

STRATEGIC, ECONOMIC AND LEGAL DIMENSIONS OF AGRIBUSINESS DEVELOPMENT IN THE EUROPEAN UNION AND UKRAINE: PERSPECTIVES, CHALLENGES, AND OPPORTUNITIES

ANETA BEŁDYCKA-BÓRAWSKA
IRENEUSZ ŻUCHOWSKI



**OSTROŁĘCKIE
TOWARZYSTWO
NAUKOWE**

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Abbreviation Meaning

€	Euro (currency)
EC	European Commission
EITI	Extractives Industries Transparency Initiative
EPA	Economic Partnership Agreement
EU	European Union
FTA	Free Trade Agreement
G8	Group of Eight
GATT	General Agreement on Tariffs and Trade
GSP	Generalized System of Preferences
HS	Harmonized System
IR	International Relations
KPCS	Kimberly Process Certification Scheme
MFN	Most-Favoured Nation
NAMA	Non-Agricultural Market Access
OECD	Organization for Economic Co-operation and Development
RMI	Raw Materials Initiative
RTA	Regional Trade Agreement
SITC	Standard International Trade Classification
TDCA	Agreement on Trade, Development and Cooperation
TFEU	Treaty on the Functioning of the European Union
UNCTAD	United Nations Conference on Trade and Development
UK	United Kingdom
US	United States
VAT	Value-Added Tax
WTO	World Trade Organization
WWII	World War II

INTRODUCTION

The significance of agribusiness as a strategic economic sector has grown notably in recent decades, transcending the traditional perception of agriculture merely as food production. Today, agribusiness encompasses a comprehensive system that integrates agricultural production, input supply, food processing, and distribution channels, thereby playing a pivotal role in contemporary global economic dynamics. The evolving nature of international trade policies, shifts in market demands, and challenges associated with sustainable agricultural practices highlight the sector's strategic, economic, and legal complexities. This monograph, provides a critical and timely analysis of these multifaceted challenges in a European context, focusing in particular on the European Union (EU) and Ukraine.

The relationship between the EU and Ukraine in the agricultural sector presents an intriguing case for investigation due to Ukraine's geopolitical position, rich agricultural resources, and recent steps towards European integration. Given Ukraine's ongoing journey towards potential EU membership, exploring the strategic, economic, and legal interactions in agribusiness between Ukraine and the EU provides crucial insights. The presented analyses take into consideration existing trade regulations, policy frameworks, and institutional arrangements necessary to enhance effective collaboration, market integration, and sustainable agribusiness development.

The structure of the monograph is meticulously organized into three parts, each addressing specific dimensions relevant to agribusiness development. The first part investigates strategic approaches to trade policies within the EU, emphasizing key issues such as the export restrictions of industrial raw materials and their implications on global trade. This section also explores the evolution and dynamics of grain trade within Poland, the EU, and broader global markets, illuminating the interdependence and strategic positioning of these entities in the international agricultural economy.

The second part of the monograph delineates the diverse factors shaping the development of agribusiness, with a particular emphasis on Ukraine and Poland. This segment provides a thorough exploration of contemporary challenges and opportunities, including the role of organic agriculture in promoting sustainable practices amid economic and political instability in Ukraine. It also

delves into specialized topics such as niche crops, rural development models aligned with European integration strategies, the emergent sector of wine tourism, financial accounting complexities, urban agricultural systems, and the critical issue of legal liabilities faced by farmers concerning environmental protection. Collectively, these discussions underline the dynamic interplay between agribusiness, policy frameworks, and market demands in facilitating sustainable economic growth.

The final part of the monograph addresses the critical aspect of agricultural extension services, particularly within the Ukrainian context. Recognizing the importance of advisory services for enhancing agricultural productivity and sustainability, this section evaluates the current state, challenges, and future prospects of agricultural extension systems. It further integrates discussions of digitalization impacts and highlights the essential role of these services in fostering economic security for small-scale agricultural enterprises.

Methodologically, the contributions in this monograph combine theoretical frameworks with empirical analyses, drawing insights from various interdisciplinary perspectives, including economics, trade policy, rural sociology, environmental science, and law. This integrative approach facilitates a comprehensive understanding of agribusiness complexities and highlights pragmatic policy recommendations aimed at enhancing sectoral efficiency, resilience, and sustainability.

The monograph aims not only to enrich academic discourse but also to serve as a resource for policymakers, practitioners, and stakeholders engaged in agribusiness. By addressing the strategic, economic, and legal dimensions of agribusiness development, the authors collectively underscore the sector's significance in fostering economic integration, sustainability, and resilience amidst changing global economic conditions and emerging geopolitical scenarios.

This comprehensive analysis provided by the contributing authors underscores the necessity of ongoing dialogue and strategic cooperation between the EU and Ukraine. Such collaboration will undoubtedly contribute significantly to advancing agribusiness development, promoting sustainable agricultural practices, and enhancing economic prosperity for both regions in the context of a rapidly evolving global economic landscape.

Aneta Będycka-Bórawska
Ireneusz Żuchowski

PART I

**STRATEGIC APPROACHES
TO TRADE POLICIES
IN THE EUROPEAN UNION**

THE EUROPEAN UNION'S STRATEGIC APPROACHES TO TRADE POLICIES ON EXPORT RESTRICTIONS OF INDUSTRIAL RAW MATERIALS IN GLOBAL TRADE

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1.1. Introduction

Raw materials, defined as "any material, such as oil, cotton, or sugar in its natural condition, before it has been processed for use" (Cambridge Dictionary), are indispensable in today's globalized economy, where production processes are dispersed across multiple regions worldwide. Consequently, export restrictions on raw materials can significantly disrupt global production networks.

The prevalence of export restrictions on raw materials has grown in recent years, with such measures becoming more frequent and restrictive. Korinek (2019) highlights the increasing application of export restrictions on minerals and metals, reflecting the strategic importance of these resources. Resource-rich countries often impose these restrictions for legitimate economic and social objectives, such as subsidizing domestic downstream industries, generating government revenues through export taxes, conserving natural resources, preventing illegal exports, or managing foreign exchange flows (Fung and Korinek, 2013). In this context, these restrictions may be justified by the resource-exporting countries' broader socioeconomic priorities.

Conversely, resource-scarce countries, particularly those dependent on raw material imports, are compelled to adopt effective external trade policies to address trade-restrictive measures. The European Union (EU), as a net importer of raw materials, requires secure and uninterrupted access to these resources to sustain its industries. Consequently, the EU has implemented a range of external trade policies aimed at dismantling export restrictions on raw materials. This paper seeks to critically analyze the EU's efforts and policies in ensuring the free flow of raw materials in international trade, using the frameworks of normative, market, realist, and neo-colonial power theories. The study endeavors to determine which theoretical lens best explains the EU's external trade policies toward export restrictions imposed by its trading partners on industrial raw materials.

The academic discourse surrounding the EU's raw material diplomacy remains relatively underdeveloped. For instance, Biedermann (2016) contends that the EU prioritizes market access over developmental objectives in its raw material strategy. Tiess (2008) emphasizes the need to balance securing raw material supplies with addressing the environmental and social costs of extraction, advocating for the EU to establish clear environmental and social standards for raw material imports. Paschke (2012) critiques the EU's unilateral approach, proposing the creation of a supranational framework for global raw material governance. Similarly, Kühlbeck (2013) highlights the developmental needs of resource-rich countries and the environmental and social challenges associated with mining activities. Fiott (2011a) underscores the structural challenges to the EU's raw material diplomacy, advocating for a more systemic and integrated approach to its raw material strategy. Ritoe (2021) suggests that the EU should focus on resource-rich countries with strong cultural and historical ties to the bloc, such as Australia. Furthermore, scholars like Gregow (2011), Ramdoo (2011), Awuah (2016), and Jourdan and Naiker (2016) have explored the implications of the EU's raw material policies on African nations, addressing the developmental challenges faced by the continent and the neo-colonial aspects of the EU's approach. Given the limited scope of existing literature, this study aims to contribute to the academic understanding of the EU's raw material diplomacy.

This paper posits that the EU predominantly acts as a realist power in its external trade policies regarding export restrictions on raw materials, as it prioritizes economic and material interests over other considerations. These policies are shaped by the dynamics of global trade power distribution, with the objective of securing a comparative advantage. The EU strategically employs

the most effective measures and diplomatic tools to ensure access to raw materials, as long as these measures adequately safeguard and promote its interests, even if they conflict with multilateral or rules-based trade frameworks. Moreover, the EU often overlooks other policy considerations, including its values, principles, and internal single market regulations, when these conflict with its strategic imperative to secure access to raw materials.

1.2. Academic literature and theories on the EU's power and role in global trade and their relevance to this study

The Power Theories and The EU's Power in Global Trade

Normative Power of The EU

The first power theory in this study that explains the EU's role and power in international trade relations is the normative power theory. Manners (2008) is of the view that the EU is a normative power and states "EU promotes a series of normative principles that are generally acknowledged, within the United Nations system, to be universally applicable" (p.46). In other words, the EU tries to spread the global norms and values in international relations. Manners (2008) discusses also the nine normative principles which are substantiated in EU law and policies, which the EU seeks to promote in world politics, and he argues that the principle of solidarity shapes the EU's trade policies by promoting free and fair trade. Similarly, Hoang (2016) divides the normative principles of the EU into political, economic and social principles and regards market-economy, fair trade and free trade as the economic principles of the EU. In fact, Article 2(5) of the Lisbon Treaty stipulates

"In its relations with the wider world, the Union shall uphold and promote its values and interests and contribute to the protection of its citizens. It shall contribute to peace, security, the sustainable development of the Earth, solidarity and mutual respect among peoples, free and fair trade, eradication of poverty and the protection of human rights, in particular the rights of the child, as well as to the strict observance and the development of international law, including respect for the principles of the United Nations Charter."

Therefore, one of the founding treaties of the EU explicitly addresses to promote its values and interests including free and fair trade. Van den Hoven

(2006) asserts that the trade policies of the EU cannot be based solely on economic interests, and values are increasingly important in explaining the EU position in the WTO. This is because, the EU would like the WTO to promote common rules and the EU can even sacrifice its own interests for the sake of its values and principles for instance it has supported the TRIPS agreement and trade liberalization in textiles in the detriment of its own pharmaceutical and textile industries. To sum up, this theory implies that the EU as a normative power in global trade promotes the common good towards free and fair trade, and the trade policy of the EU is shaped by the identity of the EU, which is composed of values and principles.

With regards to the raw materials issue, Fiott (2011b) alleges that the EU develops “raw materials diplomacy” which would be geared towards promoting “human rights, good governance, conflict-resolution, non-proliferation and regional stability”, and this shows the normative approach of the EU. However, he also acknowledges the fact that this approach is effective only in the EU’s relations with smaller states or where it has significant leverage whereas it does not work in the raw material diplomacy with China.

When the normative power theory is embraced while analysing the raw material diplomacy, it should be assumed that the EU is trying to set rules and principles to ensure the free flow of raw materials as a normative power to consolidate free and fair trade. Although it is assumed that the EU’s normative power does not need to be in conflict with material interests (Hoang, 2016), it is important whether material interests prevail over the norms and principles of the EU. Moreover, the EU has a broad range of norms and principles that are relevant to many policy objectives such as sustainable development. For the normative power approach, the EU promotes the regulatory framework to facilitate trade while pursuing other policy objectives (Woolcock, 2019). Regarding the raw material trade policies, it is important to seek about whether the EU pursues its own norms and principles such as sustainable development or human rights when promoting free trade in raw materials.

Market Power of The EU

The market power theory is based on two interconnected ideas: 1) The EU’s power in global trade relations comes from the EU’s market size and power 2) The EU is promoting its market model in global trade to the capitalist development of Global South (Heron and Evans, 2017, p. 342). The EU is

a huge single market where free movement of goods, services, capital and people is ensured. Furthermore, as a single actor in global trade, the EU is a huge market with its export and import capacity. According to WTO Stats statistics, the EU is the second biggest importer and third biggest exporter in global trade as of 2020.

If the EU is regarded as a market power in global relations, it can be claimed that the EU is trying to export its market model and rules as a huge market power. Damro (2012) supports that the EU exercises its market power. He asserts that the strategy document of “Global Europe” is a proof of this argument since the EU regards its own single market as an asset to consolidate the EU’s position in global economic relations and refers to the ability of the EU of sharing best practices and developing global rules and standards. In line with this argument, Meunier and Nicolaidis (2006, p. 907) allege that the EU is becoming a power by using access to its huge market as a bargaining chip to obtain changes in the domestic policies of its trading partners and more generally to shape new patterns of global governance. In other words, the power of the EU comes from the size of the EU single market and the EU uses its power to externalize its market model and regulatory practices.

Like the normative power theory, market power theory, also, implies that the EU pursues to externalize its rules, particularly the ones relating to the common market. However, as Damro (2012, p. 21) points out, market power theory differs from normative power theory as it argues that the fundamental identity of the EU is not shaped by principles and values but rather its large regulated market and regulatory capacity.

Relating to external trade policies towards export restrictions on raw materials, it can be assumed that the EU is trying to externalize its regulatory framework and market model where the free movement of goods is ensured. However, it should be noted that market power theory is called generally about the complex regulatory issues such as Singapore issues that are government procurement, trade facilitation, investment, competition and other regulatory issues that affect international trade (Heron, Evans 2017). The raw material diplomacy, however, aims to ensure the access of the EU industries to the raw materials that they need. Therefore, it can be claimed that raw material diplomacy is not in the framework of its market power. Moreover, the EU allows member states to restrict the free movement of goods in the EU’s single market on a broad range of grounds such as public morality, public policy or public security within its internal market (Article 36 of the TFEU). As Oliver (2010) points out, the justification grounds for the restrictions on the free movement

of goods in the EU's single market regulated under Article 36 of the TFEU is modelled on the Article XX of the GATT, which refers to the general exceptions to the GATT obligations although they are not all identical. In that vein, it should be assessed whether the EU respects this kind of justification grounds in global trade related to raw materials. If the EU externalizes its market model to its trade partners, it can be expected from the EU to respect this kind of justification grounds for the restrictions imposed by its trade partners on raw materials since they already exist within the single market of the EU.

Realist Power of The EU

From the realist perspective of IR, the state is regarded as the protector of its territory, population and national security, and states are ready to sacrifice their international obligations for their self-interests (Jackson and Sorensen, 2003, p. 69). Therefore, it can be expected that states exercise their power for economic self-interests and do not eschew resorting to coercive measures thereby granting their rights and interests. Moreover, it is understandable that states compete with each other to gain a more advantageous position and power in global trade. This is the way of protecting the economic welfare and prosperity within the territories of states. Schweller (1999) points out that states advance their national interests (economic, territorial, security, diplomatic, etc.) in a self-help competition against other states. He does not limit realism to security issues by arguing that anarchy exists even where security is granted. According to him, in commercial relations, the distribution of gains plays significant role, and states must be concerned with maintaining and improving their position within the international division of labour in a competitive, self-help system (p. 20).

In the framework of realist assumption in IR, it is coherent to support the argument that the EU is a realist power in global trade. Zimmerman (2007) argues that the EU is motivated by the interest to maximize its wealth relative to other powers and points out the rightfulness of realist assumptions in preference formation in the EU's external economic policies. He argues that the EU's stance was dominated by mercantilist concerns predicted by the realist approach than by purely commercial concerns or normative considerations during the WTO accession negotiations of China and Russia and asserts that the EU overlooked the human rights issues during the negotiations despite the rejections raised by the European Parliament. Many scholars also point out how the

EU behaves in line with its self-interest such as in agriculture and NAMA negotiations (Heron, 2007) or in GSP reform (Siles-Brügge, 2014) rather than normative considerations.

Regarding the raw material issue, the realist arguments can be recalled. In the light of realism, it can be argued that the EU pursues its self-interest and competitive advantage over its trade rivals in raw materials. Furthermore, the EU's trade policies to eliminate export restrictions on raw materials are tended to neglect other policy considerations for the sake of the EU's interests if the realist assumptions are accepted. Therefore, it should be tested about how the EU exercises its power for its economic interests, which tools are used and to what extent other policy considerations that are part of the EU's values and market principles are overlooked by the EU.

Neo-colonial Power of The EU

In the colonial era, the territories of the Third World used to be under the control of colonial Western powers, and these territories served the interests of those powers as both raw material sources and markets for manufactured products. Through colonialism, the Western powers reached higher levels of industrialization and welfare. In addition, colonialism sparked competition among the colonial powers. Pourmokhtari (2013) argues that global trade is shaped by Western states and for their interests and it is the reproduction of the global hierarchy even today. In this context, neo-colonialism focuses on the relationship between the Third World and Western powers in today's politics and assumes that the colonial perspective survives and shapes this relationship.

Neo-colonial thought approaches the EU's power and its trade relations critically in this way. The neo-colonial thought claims that the EU's trade policies have aimed at the continuation of the colonial economic system since the independence of the African continent (see Odije, 2022). The neo-colonial thought plays an important role in interpreting of the EU's trade policies.

The EU's trade policies to remove export restrictions on raw materials are convenient to revisit the neo-colonial ideas considering the fact that the former colonies of the Western world are rich in terms of natural resources. Gregow (2011) argues that the EU uses trade policy instruments mainly trade agreements to grab resources in Africa and states "the EU is confronted with the fact that it is losing its grip and 'monopoly' over natural resources in its former colonies in Africa" (p.7). Jourdan and Naiker (2016), also, support that

raw material diplomacy mainly aims at fostering the asymmetrical colonial EU-Africa relationship, where Africa provides raw materials for EU industries and purchases the EU's manufactured products. In other words, the resource-rich Africa plays raw material supplier and manufactured goods market roles from the point of view of the EU, as it did during the colonial era. On the other hand, Dür and Zimmerman (2007) argue that the simplifying assumption that there is a North-South division in global trade is misleading. Moreover, the situation of China makes the issue more complex. During the accession talks of China to WTO, fears of neo-colonisation were delivered by the opposition, but China has benefited from the liberalization of trade so far (Bishop and Xiaotong, 2020, p. 758). From general to specific, the issue is complex in raw material trade with the situation of China. Whereas China is the 8th biggest raw material supplier of the EU with 3 billion € import volume (table 1) and the EU has been combating China's export restrictions on raw materials, China depends on raw material imports from third countries for Chinese industries and competes with the EU in global raw material trade. At this point, neo-colonial approach remains scarcely sufficient and capable of explaining the trade policies of the EU towards export restrictions imposed on raw materials. This is because, some of the emerging powers, mainly China and India, which were colonies of the Western countries during the colonial area, are in competition with the EU for accessing to the raw materials in third countries.

Table-1: The EU's and Member States' Extra-EU Trade in Raw Materials (Million €)

PERIOD-TRADE FLOW/REPORTER	2021		2020		2019	
	IMPORT	EXPORT	IMPORT	EXPORT	IMPORT	EXPORT
Austria	1.709	1.619	1.137	1.186	1.340	1.403
Belgium	9.651	4.347	7.519	3.228	7.366	3.091
Bulgaria	2.526	1.078	2.553	793	1.442	776
Cyprus	45	46	22	28	29	25
Czechia	1.625	772	1.031	607	1.152	691
Germany	19.966	9.646	14.265	7.259	13.541	7.168
Denmark	790	1.624	826	1.253	874	1.616

Estonia	445	578	254	378	241	382
Spain	9.399	4.378	6.620	3.167	7.625	3.808
Finland	3.577	4.953	2.726	3.421	2.368	3.652
France	5.442	3.581	4.051	3.014	4.495	3.310
Greece	1.117	1.330	763	863	815	1.053
Croatia	166	521	117	373	126	342
Hungary	650	330	527	275	665	360
Ireland (Eire)	679	1.120	655	802	712	870
Italy	9.589	3.217	6.945	2.256	8.001	2.435
Lithuania	939	1.030	656	689	705	653
Luxembourg	98	6	64	5	39	6
Latvia	485	1.572	303	789	306	779
Malta	11	24	11	9	12	8
Netherlands	14.616	9.664	10.868	7.613	11.939	7.647
Poland	3.380	1.919	2.649	1.595	3.036	1.560
Portugal	1.205	853	949	656	1.073	693
Romania	1.317	1.429	894	952	964	959
Sweden	1.680	7.296	1.243	5.347	1.368	4.885
Slovenia	482	496	355	468	406	488
Slovakia	1.197	173	621	139	790	157
EU-TOTAL	92.786	63.603	68.625	47.166	71.429	48.818

1.3. The EU's Role in Distribution of Powers in Global Trade

Before analyzing the trade policies of the EU on raw materials trade, it is important to comprehend the academic literature regarding the EU's role in global trade and its relations with great trade powers such as the US, China, India, Russia or Japan. According to the Trade Map (2022) statistics; the US, China, the UK, Korea and India are the biggest importers excluding the EU countries; and China, the US, Japan, Korea and Canada are the biggest exporters as of 2021. Mexico, Russia, Vietnam, Malaysia and Brazil are among other countries that have huge trade volumes. As a matter of fact, the rise of emerging

powers has made the international trade politics complicated. Hopewell (2015) is of the view that China, Brazil and India play prominent role in multilateral trade governance, they entered the inner cycle of power during the Doha negotiations and firstly Brazil and India thereafter China challenged the US hegemony in multilateral trade governance. Beeson (2009) supports that China's rise and the US's relative decline are the key dynamics that will reshape the international economic system. Humphrey and Messner (2008) focus on the implications of rising China and assert that it has become de facto a significant global governance actor in the Western-dominated world. It is also important that "Global Europe" refers to the role of emerging powers and accepts that unlike the first half of the twentieth century where the US, Europe and Japan drove the global economy, they are being joined by increasingly open and expanding economies, in particular China and India, but also Brazil, Russia and others. To sum up, there are emerging powers in world trade, and this situation has been challenging the Western world hegemony and reshaping the global economic order.

Besides the North-South divide, it should be noted that both developed and developing countries may make coalitions and compete with each other. In that vein, Hurrell and Narlikar (2006) claim that the coalitions in world trade may be classified into two analytical types: 1) bloc-type coalitions and 2) issue-based coalitions, and apart from their bloc-type coalition developing countries may diversify their alliances and trade relationships with the developed countries on issue-basis. In other words, some developed and developing countries may form issue-based alliances in global trade governance. It should also be noted that developed countries are also in competition with each other. Sbragia (2010) focuses on the geo-economic competition and interdependence between the US and the EU and asserts that both parties are trying to expand their powers in developing countries by means of many instruments such as development aid and FTAs. Hurt (2012) draws attention to the fact that the EU aims at securing its comparative advantage in developing markets (specifically in Africa) against both emerging powers like China, India and Brazil and also the US. Therefore, the Global North is in competition at the same time while they are shaping the trade agenda as a bloc-type coalition under the WTO.

The trade policies of the EU to eliminate export restrictions on raw materials should be assessed with consideration of the multipolarity in global trade. In the international trade arena, it can be expected that the EU will work in coordination with other developed countries that need access to raw materials

for their industries. In that vein, the RMI refers to the collaboration with resource-dependent countries such as the US and Japan, by identifying common interests and devising joint actions and common positions in international arena. Therefore, among Japan, the US and the EU, there is both bloc-type and issue-based coalition at the WTO. However, it can be expected that these developed countries are in competition to access the raw materials, and like the EU, other developed countries such as Japan and the US pursue similar strategies to secure raw material access.

Likewise, it can be expected that resource-rich developing and least-developed countries may form bloc-type and issue-based coalition at the WTO thereby ensuring their right to restrict exports of their raw materials for the sake of various economic and social objectives.

Lastly, some emerging powers mainly China and India play important role in the distribution of powers for the EU's raw material diplomacy. Firstly, China is the dominant producer of several minerals, particularly rare elements, 97% of which China produces globally (Gregow, 2011, p. 27). Furthermore, it has restricted its mineral exports to increase its market power in global trade (Lardy, 2002, p. 47). This is an important challenge for the EU to access raw materials that exist in China. Secondly, China is in competition with the EU and other developed countries to access raw materials in third countries. As Humphrey and Messner (2008) point out, China increases its presence in Africa and it is also related to access to raw materials to sustain its rapidly growing economy, and therefore the fierce competition between Western countries and China is strong to access raw materials in developing countries. Similarly, India as an emerging economy that needs industrial raw materials for its downstream industry is among the raw material suppliers of the EU⁹. In this framework, the RMI draws attention to the unprecedented demand for raw materials driven by the strong growth in emerging economies and highlights the fact that emerging countries, particularly China and India, pursue strategies whereby they secure privileged access to raw materials in resource-rich countries namely in Africa.

In the next chapters, the policy tools and patterns of the EU's trade policies towards the export restrictions on raw materials are assessed critically in light of the theories and ideas concerning the EU's power and role in global trade.

1.4. EU's trade policy to eliminate export restrictions on raw materials

Multilateral Trade Policy Tools and The WTO

The RMI refers to supporting the awareness-raising in international fora such as the G8, OECD, UNCTAD and UNEP. In this regard, the EU supports the work of the OECD on raw materials including tackling export restrictions (EC). The main multilateral arena where the EU may challenge the export restrictions on raw materials imposed by other countries is, nevertheless, the WTO. The RMI specifically refers to the dispute settlement under the WTO and points out that the EU will challenge measures that violate WTO rules. As discussed below, the EU has been involved in various disputes under the WTO regarding the export restrictions on raw materials.

