for viticulture and winemaking.

Keywords: *grapevine, varieties, crossing, diseases, innovations, new varieties*

INTRODUCTION

The grapevine (Vitis vinifera) is one of the longest cultivated plant crops that humans use both for food purposes and for the economy of the region and country where it is grown. Today, between 5,000 and 8,000 varieties are known in the world. The largest part of today's assortment was created by crossings, which resulted in numerous characteristics, and which enabled the spread all over the world. What characterizes most of these varieties is their weak resistance to fungal diseases.

It has been established that the vine has its roots in what is now Western Asia and Europe. Since the contact of the organism (vine) with the causative agent of the disease (mold and downy mildew) is a necessary prerequisite for the development of resistance, these varieties were significantly resistant to diseases caused by fungal infections. Hrgović Štir (2018) explains that "the introduction of these diseases from America at the end of the 19th century led to a great disaster and the end of the so-called 'old viticulture', in which the vines grew on their own roots and did not need protection from fungal diseases. Scientists therefore tried to find a solution to this problem which had significant economic and demographic consequences for viticulture". The problem could be solved in two ways. The first way was the

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significant and intensive use of chemical preparations, and the second was to create a variety or varieties that are resistant to these diseases.

European vineyards and wine production can be divided in three periods. The first is characterized by the absence of fundamental problems with diseases (absence of plant protection with chemical means). The second period is recognized as the one in which the vine faced three major problems: 1. powdery mildew, 2. phylloxera, and 3. vine blight. The third period is characterized by the intensive use of chemical protection measures, which continues to this day. Today, the fourth period is underway, in which climate change affects the fact that the variable climate in the countries becomes even more unstable, and extreme weather events are becoming more common and more frequent. Therefore, it is important to develop resistance and disease protection strategies, and one of the most effective solutions is the cultivation of varieties (hybrids) resistant to fungal diseases. Historically, innovations in viticulture have focused much more on sanitary and clonal selection than on plant breeding.

HISTORY OF NEW VARIETIES

A practical question for today's winemakers and winegrowers who want to plant a new vineyard and produce wine is how resistant vines they need. Three possibilities are open to them. The first is to plant existing varieties, the second is to wait a little bit longer and plant those varieties that are currently being made, and the third option is to wait a little longer and plant those varieties that are yet to be created. Breeding plants is a long process that used to take thirty years to create a new variety, while today this process takes ten to fifteen years thanks to selection using marker technology.

In Europe, especially in France, cultivation measures were implemented after the introduction of powdery mildew, phylloxera and downy mildew. Štambuk et al. (2021) explain that at the beginning of the second half of the 19th century, "the crossing of various resistant American species (V. riparia, V. labrusca, V. aestvalis and V. berlandieri) with high-quality European varieties began". The starting material was sometimes a cross between different species that had previously come from America (clinton, noah, herbemont, othello, delaware, jaquez, etc.). These cultivars often had a distinct unpleasant odor (which we now call a hybrid or "foxy odor") inherited from V. labrusca, an economically important species in the United States, which was one of their parents (Reisch et al., 2012). These varieties were later banned for wine production in most European countries, and breeders avoided them in subsequent attempts to create resistant varieties, which is still the most common association today, so the reputation of varieties created by crossing different species is related to their poor quality.

The first crosses in Europe began in 1875 in France and the results were known as "French-American hybrids". The obtained results showed a high resistance to diseases, but in terms of quality, the wines were very poor and an undesirable hybrid or foxy smell dominated. The second generation of French hybrids (around 1958), between the first hybrids and European varieties, showed a much higher quality of

wine. With awareness of the potentially negative impact of fungicides on the environment and human health, this breeding process continued in Germany, Hungary, Moldova and Yugoslavia. It resulted in the creation of varieties from which the production of high-quality and top-quality wines is allowed thanks to ampelographic properties that make it almost impossible to distinguish them from European varieties.

In addition to the activities of public institutes, private French breeders such as Albert Seibel, Georges Couderc, Eugene Kuhlmann and others carried out thousands of crosses, resulting in tens of thousands of new plants, where potentially those plants with the best characteristics were called "French-American hybrids" or "direct-production hybrids". The goal of this breeding research was to create an ideal variety that combines the quality of the European grape variety with the disease and phylloxera resistance of the American grape variety and does not need to be grafted onto resistant rootstocks (Štambuk, 2021). The wines produced from these varieties were of medium and/or lower quality.

The second generation of European crosses was created in the 20th century by the famous French researchers Bertille Seyve and Victor Villard. Štambuk (2021) lists some of the most famous genotypes Marechal Foch, Leon Millot, seyval blanc and chancellor, which inherited most of the genome of V. vinifera varieties, which improves the quality of their wines (Gessler et al., 2011). In 1929, the area of vineyards planted with French hybrids in France was about 250,000 ha, and the peak was reached in 1958 with about 500,000 ha (Toepfer et al. 2011). Due to the poor quality of the wine, which was not comparable to that of the vine varieties, and the resulting political decisions, the areas planted with hybrids began to decrease. In 1935, the French government banned the planting of hybrids and only allowed the planting of European grape varieties. Until that time, phylloxera was prevented by grafting on varieties with a rootstock that is resistant to it, while downy mildew and powdery mildew were dealt with by using chemical means. Štambuk (2021) states that "today, French-American hybrids are still commercially grown in the eastern United States and Canada (areas too cold for growing European vines), and in France, apart from Chambourcin, found in the Loire Valley, Baco blanc, from which they are made distillates in the region, Armagnac is commercially important" (Gessler et al., 2011). The bad image attached to French hybrids prevented the continuation of breeding programs in France, but countries such as Germany and Hungary began to use valuable French material for their own breeding activities (Toepfer et al., 2011).

In Germany (Geisenheim Grape Breeding Institute-Geisenheim; Julius Kühn–Institut-Geilweilerhof; Staatliche Weinbauinstitut-Freiburg) they continued intensive work and created other well-known European hybrids: orion, phoenix, regent, sirius, staufer, rondo, hibernal, saphira , principal, johaniter, merzling, cabernet cortis, monarch and solaris. Lesser known, but no less valuable wine varieties were created in Hungary, the most famous of which is bianca. In the former state of Yugoslavia, in Novi Sad, they created the famous varieties: petra, bačka, petka, cosmopolita, morava and panonia. Although the created varieties had very good quality and resistance, their legal status was not resolved satisfactorily. According to the wine law, wines could be produced exclusively from varieties that belonged to the botanical species Vitis vinifera.

Figure 1 Pannonia
Source: Recorded by: D. Preiner

Figure 2 Cabernet cortis
Source: Recorded by: D. Preiner

In Italy, the creation of resistant varieties began in 1998 by introducing resistance genes into elite grape varieties. VCR (Vivai Cooperativi Rauscedo) is a leading planthouse in Italy, testing new varieties that are resistant to cold weather or fungal diseases (monogenic or polygenic). VCR's experimental winery can vinify up to four hundred microharvests per year and carry out oenological evaluations of new selections. Štambuk (2021) claims that "the result was presented in 2015 with five white varieties (fleurtai, soreli, sauvignon kretos, sauvignon nepis, sauvignon rytos) and five black varieties (cabernet eidos, cabernet volos, merlot khorus, merlot kanthus, julius)".

Figure 3 Phoenix
(Bacchus x Seyve Villard 12-375)
Source: Recorded by: D. Preiner

Figure 4 Regent
(Silvanac x Müller-Thurgau) x Chambourcin
Source: Recorded by: D. Preiner

Štambuk (2021) further claims that "in 1996, the requirements of German breeders were met and the varieties (phoenix, staufer, sirius, orion, merzling and regent), which showed high wine quality and resistance to diseases, were listed as Vitis

vinifera varieties and were allowed to indicate protection of geographical origin. They argued this with the fact that the mentioned varieties are within the range of varieties of the noble vine and that they do not differ taxonomically and that they have the required and appropriate economic and oenological properties, which are comparable to Vitis varieties in terms of wine quality". Today, resistant varieties are in the focus of the public and the profession due to their environmental, health and economic advantages due to the problems associated with an excessive number of chemical preparations in the protection of vineyards, and thus in wine. "This influenced the change of attitude of the European Commission and adoption of a special regulation. Council Regulation (EC) no. 491/2009 according to which the highest quality designation (Protected Designation of Origin, PDO; or in Croatian, Zaštićena oznaka izvornosti, ZOI) can be obtained by wines that are produced exclusively from Vitis vinifera varieties, and the protected designation of geographical origin (Protected Geographical Indication, PGI; or in Croatian, Zaštićena oznaka zemljopisnog podrijetla, ZOZP), can also carry wines that are produced from crosses of the Vitis vinifera species with other species of the Vitis genus", as claimed by Hrgović Štir (2018). This led to the fact that with the help of new molecular-genetic methods (selection using molecular markers MAS - Marker assisted selection) breeding programs are carried out much faster and new hybrids/varieties are created with the development of the desired properties and characteristics.

Figure 5 Merzling (seyval blanc x (riesling rhine x pinot gris)
Source: recorded by: D. Preiner

DEVELOPMENT OF VARIETIES RESISTANT TO CAUSES OF DISEASE

Resistant varieties of grapevines are wrongly associated with the negative meanings of the first crosses that occurred at the very beginning of the application of interception hybridization, that is, in the second half of the 19th century. With today's use of proven materials, cleverly designed experiments and scientific achievements, the breeding process has experienced a complete paradigm shift. In recent years, it has resulted in varieties with excellent economic properties,

including high resistance to blight and mildew. These varieties are suitable for viticulture with significantly reduced use of fungicides and for ecological cultivation. Due to the positive impact on nature and human health, these production methods fulfill the objectives of the European strategy "From field to table". They soon began to have offspring that would inherit the resilience of the American species and the quality of the European line. "However, more than a hundred years of persistent breeding work was needed to achieve this goal, i.e. obtaining varieties of appropriate quality and resistance to fungal diseases. The phylloxera problem was solved relatively quickly by grafting vines onto American species whose roots are resistant to phylloxera, and this is considered one of the oldest and most successful examples of using resistant varieties in agriculture. In parallel with the breeding work to create resistant varieties, effective means to combat these diseases were sought. With the discovery of the fungicidal effect of sulfur and copper, a new era in viticulture began, and the chemical protection of vines is still an important technical procedure in viticulture today", according to Toepfer et al. (2011).

Fungicides and diseases

In Europe, and in other countries of the world, it was not possible to produce wine and grapes without protection from numerous pests and diseases. Traditional cultivars are particularly susceptible to downy mildew (caused by the fungus Plasmopara Viticola) and powdery mildew (caused by Erysiphe necator), two biotrophic pathogens introduced from America during the 19th century. The current strategy for controlling vine diseases (downy mildew, powdery mildew...) relies exclusively on chemical treatments, i.e. on the preventive use of pesticides. This practice significantly increases production costs (especially in rainy years), creates potential problems for health and the environment, and the possibility of the emergence of resistance in certain strains of E. necator (Merdinoglu et al., 2018; Kunova et al., 2021).

Plasmopara viticola (Plasmopara viticola)

The causative agent of grape rot was introduced to Europe from North America. At that time, they were intensively used as a rootstock for the American Vitis species, and this pseudofungus spread through their importation. Phylloxera appeared in Europe in 1874, and from France it spread to other wine-growing regions of Europe (Cvjetković, 2010).

Vine powdery mildew (Uncinula necator)

According to Cvjetković (2010), "...vine powdery mildew is the first disease of foreign origin on grapevines that appeared in Europe in 1845, and six years later it spread to all Mediterranean countries".

Gray rot of grapevine (Botrytis cinerea)

Grapevine gray rot is a disease that affects not only grapevines but also many other plants. It develops on the remains of flowers that are usually damaged by pests, diseases or hail. On cracked berries, the fungus creates a gray coating that later turns

black and dries. Spores spread from the dried mass and infect healthy berries if there is enough moisture. In addition to vines, the fungus also attacks flowers and shady and moist leaves in the spring. In the rare wine-growing years characterized by dry and warm autumn, he creates the so-called “noble mold” on grapes (Licul and Premužić, 1979).