General Framework of the WTO Regarding Export Restrictions

In the GATT system; non-discrimination involving MFN (Article I) and national treatment (Article III) rules, tariff bindings (Article II) and prohibition of quantitative restrictions (Article IX) are essential provisions to provide rules-based multilateral trade governance. Besides, transparency, reciprocity, consensus decision-making and flexibility are regarded as other important principles of the GATT system (Dunkley, 2000; Baldwin, 2016). In addition, general exceptions (Article XX) and the security exception (Article XXI) are essential provisions that allow parties to deviate from the basic principles of the GATT.

The MFN principle, as a part of non-discrimination, obliges member states not to exercise trade rules differently to the products originating from different members. It is claimed that the whole GATT system is built around this principle, and it is the quintessential GATT/WTO discipline (Mavroidis, 2016, p. 195). More importantly, MFN principle is applied in both exports and imports (Matsushita, 2011, p. 290). Therefore, it is unlikely surprising that the developed countries mainly the EU, the US and Japan that are affected by the export restrictions in similar ways make collaboration with each other on this issue. If they succeed to improve the rules in terms of export restrictions, they will benefit from it equally since the advanced rules will be applied regardless of the origin of the products due to the MFN principle.

Regarding the tariff bindings, Article II obliges member states to accord to the commerce of the other contracting parties treatment no less favorable than that provided appropriate Schedule annexed to the GATT. In other words,

the tariffs are bound by member states as a result of the negotiations based on a reciprocal and mutually advantageous basis, and they are obliged to respect a “tariff ceiling” and not to increase the customs duties above the ceiling for the certain product (Mavroidis, 2016). Some international trade law experts are on the cutting edge of a debate about whether the aforementioned article does cover export duties or not¹⁰. In fact, the focus was on the import duties during the negotiations, therefore it is unclear if the tariff-binding rules cover export duties or not, and generally the parties did not bind themselves by their export duties during the negotiations.

Quantitative restrictions are dealt with Article XI, which prescribes that no prohibitions or restrictions other than duties, taxes or other charges, whether made effective through quotas, import or export licenses or other measures, shall be instituted or maintained on importation or exportation. Unlike tariff bindings, quantitative restrictions on exports are explicitly prohibited under the system of GATT. However, this aforementioned provision includes relevant exemptions in itself such as under Article IX:2, which stipulates “Export prohibitions or restrictions temporarily applied to prevent or relieve critical shortages of foodstuffs or other products essential to the exporting contracting party”. This is highly relevant to export restrictions on raw materials. As Bhala (2005, p. 370) finds out, this temporarily applied relief must be with respect to a critical shortage in essential products, and the terms of ‘critical’ and ‘essential’ are self-judging. In *China – Raw Materials Dispute*, the WTO (2012) Appellate Body ruled that products like raw materials can be covered by this exemption.

In addition to substantive rules and principles, procedure and transparency play a crucial role in rules-based multilateral trade. Article X regulates the publication and administration of trade regulations under an established and uniform practice and transparent way. The text of the Article explicitly refers to both imports and exports. In *Argentina – Bovine Hides Case*, the WTO (2001b) Panel ruled that the administration of Argentinian export restrictions on raw materials, i.e., hides was not consistent with Article X(3,) which refers to impartial and uniform administration of trade laws. However, it should be noted that the procedural rules of the WTO are also mainly import-oriented. To illustrate, under the GATT system, Import Licensing Agreement regulates the detailed rules for import licensing procedures for automatic and non-automatic import licenses. However, export licenses are not regulated in detail compared to import licenses. Lastly, the general exemptions in GATT regulated under Article XX are open-ended and vague such as environmental protection,

protection of public morals, human, animal or plant life or health or conservation of natural resources. Furthermore, among these exceptions, paragraph (i) allows to restrict exports of domestic materials necessary to ensure essential quantities of such materials to a domestic processing industry during periods when the domestic price of such materials is held below the world price as part of a governmental stabilization plan, and paragraph (j) allows WTO Members to impose measures that are essential to the acquisition or distribution of products in general or local short supply¹¹. These two exceptions can be invoked as industrial policy needs, and the exception under paragraph (i) essentially allows WTO Members to restrict exports of domestic materials to assist downstream industries (Espa, 2015, p. 221). Accordingly, the general exceptions, including the exceptions under paragraphs (i) and (j), may constitute a basis to invoke export restrictions on raw materials. Although China could not justify its measures on raw material exports in China – Raw Materials and China – Rare Earths disputes, this always constitutes a risk for raw material importers that any WTO member may justify its quantitative measures on exports within the framework of the general exceptions under the GATT. As Matsushita (2011, p. 287) states “... the prohibition of export quotas is surrounded by many exceptions. Largely classified, exceptions fall under two categories, i.e., those provided in Article XI: (a) and (b) and those in Article XX: (b), (c), (f), (g), (h), (i) and (j).”

As a result, it is argued that the WTO rules mainly focusing on the liberalization of import tariffs and non-tariff barriers are too vague and light to hinder export restrictions on raw materials, as the prohibition of quantitative restrictions may be subject to many exemptions and export taxes are not regulated in WTO legal discipline (Karapinar, 2012; Korine and Bartos, 2012; Wu, 2021). In fact, it is not surprising that the discipline in export restrictions is not as developed as import restrictions since the outbreak of GATT/WTO negotiations. Export restrictions are becoming more and more important recently due to the rapid growth of emerging economies such as China and India (Matsushita, 2011). Finally, the WTO jurisprudence is not improved on the issue of export restrictions for non-agricultural products. Therefore, the ambiguity of the rules on export restrictions is maintained.

The EU's Policies to Improve the Rules Regarding Export Restrictions

To develop more stringent rules in export restrictions discipline for all WTO members, it can be expected that developed countries mainly the US, Japan and the EU embrace common positions towards export restrictions. Whereas Japan and the US focus on the procedural aspects and transparency for export licenses in NAMA negotiations, the EU's focus is on the substantive aspect of export restrictions (Wu, 2021). In this framework, the EU proposed, at the NAMA negotiations, Agreement on Export Taxes, which is regarded as ambitious and aggressive and aims to eliminate or relieve export taxes. However, the negotiations on this issue have been congested because of the dissensus between the EU and developing countries that have been of the view that export taxes are legitimate tools for development. (Wu, 2021, p. 91-92). A more comprehensive reform of the multilateral rules in this field seems unlikely possible in the near future as well (Karapinar, 2012, p. 477).

On the other hand, resource-rich countries that request to join in the WTO, have to negotiate Accession Protocols that may include more stringent rules on export restrictions beyond GATT Agreements. In post-1994 accession protocols of newly acceding WTO members, WTO-plus commitments are particularly strict on the elimination of export restrictions. In this regard, China and Tajikistan indicated the maximum applicable export duty rates by the existence of a list of products; Latvia, Mongolia and Saudi Arabia promised to eliminate the export duties applied on a limited number of products; Vietnam and Ukraine committed to phase down and bind the export duty rates imposed on specific products and Russia bound more than 700 tariff lines for exports in its Schedule of Concessions (Espa, 2015, p. 161). Furthermore, the claimants (the EU, the US and Japan) invoked the WTO-plus commitments of China prescribed in China's Accession Protocol regarding export taxes and restrictions in China – Raw Materials and China – Rare Earths disputes. Likewise, the WTO (2022) in Russia – Wood Products Case indicates that the EU challenges the termination of tariff-rate quotas on exports of wood products by Russia on the basis that it infringes Russia's export duty bindings under Russia's Accession Protocol.

The WTO-plus commitments and obligations of newly acceding countries regarding the export restrictions are asymmetric as they are binding only on the acceding member, not existent members (Wu, 2021, p. 22). It should be assessed whether compelling new resource-rich acceding countries to undertake more stringent commitments beyond existing WTO rules is consistent with

the normative principles of the EU. This is because, this asymmetry poses threat to reciprocity, which is among the essential principles of the GATT/WTO system. As Basra (2012) points out, the negotiation processes for accession to WTO are dominated by power politics rather than rules-based, and new acceding countries are conceded to undertake market access obligations beyond the coverage of the WTO agreements without requesting demanding reciprocal concessions from existing members. The EU did not oppose asymmetrical commitments and obligations for specific countries. On the contrary, as Biedermann (2016, p. 128) states “In WTO accession negotiations, the EU seeks to secure commitments from acceding countries not to impose export duties on raw materials...”. In other words, the EU, like other developed countries mainly the US and Japan, supported and utilized WTO-plus commitments and obligations imposed during the accession process of newly acceding WTO members in order to ensure the free flow of necessary raw materials although these commitments and obligations constitute asymmetrical trade practices and pose a threat to reciprocity.

To sum up, as Biedermann (2016, p. 127) states, “At WTO-level, it (*the EU*) uses an exclusively neoliberal approach in defending market access.”. It is not surprising considering the material interests of the EU industries. Furthermore, the EU has not abstained from forming asymmetrical trade relations with newly acceding resource-rich countries by imposing WTO-plus commitments and obligations regarding export restrictions. Although it jeopardizes the multilateral rules-based system and reciprocity principle, the power politics and material interests for accessing raw materials prevail.

Bilateral and Regional Trade Policy Tools

The RMI refers to promoting new rules and agreements to guarantee sustainable access to raw materials at both multilateral and bilateral levels, including WTO accession negotiations, FTAs, regulatory dialogue and non-preferential agreements. In this regard, bilateral initiatives by the EU to handle export restrictions constitute an important pillar of the EU’s trade policy towards export restrictions on raw materials. The bilateral diplomacy tools may take many forms, mainly FTAs between the EU and third countries. In this study, RTAs refer to all these regional and bilateral agreements including FTAs, EPAs, etc...

Korinek and Bartos (2012) analyzed various several RTAs around the globe to find out ‘WTO-plus’, ‘WTO equal’ and ‘WTO-minus’ export restriction disciplines in RTAs. According to this study, some RTAs that the EU has concluded include prohibition of export taxes provisions and quantitative export restriction provisions, particularly the ones that allow fewer exceptions than the WTO. To set an example, in the EU-South Africa TDCA (EU-Lex, 1999) Articles 19.1 and 19.2 abolish all quantitative restrictions and prohibit new ones, and Article 19.3 prohibits imposing of new custom duties on both exports and imports. Furthermore, the prohibition of quantitative restrictions on exports does not refer to the exception regarding the critical shortage, unlike Article IX: 2 of the GATT.

The “Global Europe” is regarded as an offensive trade strategy for further liberalization that is premised on a new generation of bilateral trade deals (Siles-Brügge, 2013, p. 606). The so-called new generation FTAs that deal with many issues beyond pure trade ones such as competition, environment or investment, unsurprisingly refer to export duties and quantitative restrictions on exports after the publishing of “Global Europe”. To set an example, one of the new generation FTAs, the EU-Vietnam FTA (EUR-Lex, 2020b) deals with export taxes and export restrictions as well as export licensing procedures. Moreover, Wu (2021, p. 103) argues that the EU-Vietnam FTA has the most comprehensive regulation on export licensing. Therefore, the new generation FTAs have not disregarded the export licensing issues, which are not regulated specifically under the WTO unlike import licensing.

These FTAs frequently eliminate the application of export duties, recalling the fact that the EU made failed attempts for the elimination or relief of export duties under the WTO, and regulate the quantitative restrictions on exports with their exceptions beyond the WTO regime. For instance, Appendix 2-A-3 of the EU-Vietnam FTA regulates export duty schedule of Vietnam, which prescribes the elimination or reduction of export duties. Regarding quantitative restrictions, Article 2.14 of this FTA stipulates,

“Except as otherwise provided for in this Agreement, a Party shall not adopt or maintain any prohibition or restriction on the importation of any good of the other Party or on the exportation or sale for export of any good destined for the territory of the other Party, in accordance with Article XI of GATT 1994, including its Notes and Supplementary Provisions. To that end, Article XI of GATT 1994, including its Notes and Supplementary Provisions, are incorporated into and made part of this Agreement, *mutatis mutandis*.”

and therefore, prohibits quantitative restrictions on imports and exports in the same article and embraces the rules of principles of GATT regarding the general elimination of quantitative restrictions. Accordingly, the critical shortage exception under Article XI: 2 of the GATT may be applied to the prohibition of quantitative export restrictions.

In addition, Article 2.22 of the EU-Vietnam FTA stipulates “Nothing in this Chapter prevents either Party from taking measures in accordance with Article XX of GATT 1994, including its Notes and Supplementary Provisions, which are incorporated into and made part of this Agreement, *mutatis mutandis*.” Accordingly, the GATT XX general exceptions are incorporated into this FTA. Nevertheless, the second paragraph of this provision stipulates that the exporting party shall consult the other party before taking any measures provided for in subparagraphs (i) and (j) of Article XX of GATT 1994. These paragraphs are the GATT general exceptions regarding the measures taken to ensure essential quantities of materials to domestic industry under governmental stabilization plans or to eliminate general or local short supply. In fact, these exceptions are frequently eliminated through RTAs to ensure the abolition of export restrictions (Korinek and Bartos, 2012). In that vein, this FTA of the EU sets forth the additional procedures for invoking these exceptions. This may likely raise difficulties if Vietnam intends to impose export restrictions to ensure essential quantities of raw materials to domestic industry under governmental stabilization plans or to eliminate the general or local short supply of raw materials.

Like the EU-Vietnam FTA, the EU-Singapore FTA (EUR-Lex, 2019), one of the new generation FTAs, include similar provisions. Moreover Article 2.7 of this FTA eliminates all export duties rather than regulating export duty schedule.

In addition to FTAs, the EU-Central America Association Agreement (EUR-Lex, 2012a) and the EU-Colombia/Peru Trade Agreement (EUR-Lex, 2012b) include provisions regarding the prohibition of export duties or taxes, with some minor exceptions. While negotiating EPAs with resource-rich countries, they are pushed by the EU through EPAs to remove the ability to use a potentially key development policy beyond what has been agreed in the WTO (Traidcraft Exchange, 2010, p. 5). Moreover, the EU has implemented many bilateral policy dialogues with its trade partners such as the policy dialogue with Greenland¹². Biedermann (2016, p. 129) highlights that the policy dialogue between the EU and Greenland constitutes an affront against basic EU goals and norms on undiscriminating market access since it is aimed at excluding China

from raw materials supply from Greenland. This means, the EU pursues to foster its trade dialogues with third countries both to access raw materials and exclude its competitors, particularly China in raw material competition.

From the realist perspective, it is likely expectable for the EU to desire bilateral relations rather than the multilateral trade system. This is because, the EU can use its asymmetric market power in bilateral relations while developing countries can attempt to balance the EU's bargaining power by teaming up in the multilateral arena (Meisner, 2018, p. 45). This argument seems applicable in raw material diplomacy as well. The EU uses its asymmetrical power through bilateral and regional policy tools to push developing countries to accept the rules which ensure access to raw materials. Furthermore, bilateral trade policy tools enable the EU to gain a comparative advantage over its rivals in raw material resources competition for the sake of its material interest though it may be discriminatory and against the EU's norms and market rules.

Unilateral Trade Measures to Eliminate Export Restrictions

The RMI does not refer to only multilateral and bilateral diplomacy, but also unilateral actions against export restrictions by third countries. Firstly, it is stated that the EU will address distortions in the cost of raw materials through anti-dumping investigations resulting from dual-pricing practices or other mechanisms in the exporting country. Although the GATT does not prohibit dumping, by which products of one country are exported at less than the normal value (domestic price) of the product, it allows importing country to impose anti-dumping duty to address the material injury caused by the dumped imports. When the exports of raw materials are restricted, the prices of these commodities decline in the exporting country, whereby the downstream industries benefit from low-level raw material prices. In this case, the EU will adjust the costs of production of exporting producers upwards if it considers that the costs of raw materials are distorted in the domestic market due to export restrictions (Crochet, 2022). However, in EU- Biodiesel Case, WTO (2016) Appellate Body did not affirm calculation of the normal value of biodiesel products in the anti-dumping investigation, and overruled the EU authorities' determination that domestic prices of soybeans in Argentina were lower than international prices due to the Argentinian export tax system. Despite the ruling of the WTO dispute settlement body and legal ambiguity on this issue, the EU keeps the possibility of anti-dumping measures¹³ as a sword of Damocles. Secondly, the

RMI refers to other trade defense instruments (anti-subsidy and safeguard) in addition to anti-dumping measures on the basis that downstream industries in countries where raw material exports are restricted benefit from low-level raw material prices. In fact, the WTO (2001a) Panel ruled in US-Export Restraints Case does not regard restraint on exports of a product as a subsidy to other producers that use the restricted product. Despite this, the possibility of anti-subsidy measures by the EU to manufactured products of the country that implements export restrictions on raw materials exists. Moreover, the RMI refers to also safeguard measure, which is an exceptional measure that can be imposed if a product is imported in such increased quantities, absolute or relative to domestic production and causes or threatens to cause serious injury to the domestic industry. In the light of these findings regarding trade defense instruments, the RMI's referral to trade policy instruments is open to criticism. Crochet (2022) argues that the EU has turned trade defense instruments into a policy tool that is not what they were not designed for. Truly, trade defense instruments are policy tools to protect the domestic industry against unfair trade practices, not coercive tools against the trade partners that restrict raw material exports.

Thirdly, the RMI states "In cases of anti-competitive agreements or market concentration, the Commission will continue to fully apply the EU's competition rules" and refers to applying competition rules extra-territorially to market concentration in raw materials to ensure the access of the EU industries to the raw materials. Fung and Korinek (2013) find that firms in extractive industries are often multinationals that have sizeable market power, and export quotas constitute a potential for collusive behavior among oligopolistic market participants. In this regard, the EU signals that it will interfere with anti-competitive market practices to protect the raw material market and price fluctuation for the sake of its industries. However, Espa (2015, p .253) highlights that the WTO legal framework does not regulate anti-competitive business practices, the competition rules are related to sovereignty and extraterritorial enforcement of the EU's competition rules has inherent implementation difficulties. Furthermore, in the China – Rare Earths case, though China has over 95% of the world's rare earth minerals, there was no agreement or concerted practice among Chinese raw material producers and the rare earth producers were mainly state-owned bodies; therefore this could not be easy to apply competition rules extraterritorially (Daujotas, 2011, p. 17-18). Nevertheless, despite the sovereignty aspect of the issue and difficulties as well as the lack of multilateral competition rules, the RMI indicates the EU's power to resort to coercive

measures in order to ensure access to raw materials in line with the economic and material interests of the EU's industries.

Fourthly, the EU may remove the beneficiary status of the exporting country from the EU's GSP¹⁴ scheme in the case of export restrictions affecting the supply of raw materials although the RMI does not explicitly refer to. The GSP Schemes are designed as non- reciprocal tariff preferences for developing countries. However, Siles-Brügge (2014) asserts that reciprocity is sought in trade policies of the EU, and the GSP Scheme of the EU is shaped as an integral part of the reciprocity agenda in line with the commercial interests rather than normative principles. Regarding the RMI, the EU had signaled the possibility of excluding developing countries that implement export restrictions on raw materials, from the GSP scheme, but the final version of RMI did not mention it (Kühlbeck, 2013, p. 8). However, Regulation No. 978/2012 of the EU (EUR-Lex, 2012c), the main legislation that constitutes the EU's GSP scheme, has opened the door to use this possibility. Article 9/1-d of this Regulation stipulates that preferential arrangements may be withdrawn temporarily for a beneficiary country in the case of serious and systematic unfair trading practices including those affecting the supply of raw materials. Although this is compatible with the RMI and raw material strategy of the EU, it should be assessed if it is compatible with the non-reciprocal character of GSP schemes. In this case, it seems that the EU's material and economic interests outweigh the aim of the GSP schemes, which are designed as preferential tariff regimes for developing countries, not a coercive measure to ensure reciprocity.

1.5. Other policy concerns related to raw materials

Trade policies are generally related to many economic, social and political issues, and raw material trade is not an exception. It is associated with many other concerns due to the fact that extracting activities prompt some political, social and economic problems. In this regard, the EU must consider these concerns when ensuring fair access to raw material sources abroad. However, in this paper, it is argued that the EU prioritizes its economic and material interests over other policy concerns while implementing external trade policies towards the export restrictions on raw materials.

Human Rights and Security Concerns

Extracting as an economic activity may lead to human rights abuses such as forced labor or child labor as well as conflict-related concerns since armed groups in politically unstable areas can benefit from mineral trade and fund their armed actions. This is, without doubt, a policy concern that the EU must consider while designing the raw material strategy to ensure free access to raw material resources. Accordingly, the RMI addresses the conflict-related aspects of raw materials and international initiatives to promote transparency in the extractive sector such as the KPCS (for blood diamonds) and EITI.

In addition, the EU has published the Conflict Minerals Regulation (EUR-Lex, 2017) and sets a transparency mechanism for importers of tin, tantalum, tungsten and gold originating from conflict-affected and high-risk areas. However, this Regulation is under criticism due to its narrow scope. Despite justifying on the basis that it has a realistic approach and constitutes a starting step to design and test an advanced scheme, it presents some critical aspects as follows: 1) It has a geographical scope 2) It is limited to 3TG (tin, tantalum and tungsten) metals only 3) It does not cover human rights abuses occurred in non-conflicted areas 4) It does not cover all industries and other importers rather than ore importers 5) It has a weak system of compliance (Macchi, 2021). Considering the limited scope and focusing on the weak compliance of due diligence set by this Regulation, Partzsch (2018) argues that the EU's normative power is only symbolic in conflict minerals issue because the EU accepts collective international norms by imposing due-diligence but is unwilling to put a tight rein on domestic business by leaving the issue to the private sector and consumer preferences at the end of compliance mechanism¹⁵. Therefore, the EU's material and economic interests are prioritized, and normative power is only symbolic to provide conflict-free raw materials to the EU industries. Furthermore, human rights abuses are not limited to conflict-related areas (see Macchi, 2021, p. 277- 278), and the EU seems to overlook this issue in the raw materials sector without an integrated approach.

Environmental Concerns

Environmental concerns and sustainable development are among the crucial topics the EU pursues in external relations. Sustainable development is referred to among the values of the EU in Article 2(5) of the Lisbon Treaty. In

this regard, the EU designs its policies including trade policies to promote sustainable development.

Sustainable development and environmental concerns are frequently covered by the RTAs signed by the EU. Therefore, the EU regards environmental concerns when designing and implementing external trade policies. Furthermore, the protection of the environment has been regarded as a discrete ground for justification of measures to free movement of goods, and the protection of the environment frequently overlaps the protection of health and life of human beings, animals or plants, which is a ground of justification stipulated under Article 36 of the TFEU (Oliver, 2010, p. 302-303). In other words, the protection of the environment is not only among the normative values of the EU but also an exception to the free movement of goods in EU's single market.

The raw material sector is highly relevant to environmental politics owing to the environmental problems generated from extracting activities. These environmental effects are capable of changing the raw material trade patterns at the global level. As an example of this, the US used to be the main supplier of rare elements to Europe, and the US and Australia stopped producing raw materials due to production costs and environmental concerns (Biedermann, 2012, p. 8). Although the RMI refers to improving their social and environmental standards in partner countries, it should be assessed whether the EU pursues this aim when implementing raw material diplomacy. Awuah (2019) refers to the environmental and social problems generated by mining activities and argues that the influence of the EU to mitigate the effects of these problems is very limited.

Regarding the trade policies towards export restrictions, it may be expected that the EU respects the export restrictions to promote sustainable development and mitigate environmental and social problems in line with its own values and principles as well as its single market concept. In this framework, the Global Europe (2006, p. 6) states "*Unless justified for security or environmental reasons, restrictions on access to resources should be removed.*" However, in practice, the EU has consistently opposed export restrictions on raw materials on environmental grounds.

In China – Raw Materials Case, the EU asserted that China could not invoke

the aggressive trade policies towards eliminating export restrictions, not to justify the export restrictions by raw material suppliers.

Developmental Concerns

The trade policies of the EU to eliminate export restrictions on raw materials may have detrimental effects on the development needs and concerns of resource-rich countries. As Espa (2015) points out, the countries using the export restrictions in the minerals and metals sector mainly aim at encouraging value-added production and economic diversification by using their own raw materials for the expansion of their industrial structure. In fact, the economies depending on extracting and exporting raw materials have difficulties in achieving industrial development.

Sachs and Warner (1995) point out that natural resource exports can hinder the growth in the manufacturing sector and accordingly prompt slow economic growth in resource-rich countries compared to resource-poor countries. Fung and Korinek (2013, p. 32) assert that the export restrictions on raw materials may have detrimental effects in long run, but acknowledge the fact that using export restrictions increase profitability in manufacturing industries so that they may develop a position of global competitors and potentially capture markets abroad. It is found that the export taxes imposed on raw hides and skins by Kenya helped develop the leather processing industry (Traidcraft Exchange, 2010, p. 7). In that vein, Kühlbeck (2013, p. 13) argues that policies that allow countries to pursue development enhancing industrial policies including the use of local content rules and export restrictions may be needed. As a result, export restrictions on raw materials may be the driver for developing countries to promote the manufacturing sector and to decrease dependency on raw material exports that generate low profits and slower economic growth. When we look at the trade statistics of the EU on raw materials, many sub-Saharan African countries such as Kenya, Ivory Coast, Guinea, Liberia, Nigeria, Cameroon, Ethiopia and Gabon are among the raw material suppliers of the EU. Accordingly, The RMI states

“Many important raw materials are located in developing countries in Africa or in other developing countries. There is an obvious case for coherence between EU development policy and the EU's need for undistorted access to raw materials in order to create win-win situations: Good governance, transparency of mining deals and mining revenue, a level playing field of all companies, financing opportunities, sound taxation regimes and sound development practices are beneficial for both developing countries and the EU's access to raw materials.”

and refers to good governance to transform the availability of mineral resources into the sustainable development of their economies and inclusive growth for the poor and promoting sound investment climate and sustainable management of the raw materials sector. However, it disregards the need for development in the manufacturing sector and the aim of decreasing dependency on raw material exports in developing countries.

The RMI does not address the developmental concerns properly despite Article 208 of the TFEU, which requires considering the interests of developing countries in the EU's policies. The RMI does not refer to the economic diversification and fostering the downstream and manufacturing sectors in developing countries considering the fact that dependency on raw material exports is a drawback for development efforts. On the contrary, Espa (2015) points out that advanced economies have not only objected to export restrictions on raw materials but have noted with concern that such measures are adopted within the context of comprehensive industrialization plans aimed at strengthening key manufacturing sectors. This is to say that it can be expected that the EU fears losing not only raw material resources in developing countries but also its comparative advantage in the manufacturing sector which may be generated by the economic transformation in developing economies.

Table-2: The EU's Raw Material Imports By Product (Million €)

PERIOD-TRADE FLOW/PRODUCT	2021		2020	2019
	IMPORT	SHARE	IMPORT	IMPORT
Hides, skins and furskins, raw	420	0,5%	463	593
Oil-seeds and oleaginous fruits	11.710	12,6%	10.009	9.164
Crude rubber	4.684	5,0%	3.184	4.135
Cork and wood	6.710	7,2%	5.099	5.505
Pulp and waste paper	4.790	5,2%	3.704	4.946
Textile fibres and their wastes	3.154	3,4%	2.668	3.326
Crude fertilizers	4.949	5,3%	4.048	4.730
Metalliferous ores and metal scrap	49.898	53,8%	33.668	32.910

Crude animal and vegetable materials, n.e.s.	6.027	6,5%	5.639	5.880
Confidential trade of section 2	440	0,5%	22	101
Trade of section 2 not elsewhere specified	3	0,0%	121	138
TOTAL (Crude materials, inedible, except fuels)	92.786	100,0%	68.625	71.429

Table-3: The EU's Raw Material Trade Balance By Product (Million €)

PERIOD/PRODUCT	2021	2020	2019
Hides, skins and furskins, raw	611	235	686
Oil-seeds and oleaginous fruits	- 10.253	- 8.819	- 7.969
Crude rubber	- 2.239	- 1.361	- 1.898
Cork and wood	7.487	4.703	3.614
Pulp and waste paper	215	287	- 598
Textile fibres	1.055	754	1.052
Crude fertilizers	- 1.839	- 1.362	- 1.651
Metalliferous ores and metal scrap	- 27.880	- 19.382	- 18.868
Crude animal and vegetable materials, n.e.s.	3.814	3.174	2.829
Confidential trade of section 2	- 155	299	204
Trade of section 2 not elsewhere specified	1	11	- 11
TOTAL (Crude materials, inedible, except fuels)	- 29.183	- 21.459	- 22.611

Table-4: The EU's Top 50 Raw Material Suppliers As of 2021 (Million €)

RANK	PARTNER/PERIOD	2021	2020	2019
1	Brazil	12.318	7.863	8.362
2	United States	11.587	9.405	10.079
3	Russian Federation	7.023	4.797	4.591
4	Canada	6.320	5.695	4.856
5	South Africa	5.556	3.546	3.089
6	Ukraine	5.339	3.333	4.324
7	United Kingdom	4.352	3.244	3.538

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8	China	3.020	2.556	2.976
9	Australia	2.442	1.405	1.682
10	Turkey	2.433	1.688	1.485
11	Chile	2.323	1.757	2.060
12	Peru	2.138	1.551	1.545
13	Norway	1.936	1.578	1.685
14	Switzerland	1.896	1.328	1.376
15	Indonesia	1.437	972	993
16	Mexico	1.254	1.051	918
17	India	1.016	824	893
18	Belarus	954	684	686
19	Thailand	877	567	703
20	Uruguay	868	680	1.125
21	Argentina	863	870	822
22	Korea, Republic of	709	573	608
23	Japan	705	610	681
24	Morocco	647	556	612
25	Ecuador	593	411	239
26	Panama	592	335	166
27	Kenya	529	481	505
28	Côte d'Ivoire (Ivory Coast)	526	346	378
29	Bosnia and Herzegovina	514	346	365
30	Malaysia	465	335	395
31	Serbia	460	389	340
32	Taiwan	439	315	266
33	Bolivia, Plurinational State of	399	217	259
34	Guinea	397	473	453
35	Egypt	393	288	298
36	Liberia	392	312	240
37	Georgia	373	451	333
38	Israel	358	297	322

39	Mauritania	339	228	293
40	Kazakhstan	316	195	212
41	Nigeria	313	240	223
42	Viet Nam	298	188	237
43	New Zealand	265	214	263
44	Saudi Arabia	256	287	271
45	North Macedonia	250	204	238
46	Cameroon	229	199	242
47	Ethiopia	209	197	195
48	Tunisia	203	150	155
49	Colombia	201	153	169
50	Gabon	193	143	205

1.6. Conclusion

The EU implements external trade policies to eliminate export restrictions on raw materials imposed by its trade partners. In fact, promoting free and fair trade is among the main values of the EU, and the EU's single market is a distinctive model where free movement of goods is granted. Therefore, the aim of eliminating trade-distorted measures imposed by third countries is compatible with the EU's values and principles and the purpose of exporting its market model to the world. On the other hand, this strategy of the EU also serves its economic and material interests. The EU prioritizes its economic and material interests over its values, principles or market model of the EU, and trade policies targeting at elimination of export restrictions on raw materials in global trade are shaped in pursuance of the EU's interests.

The EU considers the distribution of powers in global trade governance. The MFN principle and similar concerns push developed countries, particularly Japan, the EU and the US, make a coalition to develop new rules on export restrictions at NAMA negotiations. On the other side, the bloc-type and issue-based coalition among developing countries on export restrictions discipline resists creating new rules on export restrictions as these countries tend to implement export restrictions in line with their development needs. In this regard, bilateral and regional arrangements, whereby the EU averts the coalition among developing countries in the multilateral arena, are more appropriate for the EU

to use its asymmetrical power. The EU can gain also a comparative advantage over other countries that seek access to raw materials in global market. Moreover, the EU aims at excluding its rivals, particularly China, via bilateral and regional policy tools although this constitutes discriminatory trade practices in global trade. The EU is trying to impose more stringent rules for export restrictions beyond the WTO discipline through bilateral and regional agreements whereby it gains a comparative advantage over its rivals in global trade.

Furthermore, the EU does not hesitate to form asymmetrical trade governance through the post-1994 accession protocols of newly acceded WTO members to eliminate export restrictions and bind these members not to impose new restrictions so that access to raw materials can be ensured. Regardless of their threat to non-discrimination and reciprocity, which are among indispensable principles of global trade governance, the EU invokes the WTO-plus obligations included in those accession protocols.

The EU tends to use unilateral and coercive measures regardless of their appropriateness within the framework of multilateral trade rules and their purposes. In this regard, the EU signals to use of anti-dumping measures and other trade remedy instruments to force their partners to remove barriers on raw materials although trade remedy measures aim to handle unfair trade practices in essence. Likewise, implementing the EU's competition rules extraterritoriality, regardless of legal and practical difficulties, is referred to as a policy tool. Additionally, removing the beneficiary status of developing countries from GSP scheme that use export restrictions on raw materials is on the agenda notwithstanding the fact that GSP schemes are designed on a non-reciprocal basis.

Lastly, the raw material strategy inherently relates to many other policy considerations mainly security and human rights, protecting the environment and development needs of the EU's trade partners. Notwithstanding that they are closely related to the EU's own values and principles, the EU prioritizes the interests of its downstream industries to access raw materials over these policy concerns. Furthermore, although these policy concerns may constitute justification grounds for suspending the EU's single market rules, the EU opposes invoking these concerns in international raw material trade. These remind the realist assumptions and realist power theory for the EU in the global economy rather than normative or market power theories.

The unprecedented demand for raw materials caused by the industrial development of the emerging countries, mainly China and India, has pushed the EU to design a raw material strategy thereby ensuring the access of the EU

downstream and manufacturing industries to raw materials. Apart from the sustainable supply of raw materials from European sources and resource efficiency through recycling; fair access to international raw material markets constitutes an essential pillar of this strategy. In this context, the EU implements external trade policies to eliminate and/or relieve the export restrictions imposed by the EU's trade partners on raw materials. These external trade policies include using multilateral platforms -mainly rules-based trade governance under the WTO-, achieving bilateral and regional initiatives and resorting to unilateral and coercive measures such as imposing trade remedy measures. When implementing and designing these trade policy tools, the economic and material interests of the EU are prioritized over other policy considerations which are related to the values and principles of the EU's identity as well as its single market rules. Furthermore, the EU seeks to find the best policy tools whereby it gains a comparative advantage in global trade. The EU resorts to the most appropriate and effective measures and diplomatic tools in order to ensure access to raw materials provided that these policy tools are sufficient to protect and promote its interests regardless of their appropriateness and compatibility with multilateral and rules-based trade system. Taking into account these policy patterns, this study argues that the realist power theory for the EU in global trade must be recalled in order to assess critically the EU's external trade policies towards export restrictions imposed by its trade partners on industrial raw materials.

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DEVELOPMENT OF THE GRAIN TRADE IN POLAND IN THE ASPECT OF CHANGES IN THE WORLD AND EUROPEAN UNION

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2.1. Introduction

One of the most important factor of the development of food sector is trade of agri-food products. Poland is self-sufficient in food production that is why the trade of these products is important.

Foreign trade is an important factor determining the country's development and GDP. This trade is regulated by regulations and policies, e.g. the EU's Common Agricultural Policy. Countries specializing in foreign trade can achieve competitive advantages, which translates into better competitiveness of the economy.

Foreign trade has been the subject of considerations in the history of economic thought. First attempts to explain the benefits of international trade appeared in the 16th century with the rise of absolute monarchies and the emergence of mercantilist views.

Mercantilism had two basic forms:

- 1) bouillonism, which was in force in the 16th century and promoted politics positive metallic balance, protecting the country against foreign foreign exchange the production and accumulation of gold and silver as a source of wealth; and
- 2) mercantilism proper (17th-18th centuries), which he postulated a policy of positive trade balance. A way for him achievement was

the export of finished goods and the import of raw materials. Representatives of mercantilism linked the nation's wealth with what was owned capital stock that increased thanks to the surplus obtained trade with other countries. This meant that there were benefits from the exchange obtained by one country brought losses to others.

Formalized and more comprehensive views on trade international appeared at work Adam Smith – „*Inquiry into the Nature and Causes of the Wealth of Nations*” (1776). The author himself writes about the exchange: “*If a foreign country can supply us with some goods cheaper than we can do it ourselves to do, it is better to buy this product for some price part of the products of own industry, which covers the field we have advantage over other countries.*”

Smith assumed that each country could produce one or more good at lower real costs than its trading partners. The basis for exchange is the specialization of production on an international scale, which is expressed by making the best use of available resources. Labor is the determining factor in exchange and the basis of advantage in higher work efficiency (lower costs). So to achieve the greatest benefits from trade, more manufactured goods should be imported effectively abroad, and export the goods that are made more effectively in the country. A. Smith clearly rejected the mercantilist arguments and showed that that international exchange can be beneficial to all its participants. However, the concept of absolute advantage is useful for explaining only a small part of international trade convincingly explains the exchange of goods caused uneven distribution of natural resources on Earth. It also excludes the possibility of beneficial cooperation if one of the countries produces both goods more efficiently than its partner.

An extension of the theory of absolute costs by A. Smith was published by D. Ricardo (1772-1823) in 1817 in the work "*Principles political economy and taxation*", theory comparative costs. D. Ricardo noticed that the absolute difference in production costs is not necessary to the exchange was profitable. Sufficient a condition for obtaining benefits from trade the existence of a country's relative advantage in production at least one good. The country will strive to exports of goods whose relative cost manufacturing (in relation to other goods) is lower than in other countries.

Foreign trade is an important factor in determining the development of a country and the formation of GDP. This trade is regulated by regulations and

policies, such as the Common Agricultural Policy of the EU. Countries specializing in foreign trade can achieve competitive advantages, which translates into better competitiveness of the economy.

Poland is a country with high trade turnover in agri-food products with the EU. The trade balance was positive in 2024 and amounted to EUR 17.9 billion. It consisted of high export turnover of EUR 53.5 billion and import turnover of EUR 35.6 billion. Since 2004, i.e. accession to the EU, the trade balance in agri-food products has systematically increased from EUR 0.8 billion, which means an increase of over 2000%. This is the result of the fact that Poland gained access to the markets of EU countries, which intensified exchange. Nearly 75% of exports from Poland are directed to the EU market (Polish foreign trade in agri-food products (EUR billion) in 2024).

Cereals play an important role in foreign trade in agri-food products. Due to its widespread use and processing across several sectors, cereal grain is a key resource. In addition to being essential for human and animal nutrition, cereals are also utilized in the energy, textile, cosmetic, and pharmaceutical sectors. For this reason grain market crises, for, have important domestic and international economic and social repercussions (Kalinowska, Bórawski 2024).

In 2024, cereals and processed products accounted for EUR 6.5 billion. The trade balance in cereals in 2024 amounted to EUR 1,811 million, confectionery EUR 1,861 million, and cereal and flour products EUR 2,678 million. Considering the great importance of foreign trade in cereals and their processed products, an attempt was made in the work to assess the changes (Rynek zbóż 2024).

The main objective of the scientific study is to present the turnover of foreign trade in cereals in Poland against the background of the EU and the world. Attention was focused on wheat, rye, barley, oats, triticale and corn. The turnover of these cereals in Poland, the EU and the world was presented.

We used different methods to analyze the changes in imports, exports and trade balance of grain. Descriptive statistics for sample observations 1961-2023 were presented. First, we verify Dickey-Fuller results to check whether the time rank was stationary. The test is very important and necessary to analyze the activities of advance time series research (Masudual et al. 2018).

We verify two hypothesis. The hypothesis H0 verifies that the null hypothesis of the test says that the analyzed series is stationary. The alternative hypothesis H1 says that the series is not stationary. We chose the level of significance, which is the probability that we rejected the null hypothesis despite it being true, usually 5% (Kabała 2019).

Next, we presented the VAR model and elaborated the prognosis. Finally, we elaborated the test for normality of the distribution of residuals. These tests included following tests: Dornik-Hansen test, Shapiro-Wilk test, Liliefors test and Jarque'a Bera test.

The structure of the study was subordinated to the main forces of foreign trade, i.e. imports, exports and balance. In addition, the relationship of the studied subject matter with economic theories was demonstrated.

2.2. Changes in imports of grain in the world, EU-27 and Poland

Grain imports to Poland are of historical importance. Since accession to the EU, most grains have been imported from EU countries. This was influenced by Poland's proximity and membership in the EU structures, which was associated with the elimination of barriers in foreign trade on the EU market. Since 2004, there has been a systematic increase in grain imports to Poland. In the 2015-2016 season, the balance of foreign trade in grains amounted to 4 million tons, and in the 2023/24 season it was already 11.7 million tons. (Rynek zbóż 2024).

In the period July 2023 – April 2024, we imported 790 thousand tons of cereal grain, over three quarters (76%) less than in the same period of the 2022/2023 season. The largest import was wheat (480 thousand tons), which accounted for over three fifths (61%) of the total cereal grain imported to Poland. 129 thousand tons of corn arrived (16% of the total import), and 113 thousand tons of barley (14% of import). The value of imported cereal grain amounted to EUR 344 million and was almost two thirds (64%) lower than a year earlier (Skąd przyjeżdża do nas najwięcej zboża? Z Ukrainy jest zakaz importu 2024).

The most important grains, which are wheat and rye are competitive in the market which depends on costs of production, demand, prices and quality (Mukhametgaliev et al. 2020). The competitiveness on grain market depends on grain trade and interregional grain movements, marketing policies and other (Negassa et al. 2003).

World wheat imports in 2023 accounted for 163.29% of wheat imports in 2005, while EU-27 imports accounted for 143.99% of imports in 2005. In turn, wheat imports to Poland in 2023 accounted for 346.53% of imports in 2005. World rye imports in 2023 accounted for 81.46% of rye imports in 2005, while EU-27 imports accounted for 99.03% of rye imports in 2005. In turn, rye

imports to Poland in 2023 accounted for 306.63% of rye imports in 2005. In 2005, Polish wheat imports accounted for 0.20% of global wheat imports and 0.89% of wheat imports in the EU-27. In 2023, Polish wheat imports accounted for 0.43% of global wheat imports (increase of 0.23% relative to 2005) and 2.15% of wheat imports in the EU-27 (increase of 1,26% relative to 2005). In 2005, Polish rye imports accounted for 0.15% of global rye imports and 0.24% of rye imports in the EU-27. In 2023, the above parameters increased by 0,55% and 0,74%, respectively, relative to 2005. In 2023, Polish rye imports accounted for 0,40% of global rye imports and 0,50% of rye imports in the EU-27 (Table 1).

Table 1. Wheat and rye imports in the world, EU-27, and Poland in 2005-2023 (in '000 t)

Wheat						Rye					
Year	World	EU-27	Poland	% share of Polish imports in global imports	% share of Polish imports in EU-27 imports	Year	World	EU-27	Poland	% share of Polish imports in global imports	% share of Polish imports in EU-27 imports
2005	120 277	27 301	244	0.20	0.89	2005	1 847	1 124	3	0.15	0.24
2006	126 621	26 451	592	0.47	2.24	2006	1 881	1 229	18	0.98	1.50
2007	124 659	26 115	1 176	0.94	4.50	2007	1 220	763	167	13.69	21.87
2008	128 340	26 351	1 136	0.89	4.31	2008	972	696	54	5.61	7.83
2009	146 457	32 118	619	0.42	1.93	2009	1 693	1 456	6	0.38	0.44
2010	146 713	31 970	684	0.47	2.14	2010	1 316	941	5	0.38	0.53
2011	148 573	29 660	817	0.55	2.75	2011	993	686	45	4.55	6.58
2012	164 154	29 160	735	0.45	2.52	2012	1 501	1 218	70	4.66	5.74
2013	161 716	25 810	571	0.35	2.21	2013	1 737	1 387	6	0.37	0.46
2014	172 597	30 892	547	0.32	1.77	2014	1 650	1 279	17	1.03	1.33
2015	166 252	33 192	478	0.29	1.44	2015	1 162	844	4	0.37	0.51
2016	187 874	38 048	814	0.43	2.14	2016	804	558	10	1.23	1.77

2017	194 485	36 453	925	0.48	2.54	2017	975	688	18	1.86	2.63
2018	186 515	35 090	625	0.34	1.78	2018	1 426	1 032	54	3.77	5.21
2019	180 669	32 378	554	0.31	1.71	2019	1 323	927	12	0.89	1.26
2020	191 276	31 952	869	0.45	2.72	2020	2 026	1 616	7	0.32	0.41
2021	202 722	32 003	595	0.29	1.86	2021	2 069	1 699	48	2.34	2.84
2022	190 129	32 162	952	0.50	2.96	2022	1 526	1 023	20	1.31	1.95
2023	196 406	39 310	844	0.43	2.15	2023	1 505	1 113	8	0.55	0.74
Change (%) 2023/2005	163.29	143.99	346.53	+0.23	+1.26	Change (%) 2023/2005	81.46	99.03	306.63	+0.40	+0.50

Source: own elaboration based on FAO data. <https://www.fao.org/faostat/en/#data/TCL> Access 28.03.2025.

World barley imports in 2023 accounted for 167.29% of barley imports in 2005, while EU-27 imports accounted for 172.40% of imports in 2005. In turn, barley imports to Poland in 2023 accounted for 172.32% of imports in 2005. World oat imports in 2023 constituted 142.05% of oat imports in 2005, while imports in the EU-27 constituted 217.84% of imports in 2005. In turn, oat imports to Poland in 2023 constituted 475.66% of imports in 2005. In 2005, Polish barley imports accounted for 0.50% of global barley imports and 1.63% of barley imports in the EU-27. In 2023, Polish barley imports accounted for 0.52% of global barley imports (increase of 0.02% relative to 2005) and 1.63% of barley imports in the EU-27. In 2005, Polish oat imports accounted for 0.08% of global oat imports and 0.35% of oat imports in the EU-27. In 2023, the above parameters increased by 0.18% and 0.42%, respectively, relative to 2005. In 2023, Polish oat imports accounted for 0.26% of global oat imports and 0.77% of oat imports in the EU-27 (Table 2).

Table 2. Barley and oat imports in the world, EU-27, and Poland in 2005-2023 (in '000 t)

Barley						Oats					
Year	World	EU-27	Poland	% share of Polish imports in global imports	% share of Polish imports in EU-27 imports	Year	World	EU-27	Poland	% share of Polish imports in global imports	% share of Polish imports in EU-27 imports
2005	23 422	7 220	117	0.50	1.63	2005	2 677	583	2	0.08	0.35
2006	24 087	7 546	99	0.41	1.32	2006	2 793	470	2	0.06	0.36
2007	22 163	7 032	306	1.38	4.35	2007	2 910	524	4	0.12	0.67
2008	25 633	7 579	290	1.13	3.83	2008	3 232	556	7	0.23	1.33
2009	24 092	8 486	154	0.64	1.81	2009	2 686	625	5	0.18	0.77
2010	25 360	9 000	136	0.54	1.52	2010	2 675	658	4	0.17	0.67
2011	24 573	8 958	225	0.92	2.51	2011	2 786	676	6	0.21	0.85
2012	27 667	7 245	197	0.71	2.72	2012	2 874	679	4	0.15	0.66
2013	30 168	7 559	158	0.52	2.09	2013	2 735	682	15	0.54	2.16
2014	31 766	7 315	257	0.81	3.52	2014	3 242	771	19	0.58	2.46
2015	35 764	7 804	117	0.33	1.50	2015	3 372	940	24	0.72	2.59
2016	33 849	8 719	165	0.49	1.89	2016	3 204	928	7	0.23	0.80
2017	39 334	9 654	247	0.63	2.56	2017	3 529	958	6	0.18	0.65
2018	34 723	8 515	225	0.65	2.64	2018	3 503	1 067	13	0.37	1.20
2019	32 667	9 159	215	0.66	2.35	2019	3 505	1 135	8	0.22	0.68
2020	33 861	9 413	206	0.61	2.19	2020	3 837	1 275	11	0.29	0.88
2021	44 559	9 635	170	0.38	1.76	2021	3 774	1 400	11	0.29	0.78
2022	33 536	10 185	218	0.65	2.14	2022	3 453	1 294	9	0.27	0.72
2023	39 182	12 448	202	0.52	1.63	2023	3 803	1 271	10	0.26	0.77
Change (%) 2023/2005	167.29	172.40	172.32	+0.02	0.00	Change (%) 2023/2005	142.05	217.84	475.66	+0.18	+0.42

Source: own elaboration based on FAO data. <https://www.fao.org/faostat/en/#data/TCL> Access 28.03.2025.

World triticale imports in 2023 constituted 201.4% of triticale imports in 2005, while imports in the EU-27 constituted 197.55% of imports in 2005. In turn, triticale imports to Poland in 2023 constituted 122.31% of imports in 2005.

Table 3. Triticale and maize imports in the world, EU-27, and Poland in 2005-2023 (in '000 t)

Triticale						Maize					
Year	World	EU-27	Poland	% share of Polish imports in global imports	% share of Polish imports in E-U-27 imports	Year	World	EU-27	Poland	% share of Polish imports in global imports	% share of Polish imports in E-U-27 imports
2005	390	388	5	1.25	1.26	2005	88 106	13 090	22	0.02	0.17
2006	327	313	6	1.73	1.81	2006	95 986	13 883	189	0.20	1.36
2007	154	142	4	2.47	2.67	2007	107 583	22 575	610	0.57	2.70
2008	220	213	41	18.86	19.41	2008	103 134	20 546	781	0.76	3.80
2009	503	495	7	1.40	1.42	2009	100 182	16 863	361	0.36	2.14
2010	468	454	4	0.85	0.88	2010	107 735	16 609	285	0.26	1.72
2011	275	269	6	2.35	2.40	2011	108 327	19 782	478	0.44	2.42
2012	384	366	9	2.27	2.38	2012	117 820	22 609	495	0.42	2.19
2013	590	573	4	0.72	0.74	2013	120 128	23 484	284	0.24	1.21
2014	718	704	6	0.80	0.82	2014	140 124	28 176	351	0.25	1.25
2015	866	856	6	0.67	0.67	2015	144 743	26 438	382	0.26	1.45
2016	662	637	13	1.98	2.06	2016	152 023	25 580	320	0.21	1.25
2017	591	575	10	1.62	1.66	2017	157 301	30 968	422	0.27	1.36
2018	568	549	3	0.57	0.59	2018	170 349	36 333	295	0.17	0.81
2019	476	464	7	1.43	1.47	2019	186 581	39 399	389	0.21	0.99
2020	1 121	1 112	6	0.50	0.50	2020	189 067	35 389	422	0.22	1.19
2021	918	906	3	0.33	0.33	2021	199 008	32 716	222	0.11	0.68

2022	852	832	4	0.52	0.53	2022	202 471	42 771	2 030	1.00	4.75
2023	786	766	6	0.76	0.78	2023	190 320	36 399	727	0.38	2.00
Change (%) 2023/2005	201.24	197.55	122.31	-0.49	-0.48	Change (%) 2023/2005	216.01	278.07	3322.30	+0.36	+1.83

Source: own elaboration based on FAO data. <https://www.fao.org/faostat/en/#data/TCL> Access 28.03.2025.