Štambuk (2020) claims: "As the European (noble) grapevine (Vitis vinifera L.), which is dominant in cultivation, is susceptible to diseases (powdery mildew and downy mildew) introduced from the American continent, viticulture requires large amounts of plant protection agents, especially in compared to other agricultural crops." Taking into account the period between 1999 and 2009, the consumption of plant protection products in viticulture reached about 25% of all crops (without inorganic sulphur), for only 3% of used agricultural land, and that without a trend of reducing the amount (Muthmann, 2007; Butault et al., 2011). Powdery mildew is the main fungal disease of grapevines worldwide (Kunova et al., 2021). When it is not properly controlled, it significantly reduces the grape yield, thus endangering the quality of the wine (Scott, 2021).

"When it comes to the use of chemical agents for protection against diseases, the grapevine occupies a notorious first place among other agricultural crops. It is estimated that of all the pesticides used in agriculture in the European Union, about 50% are used on vines (of which 70 are fungicides), and only 8% are used on vineyards. The European strategy "From farm to table" aims to reduce the use of pesticides by 50% by 2030 and to increase organic areas from 8 to 25% of the land", according to Hrgović Štir (2018). Greater awareness of the protection of the environment and human health will reduce the use of pesticides to a minimum. The French government, for example, introduced the Ecophyto program, which aims to significantly reduce the use of pesticides by 50% by 2025, which in turn encouraged institutes across Europe to develop resistant varieties. One of the most effective methods of planting is resistant varieties. There is insufficient genetic variability within Vitis vinifera to improve resistance to major grapevine diseases.

Resistant varieties have again come into the public's focus due to justified calls to reduce the use of chemical preparations used in agriculture to protect plants, and thus also in viticulture, which is one of the largest consumers of fungicides, in order to protect the environment and human health. The European Union has set this as a strategic goal, and the social pressure to achieve this goal will also encourage winemakers and winegrowers to carefully study the qualities and flaws of new resistant varieties when planting new vineyards.

It is expected that wines in the future, especially organic wines, do not contain synthetic pesticides, fertilizers or other synthetic additives that could pose a greater risk than conventional cultivation for human health or the environment (Mann et al., 2010; Bonn et al., 2015). However, most classic or organic wine is produced from Vitis vinifera varieties that are highly susceptible to fungal diseases and pests, making production difficult for growers (Wiedemann-Merdinoglu and Hoffmann 2010). Depending on the country of origin, 20-70% of organic growers report problems with botrytis and powdery mildew in Europe (Collective 2008). Unlike conventional viticulture, which integrates a wide range of synthetic pesticides into

pest control programs, organic viticulture relies heavily on sulfur- and copper-based fungicides such as Bordeaux mixture to control major diseases such as downy mildew and powdery mildew, as well as a wide range of other diseases and insect pests (Provenzano et al., 2010).

ECONOMIC AND AGRICULTURAL ADVANTAGES OF DISEASE-RESISTANT VARIETIES

The advantages of growing cultivars resistant to fungal diseases are well recognized and accepted in viticulture, especially in growing and in the sector of organic wine production. Indeed, most V. vinifera cultivars have low to high susceptibility to fungal diseases that result in significant production costs and economic losses (Fuller et al., 2014). In Italy, the annual cost of downy mildew control in a conventional vineyard usually ranges from 8 to 16 million euros per year, depending on the pressure and intensity of the disease (Salinari et al., 2006). Under medium disease pressure, 12 treatments per season are required for traditional V. vinifera cultivars grown under conventional management (Rousseau et al., 2013). In a study that included 183 cultivars resistant to fungal diseases and grown in six different European countries, the number of fungicide treatments was reduced by 73% and 82% respectively in organic vineyards with low and medium disease pressure (Rousseau et al., 2013). In a study of 65 German vineyards under organic cultivation, growers reported that fungal disease-resistant cultivars had to be sprayed an average of 3.8 times per season (Becker 2013). It is estimated that the cultivation of cultivars resistant to fungal diseases could reduce production costs by two times in French vineyards (Galbrun 2008). In California, it has been estimated that powdery mildew-resistant cultivars could provide savings of up to $48 million per year (Fuller et al., 2014). Resistance to fungal diseases varies depending on the genetics of the cultivar and the place of cultivation (Pavloušek et al., 2014). Therefore, most grapevine varieties resistant to fungal diseases show some susceptibility to various pathogens, including downy mildew, powdery mildew, botrytis, black rot and anthracosis. In organic management, these diseases are generally controlled by the use of sulfur-based fungicides (Rousseau et al., 2013; Siegfried and Temperli, 2008). When copper-based formulations are needed, they are used at a much lower rate than for V. vinifera cultivars (Van Der Meer and Lévite, 2010). Eibach and Töpferu (2015) emphasize that "resistant varieties from the latest traditional breeding programs in various countries enable a 50-80% reduction in the use of protective agents in the fight against moulds. This means a considerable economic benefit, but also a huge environmental benefit. It is assumed that the reduced impact on the environment will also be a good argument for the acceptance of new resistant varieties by consumers".

Creation of varieties with resistance to fungal diseases

A new grape variety is always created when a vine is pollinated by another vine. Most modern grape varieties are hermaphrodites. A grape seed grows into a plant. A chardonnay vine cutting produces another chardonnay plant. But if you grow a chardonnay seed, that plant is something else. If the grape growing industry deliberately grew vines from seeds rather than propagating cuttings, the number of

grape varieties would be countless. The circumstances under which many grape varieties arose - spontaneously, intentionally or otherwise - are unknown. In a well-organized modern vineyard, random births of a variety are less likely.

Hybrid varieties are obtained by crossing two or more different species of Vitis (Vitis vinifera x Vitis amurensis) - interspecies crossing. Because of their characteristics, they are often called "modern varieties" or just hybrids, to distinguish them from noble varieties.