World corn imports in 2023 constituted 216.01% of triticale imports in 2005, while imports in the EU-27 constituted 278.07% of imports in 2005. In turn, corn imports to Poland in 2023 constituted 3322.30% of imports in 2005. The analysis of the data for 2005-2023 revealed that in 2005, Polish triticale imports accounted for 1.25% of global triticale imports and 1.26% of triticale imports in the EU-27. In 2023, Polish triticale imports accounted for 0.76% of global triticale imports (decrease of 0.49% relative to 2005) and 0.78% of triticale imports in the EU-27 (decrease of 0.48% relative to 2005). In 2005, Polish maize imports accounted for 0.02% of global maize imports and 0.17% of maize imports in the EU-27. In 2023, the above parameters increased by 0.36% and 1.83%, respectively, relative to 2005. In 2023, Polish maize imports accounted for 0.38% of global maize imports and 2.00% of maize imports in the EU-27 (Table 3).

2.3. Changes in the exports of grain in the world, EU-27 and Poland

In 2005, Polish wheat exports accounted for 0.37% of world wheat exports and 1.45% of EU-27 wheat exports. In 2023, Polish wheat exports accounted for 3.50% of world wheat exports (an increase of 3.13% compared to 2005) and 11.76% of EU-27 wheat exports (an increase of 10.31% compared to 2005). In 2005, Polish rye exports accounted for 17.21% of world rye exports and 19.02% of EU-27 rye exports. In 2023, the above parameters increased by 25.58% and 39.61%, respectively, compared to 2005. In 2023, Polish rye exports accounted for 42.79% of world rye exports and 58.63% of rye exports in the EU-27 (Table 4).

In the first eight months of 2024, the second largest export of agri-food products from Poland, with a 12% share, was cereal grain and cereal products, the total sales of which in the period January-August 2024, compared to the

same period in 2023, decreased by 17%, to EUR 4.2 billion. In the eight months of 2024, 6.8 million tons of cereal grain were exported from Poland for EUR 1.5 billion. In the structure of export volume, wheat accounted for 57% (3.8 million tons, a 20% y/y drop in export volume), corn – 26% (1.7 million tons, a 39% drop), rye – 7% (482 thousand tons, an increase of 41%) and barley – 3% (212 thousand tons, a 36% drop). (Rekordowy handel produktami rolno-spożywczymi w Unii Europejskiej 2004).

In the first eight months of 2024, the largest exports were to the following countries:

- France – bread and bakery products (EUR 114 million, 28 thousand tons),
- The Netherlands – cereal grains (mainly corn – EUR 64 million, 312 thousand tons
- And wheat – EUR 15 million, 57 thousand tons),
- Italy – bread and bakery products (EUR 71 million, 14 thousand tons),
- Czech Republic – bread and bakery products (EUR 140 million, 54 thousand tons). (Wyniki eksportu produktów rolno-spożywczych z Polski w okresie styczeń-sierpień 2024 r. 2024).

Table 4. Wheat and rye exports in the world, EU-27, and Poland in 2005-2023 (in ‘000 t)

Wheat						Rye					
Year	World	EU-27	Poland	% share of Polish exports in global exports	% share of Polish exports in EU-27 exports	Year	World	EU-27	Poland	% share of Polish exports in global exports	% share of Polish exports in EU-27 exports
2005	120 465	30 712	445	0.37	1.45	2005	2 016	1 823	347	17.21	19.02
2006	126 436	33 998	652	0.52	1.92	2006	1 866	1 662	64	3.45	3.87
2007	124 637	28 074	336	0.27	1.20	2007	1 267	854	59	4.64	6.88
2008	131 166	37 320	346	0.26	0.93	2008	941	744	79	8.42	10.65
2009	146 967	45 059	2 016	1.37	4.47	2009	1 728	1 602	592	34.25	36.95
2010	145 740	47 608	940	0.65	1.98	2010	1 385	1 098	403	29.12	36.75

2011	148 348	40 343	825	0.56	2.05	2011	971	669	103	10.60	15.39
2012	164 621	40 348	1 061	0.64	2.63	2012	1 495	1 014	312	20.89	30.80
2013	162 798	50 103	1 642	1.01	3.28	2013	1 819	1 586	865	47.54	54.54
2014	174 032	57 274	3 200	1.84	5.59	2014	1 688	1 426	826	48.94	57.91
2015	170 869	57 766	3 955	2.31	6.85	2015	1 389	1 150	538	38.76	46.80
2016	190 101	63 264	4 402	2.32	6.96	2016	1 015	839	435	42.90	51.86
2017	196 600	53 689	2 786	1.42	5.19	2017	998	792	367	36.81	46.40
2018	190 871	48 884	1 790	0.94	3.66	2018	1 548	948	484	31.26	51.06
2019	186 305	54 068	2 080	1.12	3.85	2019	1 413	1 190	477	33.73	40.06
2020	198 574	60 871	4 689	2.36	7.70	2020	2 231	2 049	1 293	57.98	63.14
2021	201 084	55 311	3 591	1.79	6.49	2021	2 248	1 844	1 061	47.18	57.53
2022	190 977	55 979	3 638	1.90	6.50	2022	1 512	1 049	439	29.02	41.81
2023	199 114	59 271	6 972	3.50	11.76	2023	1 590	1 160	680	42.79	58.63
Change (%) 2023/ 2005	165,29	192,99	1566,23	+3.13	+10.31	Change (%) 2023/ 2005	78,87	63,64	196,14	+25.58	+39.61

Source: own elaboration based on FAO data. <https://www.fao.org/faostat/en/#data/TCL> Access 28.03.2025.

In 2005, Polish barley exports accounted for 0.44% of world barley exports and 0.93% of EU-27 barley exports. In 2023, Polish barley exports accounted for 1.19% of world barley exports (an increase of 0.75% compared to 2005) and 2.66% of EU-27 barley exports (an increase of 1.73% compared to 2005). In 2005, Polish oat exports accounted for 3.60% of world oat exports and 9.34% of EU-27 oat exports. In 2023, the above parameters increased by 0.07% and 1.96%, respectively, compared to 2005. In 2023, Polish oat exports accounted for 3.67% of world oat exports and 11.30% of oat exports in the EU-27 (Table 5).

Table 5. Barley and oat exports in the world, EU-27, and Poland in 2005-2023 (in '000 t)

Barley						Oats					
Year	World	EU-27	Poland	% share of Polish exports in global exports	% share of Polish exports in EU-27 exports	Year	World	EU-27	Poland	% share of Polish exports in global exports	% share of Polish exports in EU-27 exports
2005	25 802	12 117	113	0.44	0.93	2005	2 604	1 004	94	3.60	9.34
2006	24 024	9 585	113	0.47	1.18	2006	2 889	734	69	2.40	9.46
2007	23 202	12 204	143	0.62	1.18	2007	2 865	657	45	1.56	6.82
2008	27 213	10 929	27	0.10	0.25	2008	3 376	786	17	0.49	2.10
2009	25 669	8 952	70	0.27	0.79	2009	2 730	784	22	0.81	2.83
2010	26 483	12 272	149	0.56	1.21	2010	2 759	804	45	1.63	5.60
2011	25 356	11 803	127	0.50	1.07	2011	2 973	884	25	0.86	2.88
2012	28 460	10 868	321	1.13	2.95	2012	2 903	949	47	1.64	5.00
2013	31 102	14 548	291	0.93	2.00	2013	2 508	924	61	2.44	6.61
2014	33 483	11 836	152	0.45	1.28	2014	3 035	1 119	40	1.31	3.56
2015	38 302	17 370	185	0.48	1.07	2015	3 161	1 137	112	3.55	9.86
2016	35 111	14 295	100	0.28	0.70	2016	2 879	1 010	85	2.95	8.41
2017	39 572	14 286	71	0.18	0.49	2017	2 807	1 092	86	3.06	7.87
2018	36 547	13 283	153	0.42	1.15	2018	3 067	1 136	136	4.45	12.01
2019	32 853	13 339	83	0.25	0.62	2019	3 232	1 119	82	2.54	7.34
2020	37 974	15 259	301	0.79	1.98	2020	3 711	1 324	148	3.98	11.16
2021	43 977	16 953	454	1.03	2.68	2021	3 736	1 375	227	6.07	16.50
2022	33 035	13 251	305	0.92	2.30	2022	3 522	1 200	137	3.88	11.38
2023	39 908	17 943	477	1.19	2.66	2023	4 010	1 301	147	3.67	11.30
Change (%) 2023/2005	154.67	148.09	423.17	+0.75	+1.73	Change (%) 2023/2005	154.01	129.56	156.76	+0.07	+1.96

Source: own elaboration based on FAO data. <https://www.fao.org/faostat/en/#data/TCL> Access 28.03.2025.

Analysis of data for the years 2005–2023 showed that in 2005, Polish triticale exports accounted for 16.73% of world triticale exports and 18.60% of EU-27 triticale exports. In 2023, Polish triticale exports accounted for 71.43% of world triticale exports (an increase of 54.70% compared to 2005) and 72.60% of EU-27 triticale exports (an increase of 54.00% compared to 2005). In 2005, Polish maize exports accounted for 0.28% of world maize exports and 2.01% of EU-27 maize exports. In 2023, the above parameters increased by 2.03% and 19.04%, respectively, compared to 2005. In 2023, Polish corn exports accounted for 2.31% of world corn exports and 21.05% of EU-27 corn exports (Table 6).

Table 6. Triticale and maize exports in the world, EU-27, and Poland in 2005-2023 (in '000 t)

Triticale						Maize					
Year	World	EU-27	Poland	% share of Polish exports in global exports	% share of Polish exports in EU-27 exports	Year	World	EU-27	Poland	% share of Polish exports in global exports	% share of Polish exports in EU-27 exports
2005	523	470	87	16.73	18.60	2005	90 510	12 671	255	0.28	2.01
2006	377	328	33	8.63	9.92	2006	95 459	12 050	252	0.26	2.09
2007	231	168	16	6.76	9.28	2007	110 025	13 133	145	0.13	1.11
2008	259	218	19	7.39	8.79	2008	102 099	13 745	169	0.17	1.23
2009	645	613	198	30.69	32.33	2009	100 323	16 724	226	0.23	1.35
2010	534	502	211	39.55	42.08	2010	108 732	15 917	158	0.15	1.00
2011	348	316	103	29.71	32.68	2011	109 944	16 642	306	0.28	1.84
2012	552	506	91	16.45	17.93	2012	120 450	18 920	1 048	0.87	5.54
2013	720	705	187	25.93	26.48	2013	124 222	17 897	885	0.71	4.95
2014	825	813	446	54.09	54.92	2014	142 822	18 426	789	0.55	4.28
2015	1 108	1 100	599	54.10	54.49	2015	148 247	21 993	694	0.47	3.16
2016	813	790	457	56.22	57.83	2016	153 852	16 985	872	0.57	5.13

2017	717	705	383	53.46	54.36	2017	161 566	18 099	1 181	0.73	6.53
2018	648	631	402	61.99	63.75	2018	173 564	18 606	1 146	0.66	6.16
2019	639	630	348	54.40	55.22	2019	191 654	22 155	1 146	0.60	5.17
2020	1 503	1 496	1 063	70.73	71.06	2020	192 867	23 992	1 490	0.77	6.21
2021	1 108	1 095	821	74.09	74.94	2021	196 870	23 669	2 286	1.16	9.66
2022	1 021	1 002	623	61.07	62.21	2022	209 500	23 084	3 881	1.85	16.81
2023	1 001	985	715	71.43	72.60	2023	197 868	21 706	4 569	2.31	21.05
Change (%) 2023/ 2005	191.43	209.38	817.50	+54.70	+54.00	Change (%) 2023/ 2005	218.61	171.30	1791.48	+2.03	+19.04

Source: own elaboration based on FAO data. <https://www.fao.org/faostat/en/#data/TCL> Access 28.03.2025

2.4. Balance trade of grains in Poland

The global foreign trade balance in wheat in 2005 amounted to 187 thousand tons and was lower than the foreign trade balance in 2023 by 2521 thousand tons, which in 2023 amounted to 1,708 thousand. In 2006, 2007, 2010, 2011 and 2021, the global foreign trade balance was negative. In the EU-27, the balance of foreign trade in wheat in 2005 amounted to 3.411 thousand tons and was lower than in 2023 by 16,550 thousand tons. The balance of foreign trade in wheat in Poland in 2023 amounted to 6,128 thousand tons and was higher than in 2005 by 5.926 thousand tons. The balance of foreign trade in Poland in 2005 amounted to 202 thousand tons. A negative balance of foreign trade in wheat in Poland took place in 2007 and 2008 (Figure 1).

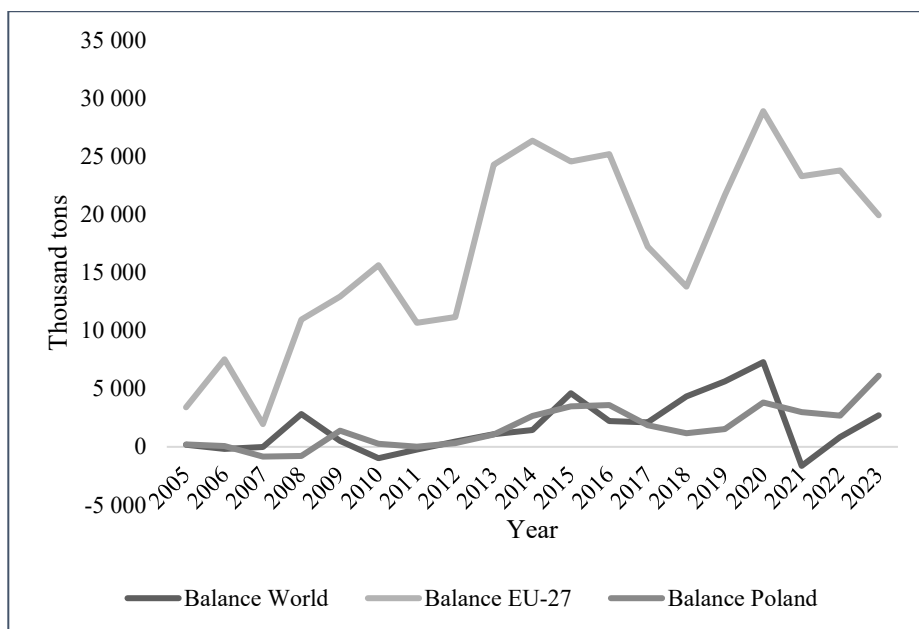


Figure 1. Balance of foreign trade in wheat in the World, EU-27 and in Poland in 2005-2023.

Source: own elaboration based on FAO data. <https://www.fao.org/faostat/en/#data/TCL> Access 28.03.2025.

The global foreign trade balance of rye in 2005 amounted to 169 thousand tons and was higher than the foreign trade balance in 2023 by 84 thousand tons, which in 2023 amounted to 85 thousand tons. In the EU-27, the balance of foreign trade in rye in 2005 amounted to 699 thousand tons and was higher than in 2023 by 652 thousand tons. The EU-27 foreign trade balance in rye was negative in 2011, 2012 and 2018. The balance of foreign trade in rye in Poland in 2023 amounted to 672 thousand tons and was higher than in 2005 by 328 thousand tons. The balance of foreign trade in Poland in 2005 amounted to 344 thousand tons. A negative balance of foreign trade in rye in Poland took place in 2008 (Figure 2).

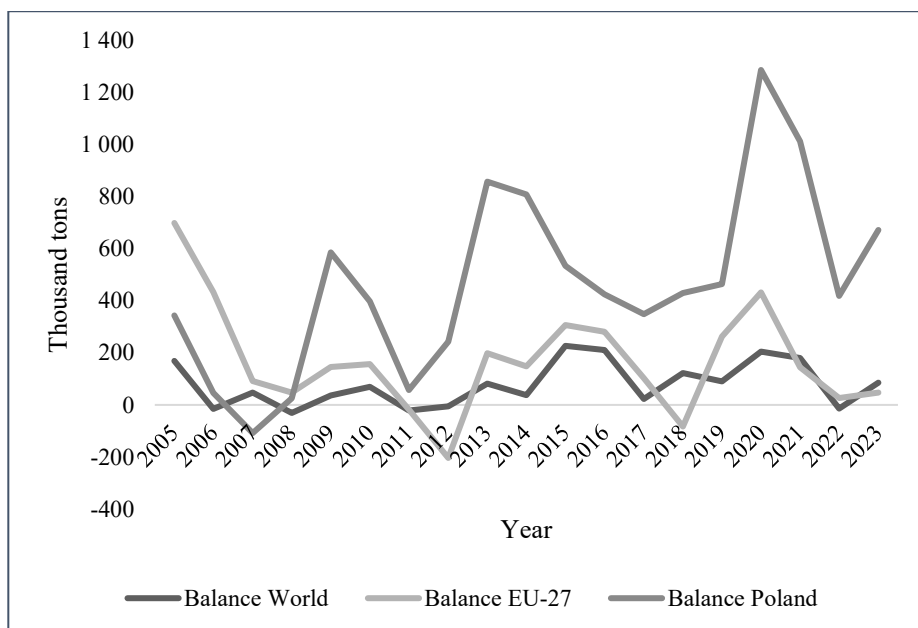


Figure 2. Balance of foreign trade in rye in the World, EU-27 and in Poland in 2005-2023.

Source: own elaboration based on FAO data. <https://www.fao.org/faostat/en/#data/TCL> Access 28.03.2025.

The global foreign trade balance of barley in 2005 amounted to 2.381 thousand tons and was higher than the foreign trade balance in 2023 by 1.655 thousand tons, which in 2023 amounted to 726 thousand tons. In the EU-27, the foreign trade balance of barley in 2005 amounted to 4,896 thousand tons and was lower than in 2023 by 626 thousand tons. The foreign trade balance of barley in Poland in 2023 amounted to 274 thousand tons and was higher than in 2005 by 279 thousand tons. The balance of foreign trade in Poland in 2005 amounted to -5 thousand tons (Figure 3).

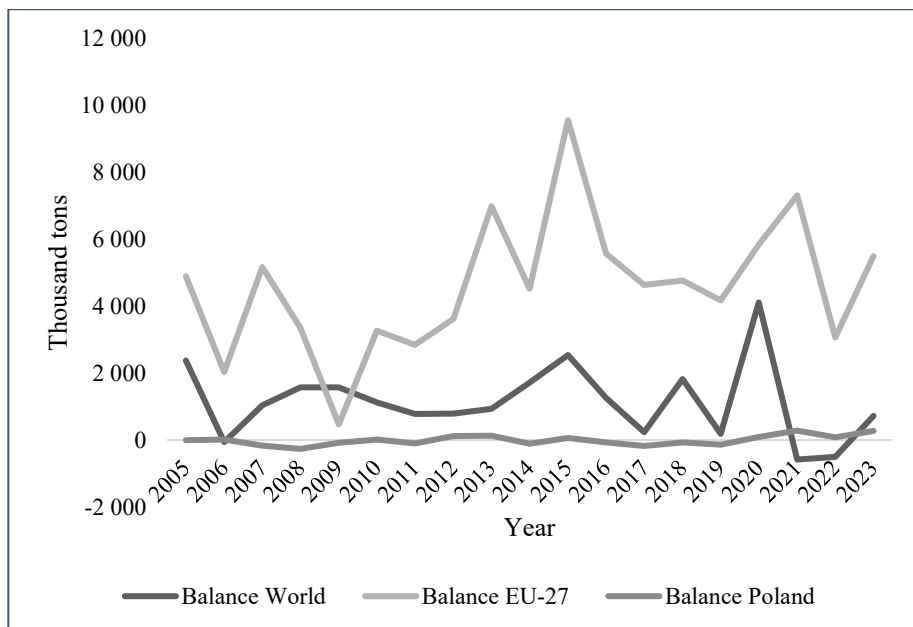


Figure 3. Balance of foreign trade in barley in the World, EU-27 and in Poland in 2005-2023.

Source: own elaboration based on FAO data. <https://www.fao.org/faostat/en/#data/TCL> Access 28.03.2025.

The global foreign trade balance of oats in 2005 amounted to -73 thousand tons and was lower than the foreign trade balance in 2023 by 280 thousand tons, which in 2023 amounted to 207 thousand tons. In 2005, 2007, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020 and 2021, the global foreign trade balance of oats was negative. In the EU-27, the foreign trade balance of oats in 2005 amounted to 421 thousand tons and was higher than in 2023 by 391 thousand tons. A negative balance of foreign trade in oats in the EU – 27 was recorded in 2019, 2021 and 2022. The balance of foreign trade in oats in Poland in 2023 amounted to 137 thousand tons and was higher than in 2005 by 45 thousand tons. The balance of foreign trade in Poland in 2005 amounted to 92 thousand tons (Figure 4).

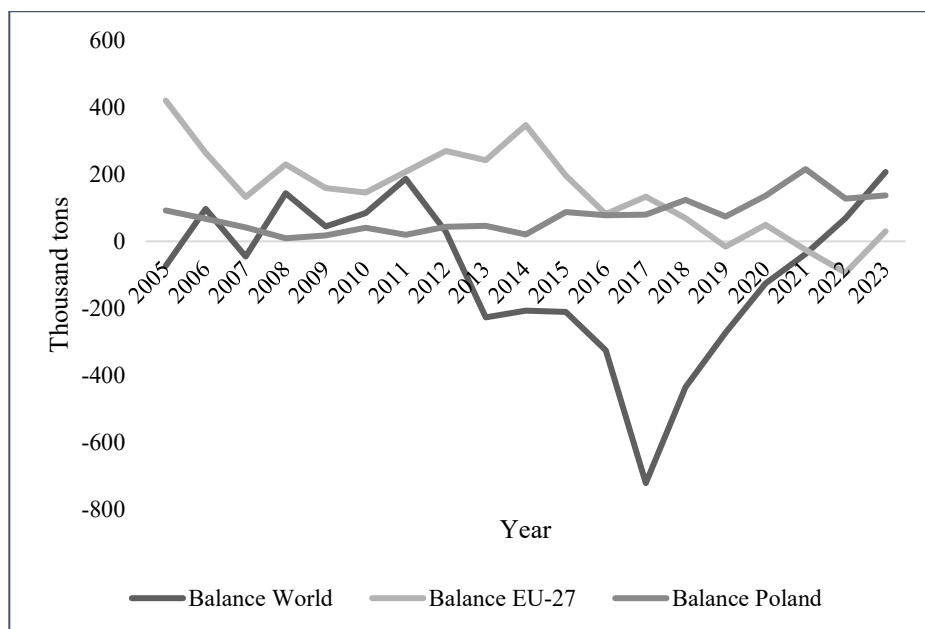


Figure 4. Balance of foreign trade in oats in the World, EU-27 and in Poland in 2005-2023.

Source: own elaboratom based on FAO data. <https://www.fao.org/faostat/en/#data/TCL> Access 28.03.2025.

The global foreign trade balance of triticale in 2005 amounted to 132 thousand tons and was lower than the foreign trade balance in 2023 by 83 thousand tons, which in 2023 amounted to 215 thousand tons. In the EU – 27 the foreign trade balance of triticale in 2005 amounted to 82 thousand tons and was lower than in 2023 by 137 thousand tons. The balance of foreign trade in triticale in Poland in 2005 amounted to 83 thousand tons and was higher than in 2023 by 626 thousand tons. The foreign trade balance in Poland in 2005 amounted to 83 thousand tons, while in 2008 a negative foreign trade balance of triticale was recorded in Poland (Figure 5).

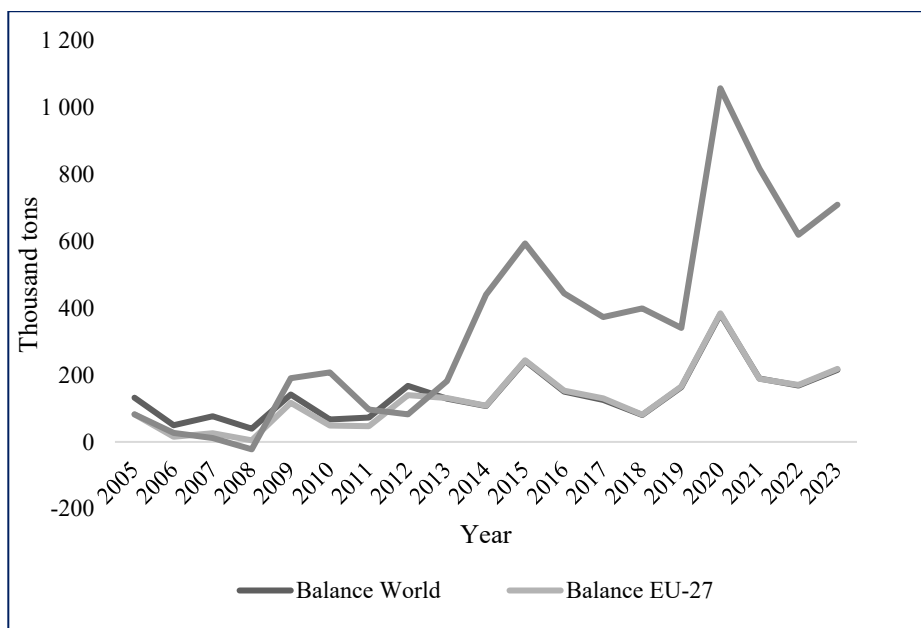


Figure 5. Balance of foreign trade in triticale in the World, EU-27 and in Poland in 2005-2023.

Source: own elaboration based on FAO data. <https://www.fao.org/faostat/en/#data/TCL> Access 28.03.2025.

The global foreign trade balance of maize in 2005 amounted to 2,404 thousand tons and was lower than the foreign trade balance in 2023 by 5,144 thousand tons, which in 2023 amounted to 7,548 thousand tons. In the EU – 27, the foreign trade balance of maize in 2005 amounted to -418 thousand tons and was higher than in 2023 by 14,275 thousand tons, which in 2023 amounted to -14,693 thousand tons. The balance of foreign trade in maize in Poland in 2023 amounted to 3,842 thousand tons and was higher than in 2005 by 3,609 thousand tons. The balance of foreign trade in Poland in 2005 amounted to 233 thousand tons (Figure 6).

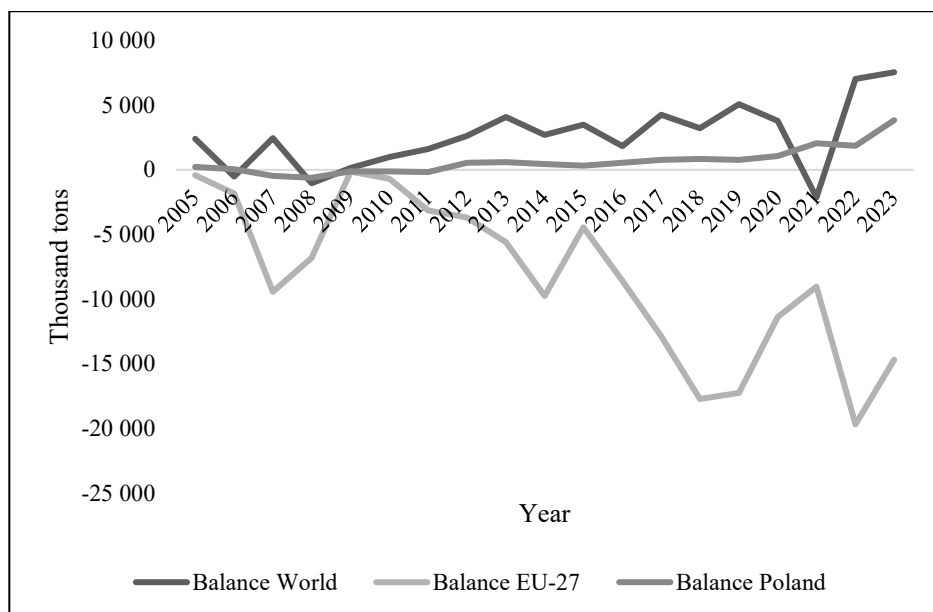


Figure 6. Balance of foreign trade in maize in the World, EU-27 and in Poland in 2005-2023.

Source: own elaboration based on FAO data. <https://www.fao.org/faostat/en/#data/TCL> Access 28.03.2025.

Poland is a very important producers of grain and achieves about 120% self-sufficiency of production. This means that Poland has to export about 20% of its overproduction. When Poland joined to the EU it gained access to demanding market. Most of the grain Poland exports to Germany and other EU countries. The good grain trade balance stems from various sources. By having access to EU markets, Poland has enhanced its competitive advantage and exports more cereal than imports. Additionally, Polish cereals and the goods made from them are valued for their great quality and competitive pricing. When compared to other EU nations, Poland's cereal production costs are comparatively cheaper. Poland has a comparatively high amount of cereal fertilization, but it is lower than in other EU nations, which lowers production costs. Another significant aspect is labor expenses, which are lower in Poland than in other EU nations (Kalinowska, Bórawski 2024). Based on the FAO data we can see that Poland had positive trade balance of grain after accession to the EU. Only in 2007 the trade balance of grain was negative (Figure 7).

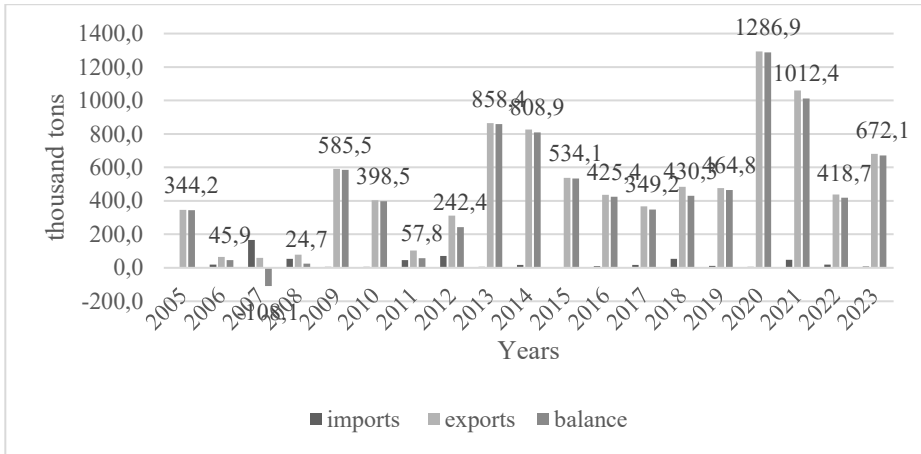


Figure 7. Trade balance of grain in Poland (thousand tons)

Source: own elaborations based on FAO data. <https://www.fao.org/faostat/en/#data/TCL> Access 28.03.2025

2.5. Statistical analysis of grain trade in Poland

In order to analyze the changes in grain trade we elaborated descriptive statistics, for sample observations 1961-2023. The time rank was quite long and included 63 observations what was the guarantee to do tests and build models. First, we analyzed the coefficient of variation which was the highest in balance, next exports and imports.

Skewedness and kurtosis are the measure of asymmetry of the rank. Indicators of distribution asymmetry, such as skewness, co-skewness and kurtosis, indicate significant variability of systematic risk measures and are widely used in statistics and econometrics (Markowski, 2010). As we can see both skewedness and kurtosis was positive what suggest that the ranks which are imports, exports and balance have right-sided distribution. This means that most of the rank are on the right side of the distribution.

Table 7. Descriptive statistics, for sample observations 1961-2023 (thousand tons)

Variable	Average	Median	Minimal	Maximal	Std. Dev.	Coefficient of variation	Skewedness	Kurtosis
Imports	88,570	45,169	0,0000	454,18	118,42	1,3370	1,6545	1,6587
Exports	193,89	38,671	0,0000	1293,5	292,00	1,5060	1,7884	2,8456
Balance	105,32	0,0000	-454,18	1286,9	348,51	3,3091	1,1093	1,3252

Source: own elaborations based on FAO data. <https://www.fao.org/faostat/en/#data/TCL> Access 28.03.2025

Augmented Dickey-Fuller test was presented in table 8. The ADF test verifies the null hypothesis of a stationarity the unit root. This test for stationarity is very important in research where the underlying variables based on time (Mushtaq, 2011). The intuitive reason for the reduced power of the ADF test is that, as p tends to infinity, the p regressors become asymptotically collinear (Papadoditis, Politis, 2016). The p value of imports and balance is very low what suggest that the ranks are stationary. Exports p value is high what suggest that the rank is not stationary.

Table 8. Augmented Dickey-Fuller test

Specification	Imports		Exports		Balance	
	Test with intercept	Test with intercept and linear trend	Test with intercept	Test with intercept and linear trend	Test with intercept	Test with intercept and linear trend
value (a-1)	-0,591271	-0,746007	0,204585	-0,010107	-0,313145	-0,506397
test: tau_c(1) statistics	-5,18246	-5,09655	1,26873	-0,046874	-3,27422	-4,44711
P value	0,00051	0,0001	0,9986	0,9957	0,0204	0,003834
Autocorrelation of first-order residuals	0,024	-0,018	0,020	0,018	-0,048	0,029

Source: own elaborations based on FAO data. <https://www.fao.org/faostat/en/#data/TCL> Access 28.03.2025

In next step we elaborated the Vector Autoregressive models (VAR models) for imports, exports and trade balance of grain. The VAR model is a basic econometric tool in econometric analysis with a wide range of applications. Nakajima (2011). The VARs models are often used for forecasting and a number of these have been proposed either to forecast worldwide economies (Dun-gey, Pagan 2000).

The first model was VAR model results for imports. The characteristics for VAR model are following:

- VAR system, lag order 1
- CLS estimation for observations 1962-2023 (T = 62)
- Log-likelihood = -376.07813
- Covariance matrix determinant = 10869.06
- AIC = 12.1961
- BIC = 12.2647
- HQC = 12.2230
- Portmanteau test: LB(15) = 11.8917, df = 14 [0.6150]
- Equation 1: import

Based on the results we can confirm that the rank is stationary. The p value is very low.

	<i>Coefficient</i>	<i>Std. Error.</i>	<i>t-Student</i>	<i>p Value</i>	
const	48,2133	16,9195	2,850	0,0060	***
import_1	0,408729	0,114091	3,582	0,0007	***

Mean arithmetic mean of dependent variance	84,94355	Dependent standard deviation	115,8028
Sum of squared residuals	673881,7	Standard error of residuals	105,9781
R-squared coefficient of determinant	0,176211	Adjusted R-square	0,162481
F(1, 60)	12,83420	P-value for F-test	0,000683
Autocorrel.residuals – rho1	0,023956	Durbin-Watson stat.	1,941344

F-test for the hypothesis of no restriction:
All lags vari. importF(1, 60) = 12.834 [0.0007]

The second model was VAR model results for exports. The characteristics for VAR model are following:

VAR system, lag order 1

CLS estimation for observations 1962-2023 (T = 62)

Log-likelihood = -420,77148

Covariance matrix determinant = 45954,014

AIC = 13,6378

BIC = 13,7064

HQC = 13,6647

Portmanteau test: LB(15) = 15,1255, df = 14 [0,3696]

Equation 1: exports

Based on the results we can confirm that the rans was not stationary.

	<i>Coefficient</i>	<i>Std. Error.</i>	<i>t-Student</i>	<i>p Value</i>	
const	68,7358	33,0397	2,080	0,0418	**
exsports_1	0,689524	0,0970099	7,108	<0,0001	***

Mean arithmetic mean of dependent variance	197,0158	Dependent standard deviation	293,3177
Sum of squared residuals	2849149	Standard error of residuals	217,9124
R-squared coefficient of determinant	0,457114	Adjusted R-square	0,448066
F(1, 60)	50,52040	P-value for F-test	1,64e-09
Autocorrel.residuals – rho1	-0,015300	Durbin-Watson stat.	1,994354

F-test for the hypothesis of no restriction:

All lags vari. importF(1, 60) = 50,52 [0,0000]

The third model was VAR model results for balance. The characteristics for VAR model are following:

VAR system, lag order 1

CLS estimation for observations 1962-2023 (T = 62)

Log-likelihood = -430,92849

Covariance matrix determinant = 63770,245

AIC = 13,9654

BIC = 14,0341

HQC = 13,9924

Portmanteau test: LB(15) = 18,9066, df = 14 [0,1685]

Equation 1: balance

Based on the research result we can confirm that the model was stationary.

	<i>Coefficient</i>	<i>Std. Error.</i>	<i>t-Student</i>	<i>p Value</i>	
const	46,0129	33,8740	1,358	0,1794	
balance_1	0,686855	0,0956397	7,182	<0,0001	***

Mean arithmetic mean of dependent variance	112,0722	Dependent standard deviation	347,1771
Sum of squared residuals	3953755	Standard error of residuals	256,7020
R-squared coefficient of determinant	0,462253	Adjusted R-square	0,453291
F(1, 60)	51,57671	P-value for F-test	1,23e-09
Autocorrel.residuals – rho1	-0,048322	Durbin-Watson stat.	2,063316

F-test for the hypothesis of no restriction
All lags vari. importF(1, 60) = 51,577 [0,0000]

In order to analyze the changes in imports, exports and balance of wheat we conducted the prognosis. (thousand tons). According to our prognosis the biggest increase in 2024-2033 will be observed in imports (58%), exports (57,68%). The balance of cereals will decrease-18,7% in 2024-2033.

Table 9. Forecast of import, export and trade balance of cereals in Poland (thousand tons)

Years	Imports			Exports			Balance		
	Prognosis	Std error	95% range	Prognosis	Std error	95% range	Prognosis	Std error	95% range
2024	51,6009	104,255	(-156,940, 260,142)	835,567	207,392	(429,085, 1242,05)	637,867	249,318	(149,213, 1126,52)
2025	69,3040	112,627	(-155,983, 294,592)	879,637	211,444	(465,215, 1294,06)	621,130	265,793	(100,185, 1142,08)
2026	76,5398	113,966	(-151,425, 304,505)	925,823	215,806	(502,851, 1348,79)	605,390	279,557	(57,4690, 1153,31)

2027	79,4973	114,188	(-148,912, 307,907)	974,225	220,497	(542,058, 1406,39)	590,588	291,188	(19,8693, 1161,31)
2028	80,7061	114,225	(-147,778, 309,190)	1024,95	225,538	(582,904, 1467,00)	576,667	301,101	(-13,4812, 1166,81)
2029	81,2002	114,231	(-147,296, 309,696)	1078,11	230,946	(625,463, 1530,76)	563,575	309,605	(-43,2391, 1170,39)
2030	81,4021	114,232	(-147,096, 309,900)	1133,82	236,745	(669,809, 1597,83)	551,263	316,935	(-69,9191, 1172,44)
2031	81,4846	114,232	(-147,014, 309,983)	1192,20	242,953	(716,025, 1668,38)	539,683	323,280	(-93,9341, 1173,30)
2032	81,5184	114,232	(-146,980, 310,017)	1253,39	249,594	(764,196, 1742,59)	528,794	328,790	(-115,623, 1173,21)
2033	81,5322	114,232	(-146,966, 310,031)	1317,51	256,690	(814,411, 1820,62)	518,553	333,587	(-135,266, 1172,37)

Source: own elaborations based on FAO data. <https://www.fao.org/faostat/en/#data/TCL> Access 28.03.2025

Finally, the authors of the paper used test for normality. These statistical tools are used to verify if a data set is well-modeled by a normal distribution. Moreover such test as Dornik-Hansen test, Shapiro-Wilk test, Lilliefors test and Jarque'-Berra test are used to compute how likely it is for a random variable to be normally distributed. As we can see from table 10 the imports, exports and balance data are normally distributed because of low p value.

Table 10. Test for normality of the distribution of residuals of imports, exports and trade of grains in Poland

Test	Imports		Exports		Balance	
	Value	p value	Value	p value	Value	p value
Doornik-Hansen test	85,7616	0,00236	65,0076	0,00756	14,8161	0,00066
Shapiro-Wilk test	0,734842	0,00024	0,709043	0,0071	0,905648	0,000148
Lilliefors test	0,25778	0,000	0,304823	0,000	0,212106	0,000
Jarque'a-Bera test	35,9647	0,00155	54,8407	0,000123	17,5308	0,000156

Source: own elaborations based on FAO data. <https://www.fao.org/faostat/en/#data/TCL> Access 28.03.2025.

2.6. Conclusion

The analysis of agri-food trade changed after integration of Poland to the European Union. The most important grain traded internationally is wheat and maize. In 2005, Polish wheat imports represented 0.20% of global wheat imports and 0.89% of imports within the EU-27. By 2023, these figures had risen significantly, with Polish wheat imports making up 0.43% of the global market—an increase of 0.23% since 2005—and accounting for 2.15% of the EU-27's wheat imports, marking a substantial rise of 1.26% over the same period.

In 2005, Polish wheat exports comprised just 0.37% of the global total and 1.45% of the exports from the EU-27. By 2023, however, Poland's wheat exports had risen significantly, representing 3.50% of global wheat exports—an increase of 3.13% since 2005—and 11.76% of the EU-27's wheat exports, marking a remarkable growth of 10.31% from 2005.

Poland has positive trade balance of grain since this country joined to the EU. Only in 2007 the trade balance was negative what was the result of higher imports than exports.

As far as the descriptive statistics is concerned the data of imports, exports and balance of trade are right-sided distribution. The highest coefficient of variation was achieved by trade balance of grain, which is the effect of exports and imports.

The ADF test was used to verify if the time series of imports, exports and balance of trade was stationary. Based on the results we can confirm that imports and balance of grain were stationary, whereas exports was not stationary because of high p value 0,9957.

In the next step of our analysis we have conducted the Vector Autoregressive model (VAR) model for imports, exports and balance of grain trade. The results of the VAR model confirm our last findings from ADF model, where imports and balance of grains was stationary and exports was not stationary.

Finally, the authors of the paper elaborated the prognosis. The biggest increase in 2024-2033 will be observed in imports (58%), and exports (57,68%). The balance of cereals will decrease-18,7% in 2024-2033.

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PART II

FACTORS SHAPING
AGRIBUSINESS DEVELOPMENT

PROSPECTS FOR AGRIBUSINESS DEVELOPMENT IN THE CONDITIONS OF MODERN CHALLENGES

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3.1. Introduction

Agribusiness is one of the most important and strategic sectors of any country's economy, as it ensures food security, creates jobs, and stimulates the development of related sectors. At the same time, agribusiness is facing numerous challenges in today's environment, driven by global economic changes, climate fluctuations, political instability and new technological realities. Intensive changes in international markets, consumer needs, and the constant transformation of agricultural policy pose challenges for agricultural companies to adapt to new conditions and find effective strategies to ensure sustainable development.

Particularly relevant are the issues of the impact of global crises, such as pandemics, wars, climate change, on agricultural productivity, national agricultural strategies and rural development. In such conditions, it is necessary to rethink approaches to conducting agribusiness, investing in innovative technologies, improving infrastructure and creating sustainable models to support competitiveness.

Ukraine's agricultural sector plays an important role in the global food supply system, and its stability has a direct impact on global security. In January 2025, representatives of Ukrainian agribusiness took an active part in the World Economic Forum in Davos to inform the international community about the challenges the industry faces in times of war. Representatives of the industry not only outlined the existing challenges but also demonstrated that, despite the

war, Ukraine maintains its position in the international market. Thanks to the implementation of innovative projects, active use of cultural diplomacy, and an effective communication strategy, the international community's attention was drawn to the importance of supporting Ukrainian agribusiness. An important positive development has been the gradual formation of Ukraine's image as a reliable partner, not just a victim, which opens up prospects for the development of the industry and the expansion of international cooperation.

The purpose of this article is to study the prospects of agribusiness development in the context of modern challenges, as well as to identify key areas for ensuring the efficiency and stability of the agricultural sector in the context of globalization and constant changes in domestic and foreign economic conditions.

The main objective of this study is to analyze the prospects for the development of agribusiness in Ukraine, taking into account current challenges, in particular political and economic instability. The study focuses on the role of organic agriculture in ensuring sustainable development, the importance of niche crops for the growth of agribusiness, and strategies for the restoration of agribusiness in Ukraine in the post-war period.

The novelty of the study lies in the integration of organic agriculture as a key factor in the sustainable development of agribusiness in the context of economic and political instability. The study provides a detailed analysis of niche crops as an important component of agribusiness development in Ukraine, which is not sufficiently covered in scientific works. In addition, the paper proposes strategies for the recovery and modernization of Ukraine's agricultural sector after the war, suggesting new approaches to the role of both international and local actors in the reconstruction process.

The significance of the study lies in its potential to shape strategic decisions in Ukraine's agricultural sector in the face of global challenges. By assessing the role of organic farming and niche crops, the study expands the understanding of sustainable agronomy that can ensure food security, economic growth and environmental protection in Ukraine. In addition, the proposed recovery strategies will contribute to the formulation of Ukraine's post-war agricultural policy for a sustainable and competitive agricultural sector.

3.2. The role of organic agriculture in ensuring the sustainable development of Ukrainian agribusiness in conditions of economic and political instability

Ukraine's organic sector has shown remarkable resilience and ability to adapt to the complex and uncertain conditions resulting from war and other challenges. Despite the difficult situation, the industry continues to develop, which underlines its importance to the national economy. The tireless work of organic operators is not only helping to restore economic stability, but also opening up new horizons for expanding production and accessing international markets.

Organic production plays an important role in the sustainable development of agribusiness in Ukraine, even in the context of military operations, as it allows to reduce the use of harmful chemicals and preserve soil fertility. This is especially relevant in conditions of limited access to chemical fertilizers and agrochemicals, which adds weight to the organic sector as an alternative way of farming.

Moreover, demand for organic products is growing in many countries as consumers increasingly appreciate their health and environmental benefits. This creates additional opportunities for exports, which is important for Ukrainian farmers in the context of changing foreign trade relations due to the war. The production of environmentally friendly products helps to develop the local market and reduce dependence on imports, which is especially important in times of economic instability.

The introduction of organic production requires certain investments and efforts, but in the long term it has the potential to significantly positively affect the sustainable development of agribusiness in Ukraine.

Organic agriculture is of strategic importance for the agricultural sector of Ukraine, as it provides a number of advantages that can be divided into three main groups: economic, social and environmental.

Economic benefits

At the macroeconomic level, organic production is beneficial:

- GDP growth through the development of high-margin organic products and the introduction of deep processing technologies.
- Strengthening the competitiveness of the Ukrainian agricultural sector in the WTO by improving the quality, safety and taste of products.

- Legalising the activities of organic producers, which will increase tax revenues.
- Transition from a quantitative to a qualitative approach, which will help expand the share of organic products on the market.
- Ukrainian organic products entering international markets, which strengthens the country's position as a supplier of quality agricultural products.
- Creating a favorable investment environment through the development of environmentally friendly production facilities.
- Enhancing the international image of Ukraine as a country that implements the principles of a green and low-carbon economy.
- Expanding opportunities for international cooperation, in particular with the EU.

At the regional level (meso-economic aspect), organic farming contributes to:

- Creation and promotion of regional organic brands.
- Formation of regional organic clusters.
- Increasing the competitiveness of individual regions.

At the microeconomic level, the benefits include:

- Bringing into circulation land that has not been used for a long time, as well as the use of wild plants while preserving natural ecosystems.
- Increasing the income of small and medium-sized farms that implement organic standards. • Increasing soil fertility and natural productivity of agricultural landscapes.
- Reducing production costs by avoiding expensive chemical fertilizers and agrochemicals.
- Increasing the competitiveness of farmers by improving the quality and environmental friendliness of products.

Social benefits

- Improving the standard of living in rural areas.
- Reducing the outflow of population from villages and stimulating the return of able-bodied population by creating jobs in environmentally friendly industries.
- Improving the quality of food products, which contributes to healthy nutrition, especially among children.
- Reducing the incidence of diseases in the population by reducing the content of nitrates and pesticides in products.

- Meeting the needs for safe products for sensitive categories of the population (pregnant women, children, people with allergies, diabetics, etc.).
- Increasing the number of qualified specialists in the agricultural sector.
- Increasing the economically active population in rural regions.

Environmental benefits

- Conservation and restoration of natural resources in rural areas.
- Protection of biodiversity.
- Protection of soils from erosion, salinization, desertification and other negative processes.
- Reducing energy and resource consumption in agriculture.
- Reduction of carbon emissions by 30-50% compared to traditional agricultural technologies, which contributes to the development of a low-carbon economy.

Therefore, organic agriculture today is not just a modern approach to conducting agribusiness, but a holistic system that harmoniously combines economic benefits, social responsibility, and environmental safety, creating real prospects for the sustainable development of Ukraine in the face of global challenges (Boiko, L., 2020). In addition, it stimulates the introduction of innovative technologies and increases the competitiveness of domestic agricultural producers. Thus, organic agriculture becomes an important strategic direction for the country's economic growth.

Organic production differs from conventional approaches to growing crops and animals not only in terms of methods and goals, but also in terms of basic principles that focus on maintaining ecological balance and ensuring the production of safe and high-quality food. An important aspect is the refusal to use synthetic fertilizers, pesticides and other harmful chemicals (Avercheva N. *et al*, 2017), which contributes to the preservation of biodiversity, reduction of water and soil pollution by toxic substances, and the exclusion of the use of genetically modified organisms (GMOs). Organic products usually command a higher price, while farmers increase their income and make their operations more sustainable, supporting the development of local markets and sustainable rural development (Boiko V., & Boiko L., 2018; Boiko V., & Boiko L., 2022).