With the aim of obtaining higher-quality varieties resistant to fungal diseases, breeders repeatedly backcrossed interspecies crosses from previous breeding programs with high-quality V. vinifera varieties, so that with each further crossing, the share of the grapevine genome in the offspring increased. They form the basis for the further development of breeding, which today also aims to improve disease resistance and grape quality (Toepfer et al., 2011). Karoglan Kontić et al. (2016) claim that "despite good quality and resistance, the status of these varieties has not yet been satisfactorily clarified. According to legal regulations, the production of quality wines was allowed only from varieties that botanically belong to the species V. vinifera. In order to solve at least a formal part of the problem, in the nineties of the last century, German growers registered their varieties phoenix, staufer, sirius, orion, merzling and regent (which showed high quality and resistance in many years of testing) recognized as Vitis vinifera varieties. This is explained by the fact that according to their ampelographic properties they belong to the noble varieties of the grapevine, that is, they are taxonomically indistinguishable from them, and that they have appropriate economic properties and produce wines of comparable quality to Vitis vinifera varieties. After consideration of all relevant indicators and research results, their application was approved and the listed varieties were recognized as Vitis vinifera varieties in 1996, which for the first time enabled them to produce wines with geographical origin protection in certain wine-growing regions of Germany". Later, several dozen varieties were recognized according to the same principle, and their number is still growing. Growers from other countries (Hungary, Serbia) did not agree with this solution and continued to declare their resistant varieties as crosses, which made it impossible to produce wines with geographical origin protection from these varieties. Zini et al. claim that "due to ecological, health and economic problems related to the use of large quantities of plant protection agents in viticulture, resistant varieties are again in the center of public attention, which finally led to a change in the position of the European Commission." In 2009, Regulation (EC) No. 491/2009 according to which the highest quality designation (Protected Designation of Origin, PDO; protected designation of origin, PDOI) can be obtained by wines obtained exclusively from Vitis vinifera varieties, and the protected geographical indication (PGI; origin, PDO) can also obtain wines obtained by crossing the species Vitis vinifera with other species of the genus Vitis".

Crossing methods

Breeding for disease resistance in viticulture is based on 'resistance', i.e. the ability of the plant to defend itself against pathogens (Prell and Day 2001). The most promising option for reducing the need for fungicides in viticulture is planting resistant cultivars. In France, in 2000, the French National Research Institute for Agriculture, Food and the Environment (INRAE) launched the Inra- ResDur

(sustained resistance/durable resistance) breeding program. Cultivars bred in previous breeding programs generally carry only one gene for resistance to major diseases, which carries the risk of "breakthrough" resistance of virulent strains of the pathogen. Štambuk (2021) states as an example that "the variety regent, which carries the gene Rpv3.1, or bianca, which carries the gene Rpv3, has been observed to show symptoms of blight infection in certain cases. A similar pattern was observed in cultivars carrying the Run1 locus derived from the species Muscadinia rotundifolia, which is fully resistant to powdery mildew. Permanent resistance is a very important characteristic of perennial plants. In order to achieve a more stable resistance to pathogens, the breeding strategy is recently based on the combination of different resistance genes from different sources, as recommended by the OIV (International Organization of Vine and Wine)". The development of new selection methods, such as molecular marker selection (MAS), enabled selection that leads to new varieties with so-called polygenic resistance (they carry several resistance genes). Karoglan Kontić et al. (2016) claim that from a breeding point of view, "it is highly desirable to combine downy mildew and powdery mildew resistance genes (e.g. Rpv12 + Ren9) and have as many resistance genes as possible to the same disease (e.g. Rpv10 + Rpv3.3) in a new varieties in order to achieve the longest possible resistance. Based on the phenotypic assessment, it is difficult to determine the presence of resistance genes in a new breeding line. Therefore, molecular markers are an excellent tool for early detection of resistance genes and speeding up the selection process".

During the last decade, intensive genetic analyzes of some of them revealed several resistance loci. However, a decrease in resistance was already observed for the Rpv3 locus (resistance to Plasmopara viticola carried by the resistant cultivar bianca) and for the Run1 locus (resistance to Uncinula necator derived from Vitis rotundifolia). To ensure durability of resistance, the INRA-ResDur program used marker-assisted selection (MAS) to stack resistance factors derived from multiple sources. Therefore, MAS allowed us to monitor six resistance loci, Rpv1, Rpv3 and Rpv10 for downy mildew and Run1, Ren3 and Ren3.2 for powdery mildew. This strategy has led to the development of candidate cultivars that carry not just one but two or three genes to control each disease. The success of this program was the inclusion on the list of cultivars that are recognized in France (artaban, vidoc, freal and voltis), and which, based on the regulations of the European Union, may be produced as wines with a protected designation of geographical origin (20 new varieties are expected by the end of 2024). The inclusion of the first four Inra-ResDur varieties in the official catalog proved the concept of grapevine cultivars that combine polygenic resistance to powdery mildew and downy mildew with very good vineyard and wine quality performance. An accelerated selection procedure based on MAS and multi-location field trials was applied. The total duration of the process has been reduced to 15 years, from seed germination to catalog entry. The ResDur program has now been extended to regional breeding programs, in partnership with IFV and the wine industry. By 2030, the goal is to obtain cultivars with multilocus resistance and produce wines of regional character.

Karoglan Kontić et al. (2016) state that all these varieties were created by ordinary crossing, i.e. by hybridization and therefore have the characteristics of both parents. Those who buy and those who produce wine will find it difficult to separate

themselves from the varieties they know, and it will be even more difficult to accept something unknown and new. When breeding new varieties, the new cultivar tries to make its characteristics as similar as possible to the existing varieties of the noble line, which is why they are often given names related to the varieties that were used in crossings, claim Montaigne et al. (2016), and as examples they cite "German varieties souvignier gris (cabernet sauvignon x bronner) and cabernet cortis (cabernet sauvignon x solaris) or Italian varieties with names such as merlot canthus (merlot x 20-3 (Ud. 31-122), cabernet volos (cabernet sauvignon) x 20-3 (Ud. 32-078) or sauvignon nepis (sauvignon x bianca), which is related to the cultivation of autochthonous varieties, the ideal solution would be the introduction of resistance genes into already known varieties".

With modern methods of genetic engineering, this can be achieved using recombinant DNA technology. The technology is based on the integration of specific genes, and newly created varieties can show improved resistance to biotic stress factors (pests and diseases) and abiotic stress factors (cold, drought) (Colova-Tsolova et al. 2009). The latest and most revolutionary technology for genome editing is certainly the CRISPR-Cas9 system, which currently serves as a promising tool for precise genetic engineering and for which Jennifer A. Doudna and Emmanuelle Charpentier received the 2020 Nobel Prize. The technology enables precise cutting or insertion of DNA sequences into the genome, which makes it possible to modify the genome of elite varieties and obtain a new variety in one generation.