The principle of environmental friendliness is one of the key principles in the concept of organic production, as it is the conservation of natural re-

sources, minimization of negative environmental impact and the use of renewable energy sources that shape the long-term prospects for sustainable development of the agricultural sector. Organic technologies promote biodiversity, improve soil structure, help restore water resources and reduce air pollution (Kwilinski, A. *et al*, 2024; Milovanov, E., 2019).

Organic producers have a number of advantages that enhance their competitiveness on the market. By not using mineral fertilizers and chemical plant protection products, they can reduce production costs. Organic products are in steady demand among consumers, who prefer products of high quality and safe for the environment. Farmers receive additional income from selling surplus products and specially grown niche crops. In addition, organic certification opens up greater opportunities to enter both domestic and foreign markets. Due to the increased value of organic products for consumers, producers can sell them at higher prices, earning additional profit due to the premium value of such products (Boiko V. O. & Boiko L. O., 2018; Boiko L., 2020).

Given the growing need for sustainable agricultural development and increased food security, the issue of organic farming is becoming increasingly relevant. In this regard, scientists are actively researching various aspects of organic production, in particular, Irtyshcheva, I., *et al.* analyzed the potential of organic production in Ukraine in the context of the war and identified its implications for global food security. The researchers substantiated that the most affected regions (Kharkiv, Luhansk, Donetsk, Kherson, Mykolaiv, Zaporizhzhia) from the military actions and occupation have the potential for organic production and have significant areas for growing crops. However, it is predicted that if the war in Ukraine continues for an indefinite period, there may be a significant reduction in agricultural production, including organic crops, and this in turn will have a negative impact on food security in many countries (Irtyshcheva, I. *et al*, 2022).

Ukraine is one of the key centers for global food security and a world leader in the supply of high value-added food products and technologically advanced services for the agricultural sector. However, the share of organic products in total production remains small. This is due to a number of factors, including the fact that most agricultural land is cultivated using conventional methods with pesticides and chemical fertilizers. The transition to organic production requires significant investment in specialized machinery, staff training and a long adaptation period. In addition, the process of certification and compliance with organic standards involves additional costs and administrative pro-

cedures, which can make it difficult for producers to implement. The uncertainty of market demand and the willingness of consumers to pay higher prices for such products remains an important factor in the development of the organic sector.

Despite the existing challenges, there are prospects for the development of organic agriculture in Ukraine, driven by growing consumer awareness of the benefits of organic products, government support, and initiatives by public organizations and the private sector. In 2021, the Cabinet of Ministers of Ukraine approved the National Economic Strategy until 2030, which provides for an increase in the area of land with organic status to 3% of the total area of agricultural land (approximately 1.3 million hectares). The implementation of this strategy will contribute to the growth of organic production, the creation of financial and advisory support programs for producers, and the expansion of the number of enterprises engaged in organic production by improving state regulation in this area (On approval..., 2021).

Ukraine pursues a policy aimed at deepening cooperation and integration with the European Union. This strategic direction was officially enshrined in the statement of intent to join the EU adopted in 2014. Since then, the country has been actively working to align its legislation, economic policy and other key areas with EU norms and standards. However, the process of joining the EU is a lengthy one and requires significant efforts. To integrate Ukraine into the EU's internal market, a number of important measures need to be implemented, including the use of Pre-Accession Assistance mechanisms.

According to world statistics, in the 2020 Covid year, there was a significant increase in the consumption of organic products and many experts feared that in 2021 there would be a significant decrease in sales in the world. However, the world consumption of organic products in 2021 increased and amounted to 125 billion euros (+4.2 billion euros compared to 2020). The largest market for organic products remains the USA, although sales here fell slightly, 48.6 billion euros compared to 49.5 in 2020. The second largest market is Germany – 15.6 billion euros (+0.9 billion euros) and the third – France – 12.7 billion euros (unchanged). If we talk about the amount of land used for organic production, it increased by 1.7% and is 76.4 million hectares, with Australia remaining the leader in such areas. The number of organic producers increased by 4.9% and is over 3.7 million operators (Korogod O., 2023).

Since June 2023, the State Register of Operators engaged in the production of products in accordance with the requirements of the legislation in the field of organic production, its circulation and labelling has been launched in

Ukraine. The launch of the registers is another important step in the development of the Ukrainian organic sector. Ukrainian organic producers already export more than 60 types of products: cereals (corn, wheat, barley), oilseeds, soya beans, sunflower oil, fruits and berries, vegetables, mushrooms, nuts, herbs and ketchup, juices, flour, honey, and others.

Organic production remains one of the priorities for the development of Ukraine's agricultural sector, even during the war. Unfortunately, there has been a significant reduction in the number of organic areas compared to previous years, as a significant part of them is under occupation in the southern regions of the country. At the same time, the activities of organic operators on the lands that have been freed from occupation have been almost completely restored. According to the results of the monitoring conducted by the organic certification body Organic Standard LLC in 2023 (Fig. 1), the total number of certified operators in Ukraine is 481, of which 383 are agricultural producers (Results of 2024..., 2024). This indicates growing trust in Ukrainian organic products on the international market and their compliance with high quality standards. The introduction of a state register will contribute to increasing transparency in the industry, monitoring compliance with certification requirements, and strengthening the positions of domestic producers.

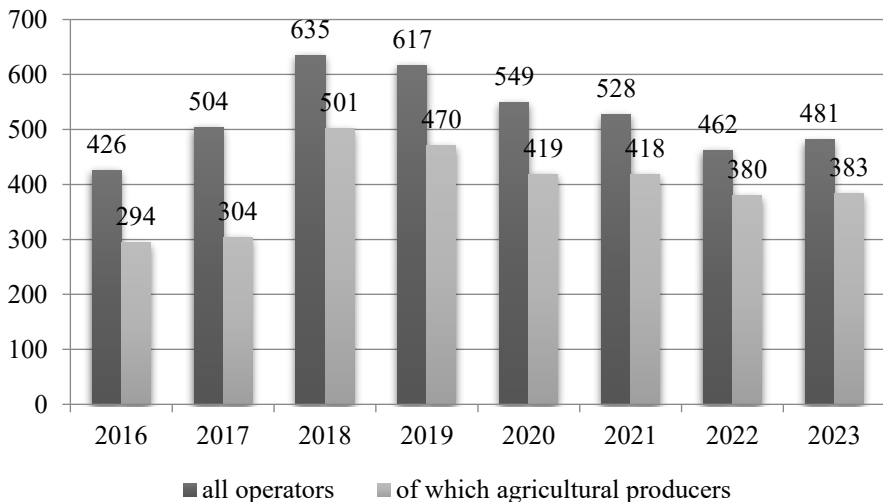


Figure 1. Number of organic operators, pcs

Source: (Results of 2024..., 2024)

In Ukraine, 27% of organic farms are headed by women, which indicates a better gender balance in this industry compared to the agricultural sector as a whole. These conclusions were drawn based on a study of the gender profile of the Ukrainian organic sector conducted by the Organic Initiative NGO and presented at BIOFACH 2024 (Current news..., 2024).

This indicator demonstrates the growing role of women in the development of organic production and indicates a gradual change in traditional gender roles in the agricultural sector. Women are actively involved in the implementation of innovative environmentally friendly technologies, developing family farms and playing a key role in shaping sustainable agribusiness. Thanks to the high involvement of women, the organic sector of Ukraine is not only growing economically, but also becoming more socially responsible and inclusive. In addition, expanding opportunities for women in agriculture contributes to the development of local communities, as women's initiatives often cover social aspects, including education, environmental awareness and support for small businesses.

Promoting gender equality in the organic sector can also be an important factor in attracting international investment and grant programs that promote sustainable agriculture. Further support for women's entrepreneurship and leadership in the agricultural sector will help Ukraine strengthen its position in the global organic market and enhance the competitiveness of the industry.

According to the results of operational monitoring of the Ministry of Agrarian Policy and Food of Ukraine, in 2023, the total area of farmlands (organic and transitioning) amounted to 471176 hectares, including 390923 hectares with organic certification (Fig. 2).

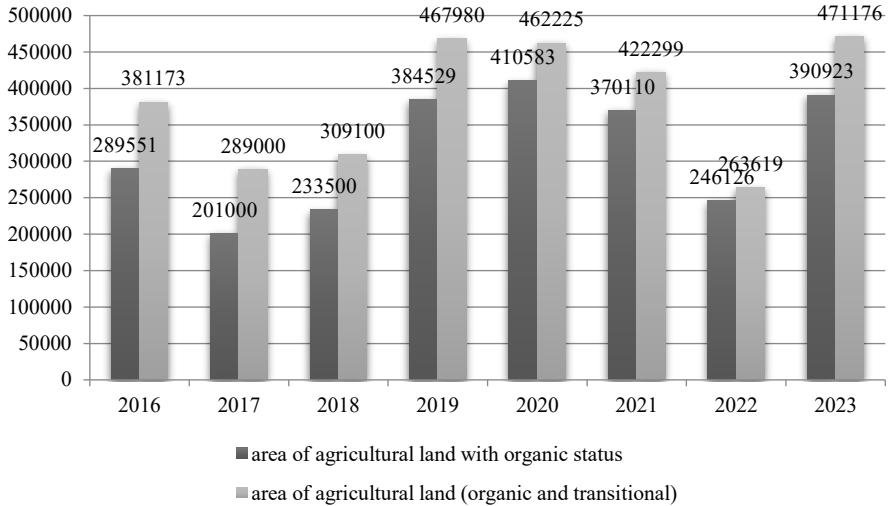


Figure 2. Total area of farmlands under organic crop production, ha

Source: (Results of 2024 ..., 2024)

The increase in the area of agricultural land certified as organic is an important step in the development of Ukraine's organic sector. However, the mere fact of expanding such areas does not guarantee an increase in the supply of organic products on the domestic market. The decisive factor is the efficient use of these lands for the production of organic products that will be available to Ukrainian consumers.

The expansion of organic farming should be accompanied by the development of production and logistics infrastructure, the establishment of local processing plants and the expansion of distribution channels. It is also important to stimulate domestic demand for organic products through educational campaigns, government support programs and the development of specialized retail chains. Thus, increasing the area under organic production should be accompanied by a comprehensive approach that includes not only the expansion of the area under crops, but also the promotion of production and efficient distribution of organic products on the domestic market.

The domestic market for organic products in Ukraine is in a state of dynamic development, driven by growing consumer interest in healthy eating, environmentally friendly products and sustainable business practices. Despite challenges such as the war, economic instability and lack of awareness of organic products among the population, this segment is showing positive trends.

In recent years, Ukraine has seen a gradual increase in the production and consumption of organic products. According to relevant organizations, the domestic market for organic products has been estimated at hundreds of millions of hryvnias, although its share in the overall food market remains relatively small.

Demand for organic products is mainly generated in large cities, where the purchasing power of the population is higher and there is a greater awareness of the benefits of organic food. The most popular categories are:

- organic fruit and vegetables,
- cereals and flour,
- dairy products
- honey
- meat and eggs,
- juices and other beverages.

A significant part of organic products is sold through supermarkets, specialized health food stores, farmers' markets, as well as online platforms. In total, in 2023, according to estimated data, 7,257 tons of organic products of domestic production were sold on the domestic market of Ukraine for the amount of UAH 982 million (equivalent to USD 27 million at the weighted average exchange rate of the NBU in 2023) (Table 2).

Table 1. Domestic market of organic products in Ukraine, 2023.

No	Organic products	Volumes, tons	Amount, million UAH
1	Milk and dairy products	3157	438
2	Vegetables, fruits, mushrooms	2824	259
3	Cereals, grains, flour, seeds, snacks	622	99
4	Eggs	283	36
5	Juices, drinks, pastes, canned foods	212	42
6	Assorted oil	70	22
7	Meat products	56	42
8	Other products	32	43
9	Spices and herbs, sugar	1	1

Source: (Results of 2024 ..., 2024)

The development of the domestic market for organic products in Ukraine is a key factor in increasing the volume of its production and sales. Growing consumer demand and expanding sales channels contribute to the increase in organic production volumes.

However, for the full development of the market, it is important not only to increase the supply, but also to effectively sell products. The volume of organic products sold depends on many factors, including the availability of organic products in retail chains, price levels, consumer preferences and purchasing power of the population (Table 2).

Table 2. Volumes of Ukrainian organic products sold on the domestic market of Ukraine, 2023

No	Organic products	Volumes, tons	Amount, million UAH
1	Organic Dairy Products		
2	Milk	1541	100
3	Kefir	590	35
4	Cottage cheese	252	72
5	Butter	218	109
6	Yogurt	166	21
7	Sour cream	139	32
8	Cheese with a hard coating	94	43
9	Fermented milk drinks	70	2
10	Ryazhanka	57	11
11	Cottage cheese products	12	5
12	Tofu cheese (vegetable)	10	6
13	Cream	8	2
	Organic cereals and grains, flour, seeds		
14	Cereals	368	53
15	Flour	114	13
16	Flakes	50	8
17	Snacks	41	20
18	Other	25	1

19	Grains/Seeds	23	4
	Organic vegetables and fruits		
20	Vegetables	2120	215
21	Fruits	667	22
22	Mushrooms	36	22

Source: (Results of 2024..., 2024)

Increasing sales volumes is also possible through product diversification, expanding the processing of organic raw materials, and establishing stable supplies to retail chains, HoReCa, and online platforms. An important role in this is played by the marketing strategy of producers, which is aimed at building trust in certified organic products and stimulating their consumption (Boiko, V., & Bioko, L., 2023).

Organic agriculture plays a key role in ensuring the sustainable development of Ukrainian agribusiness, especially in conditions of economic and political instability. Its benefits cover the economic, environmental and social spheres, contributing to the growth of the competitiveness of Ukrainian agricultural products in domestic and foreign markets.

The expansion of organic production contributes to strengthening food security, improving product quality, preserving natural resources, and forming long-term strategies for the development of the agricultural sector. Important factors for its further growth are state support, export stimulation, improving the legislative framework, and introducing innovative technologies.

Despite the challenges posed by military operations, economic instability and global market changes, organic agriculture remains a promising area for agribusiness development in Ukraine. Its active promotion and support will contribute not only to economic growth, but also to improving the environment and social stability, which is the basis for the country's sustainable development.

3.3. Niche crops in agribusiness: prospects and challenges in the face of modern changes

In the face of modern challenges such as war, climate change, disruption of logistics chains and the need to integrate into the European Union, Ukrainian agribusiness faces important challenges and opportunities for adaptation and

development. One of the promising areas is the development of niche crop production, which can not only ensure food security, but also create new markets, increase the efficiency of agricultural resource use and promote economic growth.

Niche crops, such as organic products, medicinal plants, berries, pulses, spices, chickpeas, lavender and other high value-added crops, have a number of advantages over conventional crops. Given the current challenges, growing niche crops can become an important element of agricultural diversification. This will reduce the dependence on traditional crops such as wheat, corn, and sunflower, which, in the event of economic and political changes, may have a negative impact on farmers' profitability.

Stepasyuk, L. and Stepasiuk, M. in their study focus on the importance of added value in the current conditions in the field of growing niche crops. The researchers identify the key factors that encourage agricultural producers to choose this particular segment. Creating added value is a priority for the Ukrainian economy, as it has become an important criterion for producers in planning their activities in recent years. Niche crops have significant potential as raw materials for the production of high value-added products and are also a source of additional income for farmers, especially small farms. Particular attention is paid to the prospects for deep processing in Ukraine, as the research results show that there is a wide and diverse raw material base for creating competitive agricultural products.

Boiko L. analyses the potential and identifies the main factors of competitiveness of niche crops in the agribusiness of Ukraine in the face of uncertainty. The author highlights the main characteristics of such crops, such as high added value; adaptation to specific growing conditions; narrow market; innovation and experimentation. Particular attention is paid to the characteristics of various niche crops that can contribute to the development of this segment of the agricultural sector and meet the needs of modern society.

Bezhenar I. M. and Skyba G. I. analyze current trends and main features of the Ukrainian niche crop market, taking into account the possibilities of domestic production and the effectiveness of state financial support. Scientists have systematized problems in the functioning of niche crops and provided recommendations for their solution. The presented provisions in the study are aimed at revealing typical features and the most significant problematic issues of the domestic niche crop market, which primarily require attention from state authorities, local governments, producers, exporters and other agribusiness entities.

Mirzoieva, T. and Tomashevskiy, V. emphasize that the cultivation of niche crops in general and niche cereals in particular can contribute to positive economic and environmental effects. Along with a number of advantages that are characteristic of niche cereals, their cultivation and sale differ from the production and sale of traditional crops, with which most domestic farmers are familiar, therefore the issues raised require further research taking into account the changing conditions of today.

In times of war, when some land has become inaccessible or contaminated, growing niche crops allows farmers to optimize the use of land resources, particularly in areas affected by hostilities. This can be an effective tool for restoring agricultural activity in the de-occupied territories, as well as for adapting to climate change.

Due to their scale, financial resources and influence on the economic and political spheres, agriholdings have significant competitive advantages over small farms and individual farms. They receive a significant share of government subsidies and privileges, and play a key role in shaping the export supply of Ukrainian agricultural products to global markets. At the same time, there are more and more niches in the modern agricultural economy that can be effectively filled by small producers. The specifics of their activities, which may be considered weaknesses in large-scale agribusiness, become advantages in the niche segment. We are talking about the cultivation of highly profitable crops that do not require significant land resources but provide high profits per hectare.

Oats: Over the past decade, the area under oats has declined to around 130 thousand hectares, compared to almost 600 thousand hectares in the early 2000s. The bulk of the harvest (about 95%) is used on the domestic market, while only about 25 thousand tons of grain is exported annually. Recently, oat cultivation has been concentrated mainly in the forest-steppe zone, due to its climatic requirements and crop rotation. The main sales markets are in Central Asia, where demand is driven by household consumption. Traditionally, oats are transported by land and less frequently by sea, which makes them an alternative option in case of difficulties with port operations, particularly compared to corn. In 2023, the gross harvest of oats was up to 427.3 thsd tons, with the area under cultivation at 128 thsd ha (Niche crops: benefits..., 2022).

Sorghum: The area under this crop reaches 40 thousand hectares. Despite its lower margins compared to sunflower and corn, sorghum is a profitable alternative for arid regions, especially in the South of Ukraine. The main importing countries are Southern European countries, where the crop is used for food

purposes. The price of sorghum correlates with the price of corn, which makes it relatively easy to hedge risks. According to analysts at Pro-Consulting, the popularity of sorghum in Ukraine is growing so rapidly that it can take it out of the niche crop category. And in particularly arid regions, this crop may well replace corn.

Sorghum has significant potential for development as a valuable food product, which will contribute to the sustainable development of the agricultural sector and increase the competitiveness of products in the domestic and international markets. Sorghum is included in the category of products called "smart foods": these are products that are not only tasty and suitable for preparing a variety of dishes, but also maximally beneficial for humans. This cereal is a source of vegetable protein, iron, vitamin B6, niacin, phosphorus, potassium, etc. It is a high-calorie product, rich in antioxidants and at the same time does not contain gluten, that is, safe for people with such allergies. In addition, sorghum contains a lot of useful dietary fiber. Products from this crop are an ideal choice for diabetics, they have few soluble sugars (1-5%) and many free ones. In addition, it is known that sorghum helps in the fight against some diseases of the gastrointestinal tract. Food sorghum is an important crop in terms of food security, economic benefits, environmental sustainability, and meeting the growing demand for healthy food (Boiko M.O., 2024).

Buckwheat: It is grown mainly in the Forest-Steppe region, although it is cultivated in some volumes in all regions of Ukraine. The crop is sensitive to drought conditions. Over the past decades, its production has undergone significant changes due to state price regulation. Since 2018, the volume of this crop has sharply decreased, but by 2023 the situation has stabilized (sown area – 147.6 thou hectares, production volume – over 210 thou tons). In 2023, Ukrainian farmers increased buckwheat acreage by 28%, gross harvest by 49%, and yield by 17% compared to 2018. Buckwheat is primarily exported to the domestic market, although some of it is exported to China and the US. As a traditional crop for Ukraine, it has unique properties that make it important for the country's food independence (Tkach, N., 2024).

Rye: The main areas under this crop are concentrated in the Forest-Steppe and northern Ukraine. Rye is gradually being replaced by winter wheat varieties, as the latter provides higher yields and profitability. Domestic consumption of rye is limited, so a significant part of the production is exported to Northern Europe and North America.

Until 2020, Ukraine was not a major player in rye exports. For comparison, back in 2019/2020, Ukraine exported only 8.2 thsd tons of rye, and a year

later – 121.5 thsd tons. Moreover, the cultivation area has been steadily decreasing since the 1990s. Growth in both production and exports has only recently begun. This is due to the fact that Ukrainian companies have opened new markets. Thus, in 2021/22 marketing years, rye was actively bought in Spain, Turkey, and Poland. Analysts predict that the global rye market will grow by 2.2% annually. This segment is extremely profitable for Ukrainian agricultural producers: they have virtually no competitors in this niche crop (Oh, whose rye..., 2022).

Oilseed flax: Traditionally grown in the steppe zone, covering an area of about 14 thousand hectares. The main export destinations are Europe and North Africa. Flax is mainly transported by land in containers. Flax is not expensive to grow – it is 1.1-1.3 times cheaper than sunflower. Profitability becomes positive at a price of 12 thousand per ton and a yield of 0.7-0.8 tons per hectare. A negative factor that discourages flax cultivation is the presence of counterfeit products in Ukraine: many producers grow flax varieties of unknown origin and dubious quality of seed. This affects both the crop yield and the final price of the product (Basanets O., 2023).

Mustard: Before the full-scale invasion, Ukraine held leading positions in global mustard production, ranking among the top ten in terms of area sown and among the top five exporters. The 2023 season saw a significant increase in farmers' interest in this crop. This is due to several factors, including increased domestic demand, simpler logistics compared to major oilseed crops such as sunflower, and agronomic advantages, including a positive impact on crop rotation. Overall, while Ukraine remains among the leaders in mustard production, according to official data, the area under the crop decreased from 48,000 ha to 20,000 ha from 2019 to 2021. In 2022, this figure was 19,600 ha (7% less than the previous year). The latest decline was caused by military operations in the regions where the crop was usually grown the most (the south and the Kharkiv region) (Mustard cultivation..., 2023).

Coriander: This is an essential oil crop that is widely used in the food industry, medicine and cosmetology. In Ukraine, interest in its cultivation has increased significantly, which is due to stable demand on the international market. However, due to insufficient cultivation experience, not all farmers are ready to grow it. The main importers of Ukrainian coriander are India, Sri Lanka and Indonesia, where it is traditionally used in cooking and perfumery. The average yield of the crop is 1.2–1.5 t/ha, and the growing season lasts 110–115 days. Due to its early ripening, coriander quickly frees up space, which facilitates its integration into crop rotation. In addition, coriander is a valuable

honey crop: up to 500 kg of honey can be obtained from one hectare, which is twice as much as from a hectare of sunflower, making it a promising plant for beekeeping (In Ukraine, the..., 2024).

Chickpeas: One of the most promising niche crops in Ukraine, crops occupy about 12 thousand hectares. In the 2020/21 marketing year, production amounted to 14 thousand tons. The crop has high price volatility due to the limited market. The main export destinations are India, Pakistan, the Middle East, as well as Europe, where demand for chickpeas has recently increased. Chickpeas are a full-fledged alternative to animal protein and are able to saturate the human body no worse than meat. 100 g of chickpeas contain almost 63 g of carbohydrates and 20.1 g of protein. It is worth noting that chickpea protein contains all 9 essential amino acids, therefore it is a high-quality substitute for animal protein. The production of vegetable protein from chickpeas helps save drinking water on the planet. To obtain 1 ton of vegetable protein, 15 times less water is consumed than to obtain animal protein (Chickpeas: an alternative..., 2023).

Peas: Grown on an area of 250,000 to 300,000 hectares, concentrated mainly in the southern regions, although found in all regions of the country. If we consider peas in the medium term (for 2–3 years), it is an effective predecessor crop, especially for winter wheat. Its cultivation contributes to increasing wheat yields, improving its health, reducing disease, and also has a positive effect on soil fertility by improving the nitrogen balance and reducing humus mineralization. This means that in the long term, additional profit can be obtained from subsequent crops. At the same time, in the short term, peas are not always a high-margin crop that allows for quick financial results (Pea production will..., 2024).

Beans: Annual production is approximately 75-77 thousand tons. Due to the wide variation in the quality characteristics of the crop, it is difficult to establish a stable market price. This is a very specific segment of the niche market where pricing depends on product characteristics, such as the color and shape of the beans.

In today's environment, beans are an attractive crop for farmers as they are less dependent on the logistical challenges that significantly affect the main grains and oilseeds in Ukraine. Demand for beans on the global market remains consistently high, with annual consumption of beans exceeding sunflower consumption by about five times. This indicates a significant export potential and opens up prospects for beans as an alternative crop to the traditional sunflower and soybeans (Basanets O., 2023).

In addition to these crops, which are already well established in the market, there are other niche crops that could be promising for Ukrainian agricultural producers. Some of them are still exotic for our region, but given the growing demand for healthy food and organic products, they have the potential to expand. These crops include, for example, quinoa, amaranth, chia and sweet potato, which are gaining popularity among consumers due to their healthy properties and high profitability for farmers. For Ukraine, particularly after the signing of the Association Agreement with the EU, this opens up new opportunities for exporting products to the European market. In addition, the growing demand for organic products globally creates another promising niche for the development of agricultural business in Ukraine.

Like any other agricultural product, niche crops have their advantages for producers, but at the same time a number of risks. Before starting their cultivation, it is important to carefully analyze the possible challenges and assess whether the potential benefits compensate for the possible disadvantages of this direction.

Among the main risks of growing niche crops, the following can be distinguished:

- Niche crops require specialized knowledge of cultivation technology and logistics. The lack of experience or the necessary infrastructure, for example, specialized elevators nearby, can create additional difficulties.
- The niche crop market is quite opaque, there is a lack of reliable data on demand, volumes and prices. Product quality is not always clearly standardized in Ukraine, as the main requirements are formed by importing countries.
- The absence of large traders in the niche crop segment creates difficulties for scaling the business. This is explained by the fact that such markets have limited demand, and increasing production does not always provide high profitability.
- Niche crops are characterized by high price instability. Due to the small volumes of demand and supply, prices can change dramatically. In some periods, a high level of profitability is possible, but it is difficult to predict such moments, as they depend on the situation on world markets.
- The niche crop market has limited liquidity, which complicates sales planning and forces producers to respond flexibly to changes in demand (Niche crops: benefits..., 2022).

But growing niche crops can be an important factor in increasing the competitiveness of Ukrainian agribusiness in the international arena. Ukrainian farmers have the potential to meet the demand for specific cultural products that are in high demand in Europe and other regions of the world. In particular, environmentally friendly products grown according to organic standards can become one of the main competitive advantages of the Ukrainian agricultural sector in the context of globalization and fierce competition.

For the successful development of niche crop production, an important condition is support from the state. This may include the provision of preferential loans, subsidies for the purchase of seeds and equipment, ensuring the certification of organic products and assistance in entering international markets. It is also important to support investments in research and implementation of new technologies for growing niche crops, which will allow to increase their productivity and quality.

One of the most important aspects of agribusiness development in today's challenging environment is constant adaptation to changing market requirements. Growing niche crops allows us to quickly adapt to new market trends, such as growing demand for organic products, increased attention to healthy eating and environmental awareness among consumers. This opens up new opportunities for agribusinesses not only in Ukraine but also on the international market.

Niche crop production is an important area for Ukrainian agribusiness in the face of current challenges. Given the need to diversify agricultural production, reduce dependence on traditional crops and the requirements of international markets, the development of niche crops will not only increase economic efficiency but also ensure the sustainability of the agricultural sector in the face of current global changes. Therefore, it is important to promote the development of this segment through government support, investment and the introduction of the latest technologies.

3.4. Strategies for the restoration of Ukraine's agribusiness in the post-war period

Before Russia's full-scale invasion, Ukraine's agricultural sector played an important role in the global food market. In 2021, the share of agricultural products in the country's total exports was almost 40%. Ukraine was one of the world's top ten producers and exporters of grains and oilseeds, vegetable oil, meal, and livestock products.

However, the war unleashed by Russia has become a serious test for Ukrainian farmers, significantly worsening the country's position in both production and export. Active hostilities in large areas have led to the destruction of decades-old logistics routes and disruption of technological processes, which has negatively affected the stability of the agricultural sector and its ability to meet both domestic and external demand.

After the de-occupation, a significant part of the agricultural land was mined by the occupiers, making it unsuitable for further use by farmers. In addition, much of the agricultural machinery and production facilities were partially or completely destroyed. Despite these terrible consequences of the war and the constant threat of enemy shelling, Ukrainian farmers sow their land in the spring and reap bountiful harvests in the autumn, demonstrating the indomitable spirit of the Ukrainian people. Many farmers from the eastern and southern regions have moved their businesses to the safer western regions, where they have successfully established supply chains and resumed cooperation with international markets. According to leading global experts, Ukraine, despite heavy losses due to landmines and reduced production capacity, continues to be an important food supplier for Europe and the world.

Agribusiness, as one of the most progressive and efficient forms of organizing agricultural production, has become the subject of research by a number of domestic scholars. In particular, Kriukova I. O. and Stepanenko S. V. have determined that the principles of sustainable development are now the main guidelines for the agricultural policy of the EU and other developed countries. Scientists emphasize that responsible social, environmental and economic activities of business not only help to solve global and national problems, but also significantly affect the efficiency of economic activity. In their turn, Negrei M. V. and Trofimtseva O. V. studied the role of Ukraine's agricultural sector in the global agricultural market, examining the dynamics of the country's agricultural exports and identifying the main factors of its negative changes during the war.

Lazareva O. V. *et al.* argued that in modern conditions, special importance should be given to the study of the prospects for the development of agribusiness, which would ensure ecologically and economically efficient land use. Tarasevich N.V. explores the traditional approach to interpreting the economic essence of agribusiness based on the analysis of publications by foreign and domestic scientists and considers the general conceptual principles of modern agribusiness and its role in the country's agri-food system. Savytsky E. E.

reveals the essence of agribusiness concepts and the features of innovative activities of leading agricultural holdings in Ukraine and determines the need to increase the innovativeness of agribusiness enterprises.

Today's realities, in which agribusiness faces a number of serious and unpredictable challenges, require a significant rethinking of approaches to its operation and development. The consequences of aggression, occupation of large areas, active hostilities, land pollution, destruction of infrastructure and logistics routes – all of this has a devastating impact on the agricultural sector. In addition, the growing fuel shortage, limited access to necessary resources and materials, and difficulties with labor availability, especially in the context of the relocation of businesses, have significantly complicated the production and supply of agricultural products. All of this creates new conditions for farmers that need to adapt to changes and require careful analysis to develop effective strategies, and should certainly be a topic for further research, as only through a deep understanding of these challenges can practical recommendations and strategies be developed for the recovery and sustainable development of the country's agricultural sector.

Ukraine's agricultural sector has suffered significant financial and material losses due to the hostilities, as active hostilities often take place on large tracts of agricultural land owned by agricultural enterprises and farmers. As a result, most of the agricultural land has become inaccessible or unsuitable for cultivation. An additional threat is the contamination of these areas by unexploded ordnance, mines, and spilled fuels and lubricants, which makes it difficult to restore these lands. The latest findings of international experts underline that after the war ends, Ukraine will face a serious problem – more than 13% of the land will be mined, which will require a long time and significant efforts to clear it of mines and restore agricultural use of these territories. This creates additional difficulties for the recovery of the agricultural economy and will require a comprehensive approach to solving these problems.

Due to the fighting in Ukraine, according to the estimates of the Ministry of Agrarian Policy and KSE Agrocenter, more than 84 thousand units of agricultural machinery and equipment have been destroyed or stolen by the invaders. The value of such property is estimated at almost \$2.9 billion, which is 44% of all established mechanical damage caused by the Russian federation to our agro-industrial complex.

The second largest item of damage caused to farmers is the theft or complete destruction of agricultural products already produced (Dalevska N., & Boiko V., 2022). Ukraine has suffered losses due to the loss of grain, oilseeds

and other agricultural products not only as a result of destruction, but also due to the systematic export of these products by the occupiers outside our country. During the war, according to the estimates of the KSE Russian Agricultural Centre, 2.8 million tons of grain and 1.2 million tons of oilseeds from the 21st harvest were stolen or completely destroyed, with a total value of \$1.87 billion.

Currently, as a result of the hostilities, it has been recorded that granary capacities with a total capacity of 9.4 million tons have been damaged or destroyed. The final amount of lost capacities will be possible to establish only after the end of the war, since the fate of granaries in the temporarily occupied territories is unknown. Experts have estimated that the cost of repair work to restore damaged and newly built granaries to replace the destroyed ones is more than \$1.1 billion.

In addition, the livestock sector suffered large losses of livestock due to the ongoing hostilities. During the war, 212,000 heads of cattle, 95,000 heads of goats and sheep, 507,000 heads of pigs, almost 11.7 million poultry and nearly 400,000 bee colonies were lost. The estimated cost of losses incurred by agricultural producers in livestock and beekeeping is more than \$362 million.

In addition to the above losses, more than 14.3 thousand hectares of perennial plantations were destroyed in the war-affected areas, with an estimated value of almost \$349 million. The invaders also used fuel and lubricants for the needs of their army, destroyed or misappropriated plant protection products and mineral fertilizers worth almost \$95 million. According to the latest estimates made by KSE Agrocentre and the Ministry of Agrarian Policy, the cost of losses to Ukraine's agricultural sector caused by Russia's aggressive actions is approximately \$6.6 billion. The amount of the above losses is 23% of the total value of the assets of agricultural enterprises, i.e. almost a quarter of the agricultural sector of Ukraine has been destroyed (The total losses..., 2022).

In addition to direct material losses, Ukraine's agricultural sector has also suffered significant indirect losses, including lost profits due to lower production volumes, reduced revenues due to disruption of supply chains, and lower domestic prices. In addition, the war has led to higher costs due to the rise in the price of fuel, fertilizers and machinery. Two key factors contributed to the shortfall in agricultural production in 2022. The first was the reduction in the area under certain crops, as a large part of this land was in the areas of active hostilities. The second factor was a decline in yields due to simplified cultivation techniques that became necessary in the war. This included a reduction in

mineral fertilizer application rates and limited use of plant protection products, which in turn led to a decrease in overall yields (Tanklevska N. *et al*, 2023).

The losses incurred by farmers and the state due to the disruption of supply chains are among the largest as a result of the war. The blockade of Ukrainian ports on the Black Sea has had a significant impact on domestic prices for major export crops such as sunflower, wheat, corn and barley. This led to a significant reduction in farmers' incomes and a general decline in economic activity in the sector. Although the export issue was partially resolved thanks to the support of the international community by changing the logistics through rail and road transport, the situation remains challenging. With the help of international partners, a grain agreement was signed that allowed for maritime grain convoys in the Black Sea under the auspices of the UN, which somewhat improved the conditions for exports. However, export volumes remain insufficient to meet the needs of farmers, and the cost of transporting products is still high. It is noteworthy that the lost profits of farmers due to these difficulties are several times higher than the material damage caused by Russia.

The strategy for restoring Ukraine's export infrastructure should be based on a comprehensive approach that takes into account the lessons of the war and the need to create a logistics system that is resilient to external challenges and capable of supporting the sustainable development of foreign trade. The restoration of export infrastructure should include not only the reconstruction of destroyed or damaged facilities, but also the development of new, more efficient and adapted to modern conditions trade routes, with special emphasis on reliability, diversification of routes and the ability to quickly respond to changes in the geopolitical situation.

1. Development of land routes. In the context of the war and the blockade of ports, an important component of the strategy is the development of land transport routes, such as road and rail transport. Priority areas for investment include the modernization and expansion of road and rail corridors to Ukraine's western borders, which will reduce dependence on maritime exports and provide alternative routes for agricultural products to European and global markets.

2. Investments in improving rail connectivity and technologies to overcome track incompatibility. Given the different track widths in Ukraine and the EU countries, an important step is to modernize the railway infrastructure to ensure uninterrupted movement of goods. Investments in technologies to overcome track width incompatibility (for example, wheel set change systems) will

reduce the time and cost of cargo reloading and make transportation more efficient.

3. *Development of Danube River ports.* The Danube is an important transport corridor for Ukraine's exports, so the development of Danube river ports and cargo handling infrastructure will be critical to increasing the volume of transported products, including grain. Investments in modernizing ports on the Danube, improving transshipment capacities and creating convenient connections with other modes of transport (rail, road) will allow Ukraine to become an important player in the European export transport market.

4. *Create a diversified and sustainable logistics system.* Diversification of logistics routes is an important component of the strategy. Ukraine needs to reduce its dependence on maritime exports by ensuring a more resilient system that can adapt to changes in the geopolitical situation. The development of land routes, Danube ports and efficient multimodal solutions will reduce risks and increase the reliability of supply of Ukrainian products.

5. *Integration with the European transport network.* Given the prospect of Ukraine's membership in the EU, the restoration and modernization of transport infrastructure should be focused on integration with European logistics networks. This will increase Ukraine's export potential and strengthen its position in European markets. The development of infrastructure for seamless transport connections with the EU will become a critical element of the recovery strategy.

6. *Attracting investment and international partnerships.* To implement the infrastructure recovery strategy, it is necessary to attract international investment, in particular through financing mechanisms supported by the European Union and international organizations. Joint investment projects with partners from the EU and other countries will help to introduce innovative technologies, modernize existing transport facilities, and create new logistics corridors.

Despite everything, farmers are positive. Those in the war zone hope to resume their activities after the liberation. Those in the peaceful areas are looking for new markets, new niches, and change their business areas in line with the demand and needs of the country. Agribusiness is a clear process, both in the crop and livestock sectors, with its own timelines and technologies. It cannot be suspended or mothballed; despite everything, farmers have to work and will continue to do so.

Due to the fighting in Ukraine, a significant part of agricultural enterprises were forced to evacuate to other safer regions of the country, which forced them to change the cultivation of traditional crops to niche high-margin

crops, namely peas, mustard, chickpeas, lentils, the sale and transportation of which is more variable due to the blockade of sea ports (Boiko, V. and Boiko, L., 2022).

Given the martial law in the country, agricultural enterprises of all forms of ownership are increasingly favoring pulses, with peas being particularly popular. This crop is fast-growing and can provide stable yields at relatively low costs for the sowing campaign, including seeds, fertilizers and plant protection products. Peas, like other pulses, are in high demand and always bring profit to producers. However, there is currently a shortage of quality seed for crops such as peas, chickpeas and lentils.

At the same time, large agribusiness companies engaged in the cultivation of major agricultural crops – corn, wheat, barley, sunflower, soybeans – make a significant contribution to the state budget due to cultivation on large areas. However, small and medium-sized agribusinesses focus more on niche crops, such as vegetables, herbs, berries and other specialized crops that require more manual labor. These producers find their niche in the market, where the demand for such products also remains stable.

The European Union (EU) together with the European Bank for Reconstruction and Development (EBRD) are actively supporting small and medium-sized agribusinesses in Ukraine and other Eastern Partnership countries, helping them develop their potential. Thanks to financial assistance through partner banks, agribusiness companies have access to incentive grants and loans under the EU4Business initiative, which allows them to increase the volume of agricultural exports. This contributes to sustainable economic development and the improvement of the overall economic situation in the countries of the region.

One of the most important aspects of the strategic development of Ukraine's agricultural sector is the introduction of digital technologies in agriculture. In order for the agricultural sector to become high-tech and competitive, it is necessary to actively introduce innovative technologies, including genetic development, bio- and nanotechnology. However, for the successful digitalization of the industry, it is also important to have a robust cyber defense system in place to ensure that businesses are safe from potential cyber threats (Kyrylov Yu.Ye. *et al.*..., 2020; Kyrylov, Y. *et al.*..., 2024).

Business representatives and government officials of Ukraine have identified three main priorities in the agricultural sector in the post-war period. The priorities, which were specified in the Recovery Plan for Ukraine, were reported in a press release by the European Business Association (EBA).

The first priority is to improve and develop export logistics. Despite the lack of free sea routes, businesses have made significant progress in exports and increased the volume of agricultural products sold from 350,000 tonnes in March to 3 million tonnes in July. Thanks to the intervention of the international community, ports on the Black Sea have joined the restoration of logistics corridors. The second priority is the reliable storage of the harvested agricultural products. Thanks to FAO's support, Ukrainian farmers were provided with reliable grain storage equipment, which largely resolved the issue of grain storage deficit due to their partial loss during the war. The third priority is the availability of credit lines and free access to financial flows for farmers, and Ukrainian and foreign partners are currently actively working together to address these issues.

The development of the agricultural sector after the end of the war envisages modernization of the processing industry, increase of added value, development of horticulture, livestock, bioenergy, etc. In addition, it is important to note that the overarching motive in the Recovery Plan is the formation of Ukraine's Green Deal. Even in wartime, the state institutions, together with business representatives, will make efforts to ensure that enterprises switch to a sustainable development model during the post-war economic recovery (Kwilinski A., *et al*, 2025; Buiseness identifies..., 2023).

In the process of Ukraine's integration into the European Union, especially in the context of post-war recovery, reforming the agricultural sector and social infrastructure will be one of the main areas of focus. Given the prospect of Ukraine's accession to the EU, important milestones and requirements need to be taken into account, which will form the basis for further development and financing. The EU is likely to be the main source of donor funding for Ukraine's reconstruction and recovery, and this will undoubtedly require close coordination with other international donors such as the World Bank and the European Bank for Reconstruction and Development (EBRD).

EU agriculture is one of the most regulated sectors of the economy, with clearly defined rules and standards in areas such as market regulation, food safety, environmental protection and animal welfare. For Ukraine, these standards should be the basis for rebuilding and developing its agricultural sector.

After Ukraine's accession to the EU, Ukrainian farmers will have to comply with EU-wide product requirements, including certification, quality standards and environmental requirements. Accordingly, donor funding will be used to modernize Ukrainian enterprises to meet these requirements. This includes

the purchase of modern technology, quality control systems and increased production efficiency.

European food safety standards are among the highest in the world. As the agricultural sector recovers, it is important to implement these standards at all stages of production – from cultivation to processing and transportation. The EU pays great attention to sustainable development and environmental aspects of agricultural activities. Therefore, the restoration of the agricultural sector in Ukraine should include the introduction of energy-efficient technologies, reduction of CO₂ emissions, biodiversity conservation and other environmentally friendly production methods. Donor funds can be used to develop green technologies, such as organic farming, energy-efficient systems and water management technologies.

Given the EU requirements for animal welfare and care standards, Ukraine will have to adapt its agricultural policy to these requirements. This involves building new or renovating existing farms, taking into account humane animal welfare standards and maintaining proper sanitary conditions. The restoration of the agricultural sector will also include funding to improve conditions for farm animals.

European funding is important for Ukraine not only in the context of infrastructure reconstruction, but also to stimulate the development of high-tech and environmentally friendly agricultural enterprises. Given the importance of attracting investment from the EU, as well as the need to diversify the market for Ukrainian products, the following measures should be envisaged:

- steps should be taken to create a legal and economic environment that will encourage EU investment in the agricultural sector. This includes simplifying business registration procedures, providing tax incentives for investors, and creating a transparent business environment;

- donor funding and grants can be used to support small and medium-sized farms that need to modernize their equipment, adopt new technologies and improve their financial performance. Such programs may include training for farmers, advisory services and support for the introduction of green technologies;

- given the prospect of Ukraine's accession to the EU, it is important to focus on the integration of the Ukrainian agricultural sector into the single European market. This requires not only modernizing the infrastructure but also developing new sales channels;

- an important area is the development of transport infrastructure to ensure fast and efficient exports of Ukrainian products to European markets. This

includes the development of road and rail links, and the improvement of port and customs procedures to facilitate exports;

- to enter European markets, it is important to ensure that Ukrainian goods comply with European quality and certification standards. This requires updating the product certification system, creating a food quality system and environmental standards.

Ukraine's integration into the EU requires serious reforms in all sectors, including the agricultural sector, in line with European standards and requirements. Donor funding to be provided to partner countries should be used to modernize Ukraine's agricultural sector, introduce modern technologies, improve safety and environmental standards, and integrate into European trade networks. These measures will create the conditions for the sustainable development of the Ukrainian agricultural economy and its successful integration into the European single market.

Ukraine's post-war reconstruction strategies should be based on an integrated approach that combines economic, social, environmental and institutional reforms with the requirements of sustainable development. This process should include the comprehensive restoration of infrastructure, housing, production facilities and agricultural land that have been severely damaged by the hostilities. The main goal is not only to restore what has been lost, but also to create a modern, sustainable and competitive economy capable of adapting to new conditions and global challenges.

The first strategic goal is to ensure sustainable economic growth, which should be based on the restoration and modernization of key sectors of the economy, such as energy, agriculture, transport, industry and infrastructure. Particular attention should be paid to the transition to green technologies, which will allow Ukraine not only to preserve natural resources but also to integrate into global markets for sustainable development.

The second important strategic goal is social stability and the restoration of social infrastructure, including healthcare, education, social protection, and equality of opportunity. It is important to ensure support for internally displaced persons, the restoration of normal public services, and the reintegration of de-occupied territories.

The third strategic goal is to create an effective and transparent governance system, which includes the fight against corruption, public administration reforms, decentralization and strengthening of local self-government. To achieve these goals, it is necessary to involve international organizations and

donors that will facilitate the implementation of reforms through financial and technical support.

Given the global challenges, the reconstruction strategy should include strengthening the country's environmental sustainability. This includes not only the restoration of destroyed natural resources, but also the implementation of energy efficiency and green development initiatives that will help reduce environmental impact and ensure more sustainable development.

As a result of these strategies, Ukraine will have the opportunity not only to rebuild its economy and infrastructure, but also to build a more just and inclusive society that meets the modern requirements of the globalized world.

Agrarians in Ukraine are aware that in the context of military operations, they must mobilize all available resources to preserve their businesses and jobs to increase crop and livestock production, which in turn will ensure the country's food security. In order to maintain the profitability and stability of agribusiness, a number of important measures need to be implemented, including preferential purchases of agricultural products, VAT refunds, additional insurance guarantees for producers, and reduced transportation costs.

In response to the new challenges, we have launched a new logistics business in Ukraine, including the creation of our own fleet of trucks and containers for the transport of grain crops. This allows us to reduce dependence on traditional routes and maintain the efficiency of product supply. In addition, an important step is the implementation of an effective export policy and diversification of agricultural markets, which will help farmers adapt to changes in the global economy and increase their export potential.

All these efforts of farmers are part of a global mission – to ensure the country's food security and help the most vulnerable segments of the population on the planet overcome hunger. Ukrainian farmers hope for the support of the international community, in particular financial assistance, which will allow them to effectively fulfill their mission in conditions of war and economic instability.

3.5. Conclusions

The development of agribusiness in Ukraine in the context of modern challenges requires a comprehensive approach that takes into account both economic and social, environmental and political aspects. One of the key factors

in ensuring sustainable development of the industry is the introduction of organic agriculture. In the context of economic and political instability, this sector acts not only as a tool for preserving soil fertility and increasing export potential, but also as a mechanism for adapting to the EU's stringent environmental standards, which is important on Ukraine's path to European integration.

Niche crops are becoming an important component of the agricultural sector, as they allow small and medium-sized producers to find their own niche in the market, reduce dependence on monoculture production and increase farm profitability. Expanding the range of crops grown and developing processing will contribute to the creation of added value and increase the competitiveness of Ukrainian agribusiness.

The post-war recovery of Ukraine's agricultural sector should be based on diversifying export infrastructure, modernizing logistics routes, and adapting to the new realities of global trade. Investments in sustainable logistics, the development of western transport corridors, and integration with EU markets will help ensure the stability of agricultural exports.

Thus, the prospects for the development of Ukrainian agribusiness depend on the ability to adapt to new conditions, implement innovative approaches and integrate into global agricultural markets. Sustainable development, exploitation of niche opportunities, and strategic recovery will be key factors in improving the efficiency and competitiveness of the industry.

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MODELS OF RURAL DEVELOPMENT IN THE CONTEXT OF EUROPEAN INTEGRATION

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4.1. Introduction

The development of rural areas is one of the key factors of the socio-economic stability of the country, as it determines the standard of living of the rural population, ensures food security, supports the regional economy, and influences demographic processes. The current stage of Ukraine's development is accompanied by complex challenges faced by rural communities due to hostilities, structural transformations of the economy, and the need to adapt to European standards. The degradation of social infrastructure, the reduction of employment, and environmental threats require original approaches to rural development management.

The decentralization reform has created preconditions for increasing the autonomy of communities, but its effectiveness depends on the financial capacity of local self-government, the level of infrastructure development, and the ability to attract investments. The lack of an integrated approach to the regulation of rural development, insufficient integration of modern digital technologies, and environmental standards hinder the economic growth of regions.

The relevance of the study is due to the need to search for effective models of rural development in the context of European integration and global transformations. Successful examples of EU countries demonstrate that sustainable development is possible only if a multidimensional policy that covers economic, social, and environmental aspects is implemented. Remain fragmentary, which requires scientifically grounded management decisions.

Further development of rural areas requires adaptation of European best practices, including financing mechanisms, digital transformation of management processes, and implementation of environmental standards. An important task is the creation of effective tools for post-war economic revival, in particular, the development of the cooperative movement, the diversification of the economy, and the attraction of innovative business models. The integration of these approaches into the system of state and regional policy will contribute to the formation of an effective model of rural development management and ensure the stability of socio-economic processes in the regions.

The purpose of the study is to develop models and practical recommendations for the formation and functioning of institutional mechanisms for the development of rural areas in the economic space of the region, taking into account international experience and modern challenges caused by the processes of European integration, digital transformation, environmental adaptation, and decentralization.