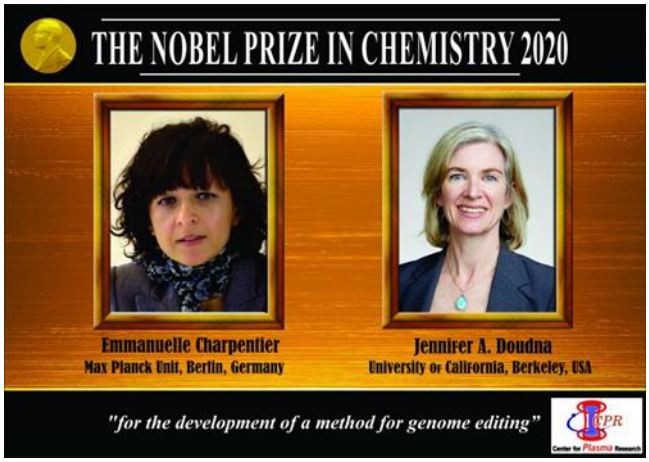

Figure 6 Jennifer A. Doudna and Emmanuelle Charpentier
Source: https://cpr.undip.ac.id/press-release-the-nobel-prize-in-chemistry-2020/

Hybrid varieties - "modern varieties"

Because of their often-excellent tolerance to powdery mildew, other fungal diseases, nematodes and phylloxera, they have become somewhat of a new focus of European breeding programs. They are also called Fungus resistant grape varieties/resistant varieties (English) or abbreviated PiWi sorten – Pilzwiderstandsfähige Rebsorten (German). Analogous to that, in Croatia they should be called “otporne sorte” or

resistant varieties or more precisely “sorte s otpornošću na gljivične bolesti” or varieties with resistance to fungal diseases.

RESEARCH IN CROATIA

Although they are not pure grapevine varieties, but rather hybrids, that is, crosses of grapevines with other resistant grapevine varieties, these varieties are considered grapevine varieties in the legislation of many wine-growing countries and as such are slowly entering the official variety lists of this country. During the last twenty years, more and more resistant varieties have been registered as a result of the breeding activities described above.

These varieties are seen in almost all European countries as grape varieties and are increasingly included in the assortment lists of individual countries. Karoglan Kontić et al. (2016) explain that "Croatia, as a member of the European Union, adapted its national legislation in the wine sector to the European one, which means that wines with a protected designation of geographical origin can also be produced from varieties created by crossing the species Vitis vinifera with other species genus Vitis. In order for new varieties to be recommended for cultivation in areas where they have not been cultivated before, it is necessary to conduct studies to determine the justification for their introduction. Based on the results of the introduction experiments, a recommendation is made for the entry of varieties into the National List of Recognized Vine Varieties, after which wine can be produced from them and placed on the market".

Based on the results, Štambuk (2021) emphasizes that "after several years of monitoring the varieties in the conditions of northwestern Croatia, the varieties merzling, phoenix, staufer, johanniter, solaris, regent and cabernet cortis were included in the National list of recognized grape varieties in 2014 and recommended for the western region of Croatia (subregions of Prigorje-Bilogora, Moslavina, Plešivica, Pokuplje and Zagorje-Međimurje). In the last twenty years, as a result of the described breeding activities, more and more resistant varieties have been registered. The resistance of these varieties is based on several genes (polygenic resistance), and their quality is constantly improving. In order to expand the list of resistant varieties on the National List of Recognized Varieties and recommend them for cultivation in other Croatian subregions. The Faculty of Agriculture of the University of Zagreb, in cooperation with the Zagreb County and the Kutjevački vinari Association, conducted an introduction trial that will determine their suitability for growing in our region. In the experiments, 22 new varieties grown in Germany, France and Italy were planted on the experimental grounds of the Faculty of Agriculture Jazbina in Zagreb and at three producers in the Kutjevo vineyard, where they are represented by a sufficient number of grafts for economic evaluation.
If we follow the cultivation styles of the strongest wine-growing countries in Europe, which strive to preserve the characteristics of their autochthonous varieties, the Faculty of Agriculture in Zagreb has come close to this goal through its research, so it is working on crossing Croatian autochthonous varieties with varieties bearing resistance to powdery mildew and downy mildew, as well as assessing sensitivity

varieties. Assortment selection is carried out in order to choose the best progeny for further research and selection.
Today, 17,277 ha of vines have been officially planted in Croatia (vine cadastre for 2023). Viticulture and wine production in Croatia have a strong and enviable tradition, and in some areas of Croatia they are even the only possible agricultural branch. Due to the different climatic and soil characteristics of the wine-growing regions in the Republic of Croatia, there are four regions: Slavonia and Croatian Podunavlje, Central Hilly Croatia, Croatian Istria and Kvarner and Dalmatia, or wine-growing zones B, C I, C II and C III(b).

In Croatia, viticulture and wine production takes place in different climatic and pedological conditions, which made it possible to develop many autochthonous cultivars. According to the data found in the national list of recognized vine cultivars, there are 258 varieties, of which about two hundred are recommended for the production of wines with ZOI or PDO (in Croatian, Zaštićena oznaka izvornosti, ZOI or Protected Designation of Origin, PDO). According to the data of the Agency for Payments in Agriculture, Fisheries and Rural Development, the most represented varieties are Graševina (32% of the area), Malvasia Istria (11.5% of the area) and Plavac mali crni (10.1% of the area).

Since the accession of the Republic of Croatia to the European Union, the wine labeling system with a protected label has been applied. The accession agreement at the EU level recognized 16 Croatian protected wine designations of origin (PDO). With the accession of the Republic of Croatia to the EU, at the request of the producer, two more labels of wine origin (PDO) and one protected geographical indication (PGI) for an aromatized wine product were protected.

WINE AND SENSORY PROPERTIES

The sensory properties of wine are always one of the most important factors in choosing a particular wine, while information about the technology of how the wine was produced and the reduced use of pesticides significantly increase the acceptance of wines that would not have been chosen organoleptically.

The European Union has set the reduction of the use of chemical agents in the production of grapes and wine as a strategic task. Consumer pressure to achieve this goal will also encourage grape and wine producers to change methods and varieties when planting new vineyards. However, this decision is not so simple because in a permanent plantation such as a vineyard it has long-term consequences. When choosing varieties, you should choose between old varieties with which there are already experiments and new varieties that could have better quality and resistance, but are not yet in long-term production. Researching the properties of varieties that have already been planted in different viticultural conditions will give winemakers important and essential information about the production method, as well as about technological solutions in the vineyard and cellar. The first and biggest problem of these new varieties is their (un)acceptance by consumers. One of the possible strategies is the sale of wine under fictitious names that have nothing to do with the name of the new grape varieties from which the wines are made, or the production

of cuvées from such wines. The most important factor in wine is its organoleptic properties, while information on the technology of wine production and the use of chemical agents are not currently in the primary interest of consumers. It would be desirable to create a specific labeling procedure for labeling wines that have been produced with reduced use of chemical agents.

Grapes resistant to fungi/fungal diseases (FRG = fungus resistant grapes)

FRG varieties contribute to improved disease management in organic as well as conventional viticulture, reduce production costs and copper accumulation in the soil. Recently, many FRG varieties have favorable agronomic and oenological properties, especially those developed for North America and Europe suitable for conventional and sustainable cultivation.

FRG varieties are almost completely absent from the wine market in major wine-producing countries, a situation that limits their spread as they remain unknown to consumers. The "problem of unknown varieties" is considered to be the biggest handicap for the marketing of FRG wines (Becker, 2013). As FRG cultivars carry non-V. viniferagenes (even at low levels), may suffer from the perception that interspecific hybrids produce low quality wines (Fuller et al., 2014). Similarly, organic wine has until recently suffered from a reputation of average quality (Collective, 2008).

Recent studies have shown that wine quality from FRGs is generally rated equal to that of V. vinifera (Van Der Meerand Lévite, 2010; Pedneault et al., 2012; Rousseau et al., 2013). For example, in a blind tasting of 52 FRG wines from Europe, 62% were red FRG varieties (24 wines tasted), including Cabernet Jura (VB 502), Cabernet (VB 91-26-17) and the old cross-breed Chambourcin (J. Seyve 26-205), was recorded as equivalent superior to Merlot (reference wine), and 31% of white (28 tested wines) was classified as equivalent or superior to reference Chardonnay wine, including interspecific varieties Gf. GA.47-42 (bacchus weiss X seyval blanc), saphira (Gm 7815-1) and solaris (Fr 240-75) (Rousseau et al., 2013). A consumer survey conducted in Switzerland concluded that 70-90% of consumers perceived solaris and maréchal fochwines as equivalent to V. vinifera riesling and zweigelt wines (which are used as reference wines), and 23-30% of consumers rated FRG wines as "clearly superior" compared to reference wines of V. Vinifera (Van Der Meer and Lévite, 2010). A consumer survey comparing 21 FRG red wines produced in eastern Canada with three imported V. vinifera wines described as the main selling products in this area found that 76% of the FRG wines were rated as equivalent or superior to the reference wines (Pedneault et al., 2012). Most FRG wines were blends that included marechal foch or frontenac with other locally grown FRG varieties (Pedneault et al., 2012).

CHALLENGES IN FRG WINE PRODUCTION

Recent findings (Manns et al., 2013; Slegers et al., 2015; Springerand Sack, 2015) show that many aspects of current oenological knowledge may have limited

application in FRG varieties, as most of them present specific biochemical changes. Therefore, special winemaking procedures should be developed for this grape.
Many varieties of FRG contain high levels of pectin that require the use of enzymes to increase the juice yield during pressing. High pectin levels are thought to increase the methanol concentration in FRG wine (Lee et al., 1975). However, research has shown that the level of methanol in FRG wines ranges between 20 and 197 mg/L, which is slightly higher than V. vinifera wines (26 – 111 mg/L), but significantly lower than the recommended limits of the OIV both for red (≤ 400 mg/L) and for white (≤ 250 mg/L) (Lee et al., 1975; Organization Internacionale de la Vigne et du Vin, 2011).

Most studies on the aroma of FRG wines have focused on the well-known foxy compounds that give the "hybrid character" to V. labrusca-based FRG wines. Recent GC/MS analyzes showed that most foxy compounds such as o-aminophenone and methyl-anthranilate are not abundant in FRG wines based on V. Riparia (Sun et al., 2011a). Similarly, no foxy compounds were reported in GC-O/MS analyzes of Frontenac wines from Minnesota (Mansfield and Vickers, 2009). Many FRG red wines are known for their fruitiness, but herbal notes are also present in certain varieties such as cabernet cortis, prior, regent and frontenac, among others (Mansfield and Vickers, 2009; Rousseau et al., 2013). Herbal notes could be associated with the presence of methoxypyrazine and/or C6 compounds such as hexanol and cis-3-hexenol in wine (Mansfield and Vickers, 2009; Pedneault et al., 2013). Methoxypyrazine levels have been shown to decrease significantly in Frontenac berries during berry ripening (Pedneault et al., 2013).

Historically, the tests carried out to improve the quality of FRG wines were primarily intended to reduce the appearance of unpleasant flavors by using different winemaking processes. In 1974, carbonic maceration was found to effectively reduce the foxy flavor in concord (V. labrusca) red wines (Fuleki, 1974). Carbonic maceration (CM) was originally developed to reduce oxidation reactions that occur spontaneously in grapes to preserve fruit flavors (Paul, 1996b). In organic wine production, limiting the contact of berries with air using CM can be of particular interest because organic grapes have been shown to have twice the polyphenol oxidase activity compared to conventional ones (Núnez-Delicado et al., 2006). White FRG wines such as Chardonnel, Solaris and La Crescent generally present desirable floral notes that may be related to compounds such as C13-norisoprenoids (e.g. damascenone) and monoterpenes (e.g. linalool) found in the berry skin (Cadwallader at al., 2009; Savits, 2014; Liu et al., 2015). In fact, prolonged skin maceration (24 h of cold maceration and 30 h of skin fermentation) significantly improved the intensity of floral notes in solaris wines, but also increased green vegetable notes (Zhang et al., 2015). In contrast, short-term cold maceration (3 – 8 h) did not improve the aroma intensity of traminetta wine (Skinkis et al., 2010).

A recent study reported for the first time the presence of 3-mercaptohexanol in FRG variety cayuga, at a concentration of 195 mg/L (Musumeci et al., 2015). This compound is a very odorpotent thiol (odor perception threshold: 60 mg/L) that produces the grapefruit aroma in white wine (Musumeci et al., 2015). Cayugawhite is a descendant of the seyval blanc (Seyve-Villard 5–276) variety that was often used during the breeding of the newer FRG varieties. This suggests that 3-

mercaptohexanol may be present in other FRG cultivars, although its presence has not yet been established. Based on this finding, viticultural (e.g., nitrogen status, disease control) and winemaking practices (e.g., oxidation control) that either enhance thiol production in berries, protect thiols during winemaking, or lead to thiol expression in wine may contribute to increased occurrence of tropical aromas in FRG wines (Musumeci et al., 2015). Blending is one of the most effective ways to optimize the aroma of SRN wines. Indeed, most FRG varieties have a very wide and rich flavor range, and many of them have complementary flavor profiles (Slegers et al., 2015). Blending can also significantly improve a wine's balance, particularly acidity, reduce bitterness, and improve the overall aroma of a wine. Such richness makes FRG variants suitable for a wide range of styles that have great potential to appeal to consumers.

The well-documented susceptibility of V. vinifera cultivars to major diseases such as powdery mildew, downy mildew and botrytis is a significant challenge in organic viticulture. Increasing the use of FRG varieties would provide significant benefits for organic and conventional growers, including reducing the number of treatments per season, increasing grape yields and reducing labor costs. In addition, the FRG would enable a significant reduction in the use of copper-based fungicides, thereby contributing to the reduction of copper accumulation in vineyard soils, especially in areas under high disease pressure. Consumer surveys have shown that wines produced from FRG varieties are at least equivalent and often rated as better than V. vinifera wines in terms of quality. Tests conducted over the last thirty years have shown that canopy management and wine production practices can contribute to improving FRG wine quality.

Further development of viticultural practices for FRG varieties is needed, focusing on the potential side effects of disease resistance that could hinder the development of high quality wines (eg PR-protein). The commercialization of FRG organic wines faces the double challenge of growing grape varieties that are generally unknown to consumers, and under organic management. Both France and organic wines have previously suffered from the production of poor wines, which has contributed to negative opinions among consumers regarding these products. Therefore, it is necessary to make significant efforts to prove and improve the quality of FRG organic wines and to make them accepted by consumers.

CONCLUSION

In their work, Karoglan Kontić et al. (2016) refer to the raising of experimental plantations of varieties resistant to fungal diseases of bačk, bianca, merzling, orion, pannonia, phoenix, sirius, staufer and regent at the experimental site of the Faculty of Agriculture Jazbina in Zagreb and show that after carried out physical-chemical analyzes of the wine and the results of the sensory evaluations, that the wines of all varieties are rich in alcohol, which, along with the appropriate acidity and high amounts of total extract, led to good sensory evaluation scores. The bianca and regent varieties stood out in terms of quality with an average rating of more than 80 points, but most years, wines were also produced from other varieties that the evaluators classified in the quality category. With most of the newly cultivated and

tolerant varieties, the hybrid smell is not felt in the wines, and their quality potential is such that by adapting the technology in wine production, quality wines can be achieved, with some varieties even being top quality. It is important to point out that these are new, insufficiently known varieties and that there is little experience with their technological requirements in wine production, so it can be said that in this area there is potential for improving quality and bringing them closer to traditionally grown wine varieties.

Štambuk (2021) claims that "the cultivation of resistant varieties is recommended in ecological viticulture, and it is also suitable for 'weekend winegrowers'." Due to the reduced use of chemical agents, the grapes of these varieties are particularly suitable for fresh consumption, but also as a raw material for other food, pharmaceutical and cosmetic preparations. The high sugar content and good acidity make grapes an excellent basis for the production of juices, jams, compotes and other products that are unfortunately not used in the right way in our country. After vinification, large amounts of grape pomace remain, which contain significant amounts of polyphenols that have numerous positive effects on human health. Lower production costs due to the lower level of protection and health value of these products are a good prerequisite for profitable production".

Although they are not Vitis vinifera varieties, but rather hybrids, i.e. crossbreeds of vines with other resistant vine varieties, these varieties, apart from disease resistance, have all the other characteristics for the production of quality wines.

Due to great motivation and desire for success, many breeders stuck to their idea of crossing different species despite numerous prejudices and misunderstandings. Today, there are many fungus-resistant varieties of enviable quality that can be compared to classic varieties. The term hybrids or crossbreeds is burdened with numerous negative controversies, but the public is gradually realizing that hybrids reduce the use of chemicals for protection against various diseases and pests, and this is exactly what leads to ecological awareness among producers, but also among the producers themselves, because resistant varieties are thus in the center of attention professional and scientific public and are gaining more and more popularity. In most of the newly cultivated and tolerant varieties, the hybrid smell is not felt in the wines, and their quality potential is so great that by adapting the technology in wine production, quality wines can be achieved, with some varieties even top quality. It is important to point out that these are new, insufficiently known varieties and that there is little experience with their technological requirements in wine production, so it can be said that there is potential for improving the quality and bringing them closer to the wines of traditional varieties.

Climate change is making the country's already volatile climate even more volatile and increasing extreme weather events. In the case of the Vitis vinifera varieties – the type most often used for vines in Europe – it is often very questionable where and how they grow. However, hybrid varieties are generally easier to grow. Their hardiness, especially to the cold winters and wet summers of the Northeast, means growers can use far fewer synthetic preservatives (such as fungicides).

Among the most important resistant grape varieties today are black varieties: regent, cabente cortis, marechal fosh, Leon Millot, chancellor, monarch; and from white varieties: merzling, phoenix, orion, lisa, cosmopolitan, bačka, johanniter, solaris, chardonel, traminete and others.

Although they are not pure grape varieties, but hybrids, that is, crosses of grape vines with other resistant grape varieties, these varieties are considered grape varieties in the legislation of many wine-growing countries and as such are slowly entering the official variety lists of these countries.

In most cases, all "new" varieties show very good resistance to fungal diseases. These are not completely resistant varieties and in "worse" climatic years, a certain dose of chemical protection is required. Most varieties do not have an unwanted foxy smell. The common opinion that these varieties produce a high methanol content and endanger the health of consumers has been disproved by analyzes in which a lower methanol content was found than in classic wine varieties. The viticulture profession believes that there is no difference in the quality of wine between new varieties and classic varieties. Oenologists around the world (and in the Republic of Croatia) regularly produce wines from "new" varieties in the category of quality or premium wine. Wine consumers as a conservative group, especially in the selection of varieties, increasingly accept wines produced from "new" varieties.

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INSTEAD OF CONCLUSIONS – SCIENTIFIC PROJECTS THAT MAKE OUR RESEARCH POSSIBLE

Economic Perspectives and Sustainability of the Agricultural Sector (uniri-iskusni-drustv-23-295)

Due to the strategic importance of the agricultural sector, scientists have come together to work on the economic perspective and sustainability of the agricultural sector with the aim of increasing competitiveness. Agriculture is one of the most important sectors of the economy. At the European Union level, it accounts for an average of 2.19% of GDP, while in the Republic of Croatia it accounts for 2.48% of GDP. Together with other related sectors, the share of GDP is many times higher. The sustainability of the agricultural sector is becoming a growing global challenge due to the increase in the world population, migration, climate change and conflicts, which lead to a decline in the quality and quantity of food and the depopulation of rural areas.

The sustainable production of food in quantities that are available to people at affordable prices is one of the strategic goals and political challenges of every country. This makes agriculture one of the most complex and sensitive areas of scientific research. Although the European Union promotes the environmental, social and economic sustainability of the agricultural sector through the Common Agricultural Policy (CAP) measures, Croatian producers are in a specific situation, mainly due to the small average size of the economy compared to competing countries. Farmers also face challenges resulting from fragmented plots, unresolved land registers, depopulation of rural areas, increased costs due to war events and lack of raw materials. The coronavirus pandemic exacerbated all existing problems and led to major problems in supply chains, new challenges and trends in the labor market, logistical problems in the distribution and donation of agricultural products, and posed additional challenges for producers and regulators as the competitiveness of the sector declined. As agriculture is a traditional area of human activity and strives to remain competitive in a very demanding modern market environment, solutions and successful business models must be sought within the framework of economics.

In addition to the project leader, Asst. Prof. Jana Katunar, the project's researchers also include Full Prof. Alen Host and Assoc. Prof. Jelena Jardas Antonić.

The Institutional Framework of the Wine Sector in the Republic of Croatia (ZIP-UNIRI-2023-4)

In institutional economics, institutions are understood as a set of formal rules and informal norms. This particular concept encompasses influences such as laws and other regulations, the entrepreneurial climate, the accessible legal system and local business practises, etc. Therefore, an institutional perspective is appropriate to incorporate the joint efforts of scientists from different fields in this multidisciplinary project.

The project brought together researchers from the fields of economics, agricultural economics and law with the aim of conducting research in the field of competitiveness of the wine sector and consumer preferences in wine production. Viticulture in the Republic of Croatia is an important and successful economic sector in agriculture and tourism. In the last twenty years, the wine sector has developed significantly thanks to the increase in the share of quality and premium wines and recognition on the foreign market. Adapting the sector to market needs in the context of adapting EU policies to the specificities of member states and adapting to consumer needs can lead to strengthening the competitiveness of small wine producers. As the wine sector is predominantly made up of small family businesses, producers are often in an unequal position where, if they have not developed their own distribution channels, they face an asymmetry of power and information that favors distributors and retail chains. The dependence of wine producers on dostributors, as the dominant partner, has a negative impact on the price and reduces the capacity for further investment in the development of technological and innovative solutions. Climate change has a significant impact on the level and quality of production. Therefore, investments in the development and application of new technological products and processes are extremely important for a sustainable economy and the preservation of traditional wine production.

In addition to the project leader, Asst. Prof. Jana Katunar, the other researchers involved are Full Prof. Alen Host, Full Prof. Ivana Kunda, Full Prof. Ivana First Komen, Nina Grgurić Čop, Hrvoje Katunar, Daniela Ježić and Sanda Grudić Kvasić, PhD.

Chair Jean Monnet: EU Business Policies and Contemporary Challenges of European Integration

In 2022, as part of the Erasmus+ programme for staff of the Faculty of Economics of the University of Rijeka (EFRI), the European Commission has appointed Asst. Prof. Marko Tomljanović as holder of the Jean Monnet Chair in European Integration and head of the project EU Business Policies and Contemporary Challenges of European Integration. The aim of the Jean Monnet Chair is the continuous improvement of teaching in the field of higher education studies on European integration included in the official curricula of higher education institutions in the EU Member States and beyond. The Chair's activities will also ensure the provision of open educational content to increase the flexibility and availability of learning. From 2022 to 2025, the Jean Monnet Chair at the Faculty of Economics will focus on looking at the main challenges and prospects of European integration and the economy in the European single market.

Since its beginnings in the 1950s, European integration has been clearly focused on peace, prosperity, equality and cohesion, with the aim of achieving economic progress and international competitiveness. At the same time, there has always been a "battle" with leading competitors (USA, Japan, China, etc.) for global supremacy, which Jean Monnet warned of in 1954, stating that "Europe has become too small for today's world and major competitors". As a key tool to address this challenge, the European Union has opted for European development strategies aimed at smart, sustainable and inclusive economic growth and human resource development, based on the main slogan "United in diversity".

In the early 2000s, the Faculty of Economics at the University of Rijeka was one of the first in the Republic of Croatia to start continuous education of students on the topic of European integration and business in the European market with a variety of courses, organised study programmes at graduate and postgraduate level and the activities of the former EFRI Jean Monnet Chair. The activities in this field continue to this day through the organisation of the Summer School on European Integration and the continuous participation in the preparation and implementation of scientific and professional projects funded by the European Union.

The activities within the framework of the EFRI Jean Monnet Chair represent the continuation of a process that began almost 20 years ago. During the implementation of the project, it is planned to hold courses in eight undergraduate and postgraduate university programmes and to improve knowledge about European integration and the economy in the European market, develop and disseminate teaching materials, stimulate discussions and generate new knowledge on key topics through student round tables, study tours, the publication of scientific papers and textbooks for universities, and other academic activities. The activities will also aim to create new and strengthen existing links with related departments in the Republic of Croatia and beyond.

In addition to the project leader Asst. Prof. Marko Tomljanović, Full Prof. Alen Host, Asst. Prof. Igor Cvečić and Ema Murić from the University of Rijeka, Faculty of Economics and Business, and Full Prof. Srdjan Redžepagić from the Balkan Institute for Science and Innovation of the Université Cote d'Azur, Nice, France, will also be involved.

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