To achieve this goal, it is necessary to solve the following tasks:

- To substantiate the theoretical and methodological foundations of the development of rural areas by analyzing the main conditions and factors of the formation of mechanisms for their regulation.
- To explore modern concepts of rural development management, in particular European approaches, digital technologies, and environmental and financial mechanisms.
- To develop models of institutional support for the development of rural areas, adapted to the regional characteristics of Ukraine, considering their economic, social, and spatial differentiation.
- To offer practical recommendations for improving the mechanisms of rural management in the context of post-war recovery, European integration, and sustainable development.

The scientific novelty of the study lies in the development of complex models of institutional support for the development of rural areas, considering the modern challenges of European integration, digital transformation, environmental adaptation, and decentralization. Within the framework of the study, the theoretical and methodological foundations of rural development are also clarified through a systematic analysis of the mechanisms of their regulation, which includes the influence of economic, social, environmental, and institutional factors.

The results of the study can be used in the practice of state and local government to develop strategies and programs for rural development, introduce innovative mechanisms of financial support, and adapt the European experience in Ukraine. The proposed management models can become the basis for the implementation of innovative approaches to regional development, improving the mechanisms for attracting investments and increasing the competitiveness of rural areas.

The theoretical significance of the work lies in the expansion of the scientific basis for the management of rural development, the integration of modern theoretical approaches to the analysis of territorial development, and the formation of new managerial decisions in the field of agriculture, spatial planning, and economic policy.

4.2. Conditions and factors of formation of mechanisms for regulating the development of rural areas

The international community defines the concept of "development" as a process in which the actions of the people themselves are combined with the actions of the authorities to improve the economic, social and cultural conditions of the community and its integration into the general flow of the nation's life, to enable them to make the maximum contribution to national development (Liu et al., 2024). This interpretation of development most fully reflects the importance of the personal humanistic factor in achieving positive and qualitative dynamics of the object of social relations.

From the point of view of managerial activity, the sustainable development of territorial units of self-government of the rural subsystem of society can be characterized as a system of subject-object relations. At the same time, the object is the territorial units of the rural subsystem of society as a system, and the human community is the subject. Conditions for ensuring their satisfaction.

If we turn to the theories of cycles of industrial development of J. Schumpeter, then the development of rural territorial units can be studied as a process that includes the following stages:

1. The revival of rural territorial units is the achievement of such a level of social and economic development, under the conditions under which the revenues of the territory will be able to cover the costs caused by the need

to ensure an adequate standard of living of rural residents with revenues from the use of their resources and production capacities.

2. Sustainable development of rural territorial units is the stage of expanded reproduction, i.e. ensuring such a level of social and economic development of the territories of the rural subsystem of society, at which the income received from the use of their resources and production capacities will compensate for the costs caused by the need for further social and economic development, and at the same time, will contribute to the achievement of a higher than standard of living of their inhabitants and the further development of rural subsystems of society (Ribeiro et al., 2023).

The main component element of the development of territorial self-government units of the rural subsystem of society is the stability of the economic base of the village and the expanded reproduction of agricultural production in a combined combination of small, medium, and large. Hence, everything else – the social sphere, decent living conditions, the formation of a sense of ownership on this land, an active civic and political position. Without creating an economic base for the livelihood of the rural population, it is simply impossible to solve the whole complex of problems of the village. By the definition of the concept of rural development, we will note the main functions of rural areas that provide it (Fig. 1).

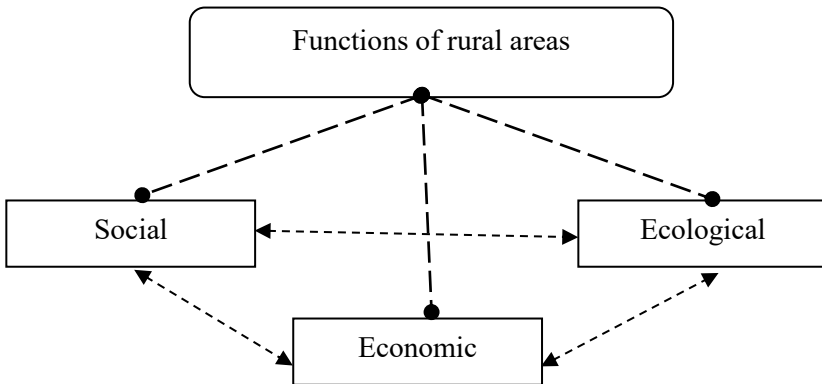


Figure 1. Functions of rural areas

Source: developed by the author

In Europe, there is an increasingly dominant belief that rural development is based on the development of local self-government, structural and regional policies, and the powerful influence of agricultural policy. It is a common and correct statement that the development of rural areas directly depends on the income level of rural residents and local budgets.

The development of rural areas should not be understood in a simplified way, only as the development of the material and technical base, housing, and social infrastructure in the countryside. It is certainly related to the restoration of the village from the point of view of systematizes, that is, through the restoration of rural communities. Its two vectors are important in this context: raising living standards (related to material factors) and improving the quality of life in the countryside (related to the extra-material, spiritual, and social needs of a person). However, it is not difficult to trace its other dimensions: the preservation of a specific rural way of life and its social values and the adaptation of the "rural lifestyle" to modern requirements.

For the development of rural areas to acquire a purposeful, predictable character and to be effective in compliance with the criterion of optimal use of resources, it is necessary to provide appropriate institutional support for the management of these processes.

Managerial activity implies the existence of two important components – the subject of management (exerts managerial influence) and the object of management (the component of the system, which indicates this influence, creates conditions for the implementation of the social mission of managerial influence). Managerial influence is the process of forming purposeful interaction between the subject and the object of management to achieve socially important results (Melnik-Shamrai et al., 2023). The above definition contains fundamentally important points. On the one hand, the managerial influence of the subject of management on the object is transformed from a one-sided phenomenon into their close interaction, which to a greater extent reflects the dialectical features of irreversible, directed, regular changes in socio-economic systems. On the other hand, the use of the criterion of social importance of the result of managerial influence reflects the social orientation and mission of any management system.

As a result of agrarian reforms and European integration processes, significant structural changes have taken place in Ukraine's agriculture. The introduction of the land market, decentralization of management, digitalization of the agricultural sector, and integration into EU policies have become key factors in the transformation of rural areas.

In parallel with these processes, new models of rural development management are being formed, based on the involvement of communities, local self-government, and businesses as active participants in regional development. An important task is the adaptation of rural areas to modern challenges, such as economic instability, the consequences of war, population migration, climate change, and the need to transition to ecological production.

Modern rural communities are not only administrative units but also centers of sustainable development, implementing economic, social, and environmental initiatives in cooperation with state institutions, businesses, and international partners. Rural development increasingly depends on the ability of communities to generate their financial resources, attract grant funding, create cooperatives, and implement local initiatives.

In modern regional politics, the balance of territorial development is considered a key task of economic reforms. The EU uses the "growth poles" model, which allows stimulating the development of depressed territories by creating economic clusters and promoting domestic investment.

The experience of the EU demonstrates that the lack of an active regional policy can lead to increased socio-economic disparities between regions. Studies show that rural development requires a targeted movement of capital and investment to underdeveloped regions, which is in line with the principles of the EU cohesion policy (Li et al., 2021).

Summarizing the experience of European countries, it is possible to provide a list of institutions (Fig. 2) that are directly involved in the processes of irreversible, directed, natural change of the rural area along with state authorities and multi-level local self-government bodies.

The concept of "new regionalism", which dominates in Europe, provides for an integrated institutional approach to rural development. This means that state bodies, local governments, agribusiness, and public organizations must act together to find effective models of cooperation and investment.

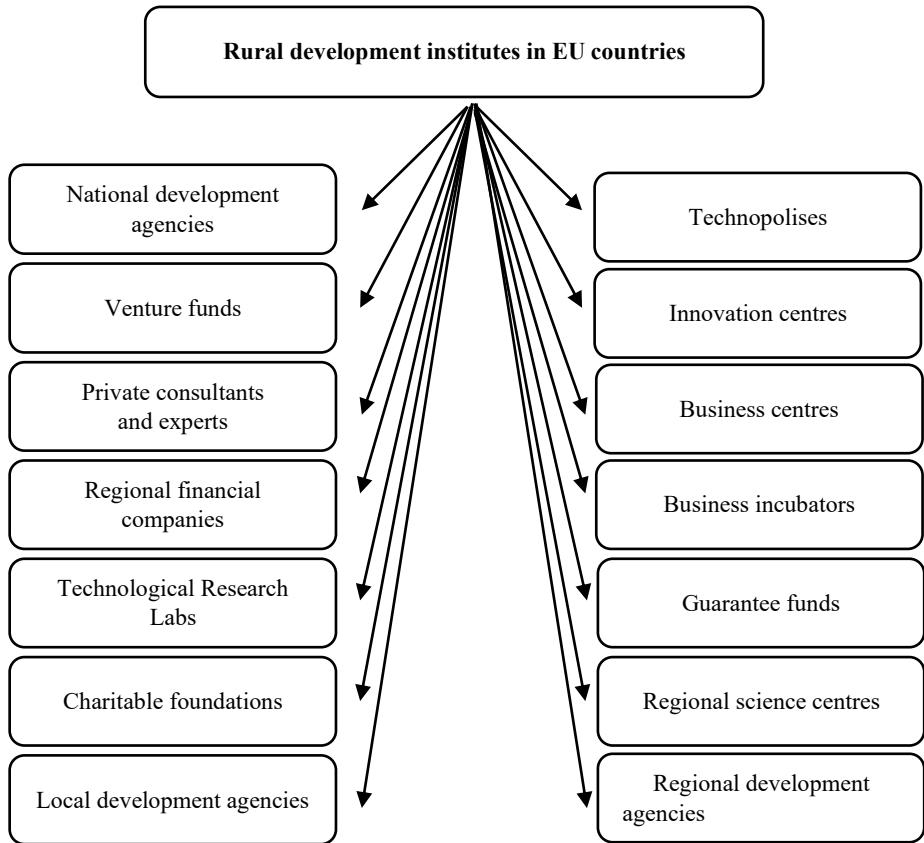


Figure 2. Rural Development Institutions in EU Countries

Source: formed by the author based on Martino, 2024)

In Ukraine, agribusiness is traditionally focused on achieving its profitability, but in recent years, there has been an increase in its participation in the development of local communities through corporate social responsibility programs. Some agricultural holdings and large enterprises invest in social infrastructure, education, environmental initiatives, and support for small farms. However, this process is not yet systemic and requires state stimulation.

The European model of rural development is based on the principles of multi-level governance. EU governments are mostly assigned the function of creating favorable conditions – developing a legislative framework, forming infrastructure, and providing financial resources. Regional authorities act as an

intermediary between central policy and local initiatives, helping communities implement development strategies (Pollermann et al., 2020).

To finance regional development, the EU has a Cohesion Policy (Cohesion Policy 2021–2027), for which 392 billion euros have been allocated. A significant part of the funds is directed to depressed areas, innovative projects, environmental initiatives, and digitalization. Just Transition Fund (JTF) and Invest EU programs are also important as they contribute to the sustainable development of rural regions.

The EU also has territorial convergence programs aimed not only at new member states but also at neighboring states, including Ukraine. Through the Neighborhood, Development, and International Cooperation Instrument (NDICI), Ukraine receives funding to support rural areas. In addition, the ENPARD initiative ensures the adaptation of Ukraine's agricultural sector to the standards of the EU Common Agricultural Policy (CAP) (Stoustrup, 2021).

A special role in rural development is played by the LEADER program, which stimulates community development through Local Action Groups (LAGs). LAGs are created from representatives of the community, NGOs, and local government. Several LAGs are already operating in Ukraine, attracting international funding and contributing to the formation of local initiatives.

The basic principles of operation of LAGs include:

- Development of local partnerships and cooperation networks.
- Integration of different sectors of the economy.
- Decentralization of management and public control.
- environmental sustainability and the use of renewable resources.
- digital transformation of rural communities.

An important aspect of LEADER is the active participation of the community, which contributes to the empowerment of local self-government and the formation of sustainable economic models at the rural level.

The territorial rural community should play the role of a local economic driver, coordinating sustainable development and digital transformation initiatives. Its main functions are:

1. Development of the economy and entrepreneurship, attracting investments, support for farmers' cooperatives and SMEs.
2. Digitalization and innovative development, including Smart Villages, electronic services, and the development of IT infrastructure.
3. Creating jobs and developing human capital, expanding employment opportunities, training specialists for the modern agrarian economy.

4. Development of social infrastructure and improvement of the quality of life, including healthcare, education, culture, and public spaces.
5. Environmental sustainability and climate adaptation, development of a circular economy, support for ecological farming.

Modern rural development should be based on an integrated approach that includes public policy, local autonomy, international support programs, and the private sector. Within the framework of this strategy, four main models of institutional partnership can be distinguished:

1. Institutionalized partnership between government bodies – community associations, regional development agencies, intermunicipal cooperation.
2. Flexible intermunicipal partnership – implementation of joint projects at the level of territorial communities, cross-border cooperation.
3. Private business partnership – development of cooperatives, agricultural clusters, value chains, innovation ecosystems.
4. Public-private partnership (PPP) is cooperation between communities and businesses and international investors to implement environmental and social projects.

Thus, modern communities should be not only coordinators but also active participants in the development of rural areas, using European financing mechanisms, digital technologies, and sustainable development strategies.

At the same time, an American researcher, based on the generalized experience of the development of the rural subsystem of society, in particular in the United States and some European countries, has developed three models of the functioning of a special institute for the development of territories (Sili et al., 2022).

Model 1. The Institute of Territorial Development functions as a subdivision of the government at the local level, in particular in the form of the Department of Planning and Economic Development. It is formed by the following departments: economic planning; planning; economic development; public services; financial management; business development, employment, and training.

Model 2. The Institute of Territorial Development functions in the form of a commercial enterprise and is based on private property.

Model 3. The Institute of Territorial Development functions in the form of an associative association of local self-government bodies, business structures, and public organizations.

The models of functioning of special institutions for the development of territories, proposed by E. Blackley, remain fundamental, but in modern conditions, they need to be updated and adapted to new challenges. Today, the development of territories requires flexible approaches, the integration of digital technologies, international cooperation, and the implementation of sustainable development principles. With this in mind, traditional models of territorial development are complemented by new management tools that consider modern European practices, Smart Village policies, and environmental transformation.

The updated state model of territorial development provides for the functioning of local development agencies, communal enterprises, or economic development departments in communities. It is focused on strategic planning, spatial management, and the involvement of international partners through the LEADER, Interreg, and Horizon Europe programs. Of particular importance in this model is the introduction of digital governance (Smart Governance), which includes electronic platforms for territorial management, digital cadastre, and mechanisms for the transparent allocation of resources.

The private-economic model of territorial development, which traditionally provided for the functioning of commercial enterprises based on private property, is now being transformed into the creation of innovative rural hubs, agro-industrial parks, and green incubators of entrepreneurship. It is focused on the development of venture funds, corporate initiatives, cooperation of farmers, and attraction of international business. In this model, the key priorities are the development of agro-processing, short food chains, green economy, and agritourism, which is in line with the European Green Deal strategy and the principles of the circular economy.

The partnership model of territorial development has evolved from a classic associative association of local authorities, business structures, and public organizations to a more integrated system of intersectoral cooperation. The modern approach involves the development of cluster models and interaction between communities, businesses, and educational institutions. This model is based on inter-municipal cooperation networks, international funding programs, grant initiatives, and public-private partnerships (PPPs). It also includes the creation of Community Development Centers, platforms to support small businesses, consultation centers for farmers, and agro-innovation hubs that ensure the integration of intellectual capital into the development of territories.

Thus, modern models of territorial development should combine public management mechanisms, private initiatives, and partnership formats within the framework of the overall strategy of Smart Rural Development and Green

Transition. This allows us to ensure the sustainable development of rural areas, their financial self-sufficiency, integration into the European economic space, and improvement of the quality of life of the population.

Rural development should be based on maintaining a balance between the autonomy of local communities and effective interaction with state institutions. It is important to ensure the independence of NGOs working in the field of rural development from political influence, promoting their role as drivers of local initiatives and partners in the implementation of Smart Village strategies. But also, to take an active part in the processes of planning, attracting investments, digital transformation, and ecological adaptation of territories (Stojanova et al., 2021).

The development of rural areas directly depends on local resources, managerial traditions, and regional specifics. The use of cluster approaches, decentralized financing models, and cross-border cooperation allows territories to adapt to global challenges and form sustainable development strategies. Considering local specifics, environmental potential, and digital opportunities, a determining factor for the effective development of each community.

Therefore, its management requires an organization whose main mission is the collective interests of the peasants in the development of the rural area. Such an organization should have clear links with local and regional authorities, in particular in matters of management, financing, or defining development tasks. To perform these tasks, the institution must meet the following criteria:

- be perceived as an institutional mechanism of regional development by state authorities, local and regional self-governments, and other structures.
- coordinate their activities with state and self-government structures.
- at the same time maintain autonomy in decision-making.
- Have a developed rural development strategy that will be consistent with the priorities identified by public authorities and the public.
- Have sufficient financial resources for the implementation of basic projects for the development of rural areas, support of their infrastructure.
- Have qualified professional staff.

Rural development management should be conducted based on a mechanism for involving various institutions (government agencies, organized public, local business, community-based organizations) in the development process and determining the necessary prerequisites for their effective interaction.

The main role in the organization of coordinated work of all management entities (state and local authorities, business sector, community) should be played by optimal institutional support, the assessment of the effectiveness of which is a necessary condition for improving the tools for the influence of local authorities on the nature of changes taking place in the local socio-economic system (community). The assessment methodology should be aimed, on the one hand, at analyzing the level of socioeconomic development of the rural area and, on the other hand, at assessing the process of community participation in the development and implementation of strategic concepts and programs for the development of the community itself.

From the point of view of the possibilities of their application by local governments and compliance with the basic criteria for rural development management, modern tools for diagnosing the level of development can highlight advantages and disadvantages. Significant shortcomings are the insignificant attention paid to the assessment of the managerial impact on the level of rural development and the underestimation of the significance of the social and environmental components of development. In addition, the analysis of the management process itself on formal grounds (sequence of stages, compliance with procedures, etc.) is not sufficiently related to the real (actual) results of managerial influence on the community.

The methodology used by the institutions of power to determine the effectiveness of the program, plan, and concept conducted and planned for implementation has quite wide opportunities for comparing and grouping a large number of territories according to the level of development, determining the rank of a particular of them. However, it does not allow assessing the adequacy of the management decisions made and their perception by residents and contains contradictions in the dynamics of interrelated indicators. An important criterion for analyzing the quality of management is the correspondence of the goals and objectives of territorial socio-economic development to the interests and needs of the population, the rural community. Therefore, in the study of the effectiveness of management, the attitude of residents to the results of managerial activities of local authorities and the level of interaction of various subjects in the management of rural development should be considered.

At the same time, it should be noted that the results of the implementation of management decisions and programs adopted by government institutions without coordination with the rural community do not always meet the expectations of residents. Therefore, the system of indicators for assessing the effectiveness of rural development management should include two parts:

- 1) evaluate the results of rural development.
- 2) Grouped indicators of the analysis of the process of managing the development of rural areas with the involvement of rural communities.
 - The main directions of improving the instruments of influence of local authorities on the nature of changes taking place in the local socio-economic system – the local community – are as follows:
 - Increasing attention to the assessment of managerial impact on the level of rural development.
 - Introduction to the toolkit for assessing the social and environmental components of development.
 - Minimizing the list of indicators.
 - Simplification of calculations due to the introduction of integral indicators.
 - "e-governance" systems.

Assessment of the compliance of the goals and objectives of territorial development with the interests and needs of the rural community is an integral element of the analysis of the quality of management of rural development. In the study of the effectiveness of management, it is necessary to take into account the attitude of residents to the results of managerial activities of local authorities and the level of interaction of subjects of management of rural development with such indicators as the level of trust in local authorities, public awareness, the level of participation of residents in implementation of development programs and others. Such a system of indicators for assessing the management of rural development allows, on the one hand, to assess the dynamics of the main areas of rural development (economic, financial, social and environmental), on the other hand, to assess the process of rural development management as a set of program documents: strategic plan, programs and development projects and current activities of local authorities. In addition, it makes it possible to answer the questions of how the dynamics of indicators of various spheres of life of the village is reflected in the well-being of the population; what are the problem areas in the activities of local authorities in the field of governance, etc. (Shelenko et al., 2023).

A different understanding of the essence of the development process inevitably affects the nature of its management, which is reflected in the typology of approaches to determining the content of the category of "management" of rural development (Table 1).

The systematization of approaches to development management is the beginning for understanding the peculiarities of local development and the specifics of managing this process, the formation of a system of priorities for the development of rural areas, which corresponds to modern trends in the development of society and management relations. In addition, the comparison of different approaches to the composition of participants and the expected results of management lays the foundation for the development of modern tools for assessing the effectiveness of local development management.

Table 1. Typology of Approaches to Determining the Essence of the Process of Management of Rural Development

No. p/p	Approach	Subjects of action (management)	Results
1	Objective (evolutionary)	Not considered	Identifying changes that can be both positive and negative
2	Command and Administrative	Power institutions (authorities: ministries, departments)	Meeting the needs of sectoral ministries and departments, new development of territories
3	Economic (infrastructure)	Local authorities	Development of infrastructure, increasing the efficiency of economic activity and management of state property.
4	Comprehensive	Various subjects (primarily state and local authorities)	Achieving a certain level of development to meet the needs of the community and the state in a certain territory
5	Quality	Many actors/stakeholders (state and local authorities, communities, and the business sector)	Improvement of the well-being of the population (more complete satisfaction of needs), its involvement in the management process, and preservation of the previous environment

Source: developed by the author

Based on the generalization of approaches to the management of rural development, it can be concluded that in modern conditions, the analysis of the management process should be based not only on quantitative but also on qualitative criteria. The main goal of development should be to improve the living conditions of the rural population, which are reflected by a complex indicator

that includes the level of income, the number and quality of jobs, the level of education, the quality of the habitat and other indicators that characterize the ability of rural residents to meet their needs.

The development of the territory is influenced by a complex mix of subjective and objective factors. Objective factors include spatial location, resource potential (natural resource, financial and human potential), and place in the management system (district center, rural settlement, etc.).

Subjective factors include the availability of qualified managerial personnel, their understanding of the essence of socio-economic development and their ability to organize it (development of a strategic development plan), conjunctural factors, investment attractiveness, and participation of the population in development.

The development of a rural area depends on a combination of natural factors and the purposeful action of interested subjects, i.e., the management of this process. For successful adaptation to changes in the external and internal environment of local authorities, it is necessary to adjust the traditional functions performed by local development management entities to supplement them with new ones corresponding to the modern model of "joint management" (Table 2).

Table 2 shows the ratio of traditional functions performed by subjects of the process of managing the development of rural areas, target areas of improving its quality. The study of the level of implementation of the reflected benchmarks is an essential element of the analysis of the tools for assessing the effectiveness of management of rural development.

As mentioned above, the main tools of the development management process are the strategy and programs of rural development. In practice, there is often an identification of planning and programming processes, which reduces the effectiveness of the use of these management tools. The strategy of socio-economic development of rural areas should be built taking into account modern principles of strategic planning, which allows to fully use the potential of local authorities and use all available resources, including social capital, and based on a clear idea of the state of the object of management, possible changes in the external environment that open up new development opportunities or create threats to it (Gutorov & Gutorova, 2023).

Table 2. Rural development management institutions, according to the model of "joint management"

No. p/p	Subjects	Traditional functions	What should be the participation in management
1	Institutions of state power	Formation of the legal space, implementation of macroeconomic planning and control	Selective support for priority areas of development
2	Local Government Institutions	Forecasting and planning of development, solving current problems, control functions	Emphasis on the effective use of the existing development potential, organization of interaction between management entities, search for "new ways of development"
3	Business entities	Meeting the needs of the population in goods, services, and jobs, and making decisions on their investment policy.	Partnerships with local authorities in the development and implementation of development programs
4	Community	Choosing the type of your behavior and the form of dialogue with the authorities	Transition from the state of the object of influence on the position of the subject of development (self-development)

Source: developed by the author

Therefore, the strategy for the socio-economic development of rural areas is not a tool for attracting resources from budgets to solve current problems and "patch up existing holes", as is the case now.

In the management of local development, new requirements for strategic management should be reflected. The most relevant for local institutions of power are such interrelated factors as changing the role of management entities, increasing the importance of information, involving the population in the process of development management, etc. An important characteristic of effective management is the orientation towards moving away from standard solutions and finding new ways to achieve goals, which is especially important in the context of increased differentiation of institutional formations by the level and potential of development.

Active involvement of the community in development management contributes to improving the quality of the "management product" due to several factors:

1. by researching and considering the needs of the rural community when making strategic decisions that provide a positive assessment of the process of rural development.
2. due to the use of such an inexhaustible resource of development as social capital and creative abilities of people living in rural areas.
3. due to the consolidation of the rural community, which will contribute to a more effective achievement of the goals of rural development.

There are two forms of participation of the rural population in the process of managing the development of rural areas: active and passive (Fig. 3). In modern conditions, the active participation of the rural community in the process of building a strategy and concept for the development of a rural area is a priority since it reflects the issues of rural life and their further solution.

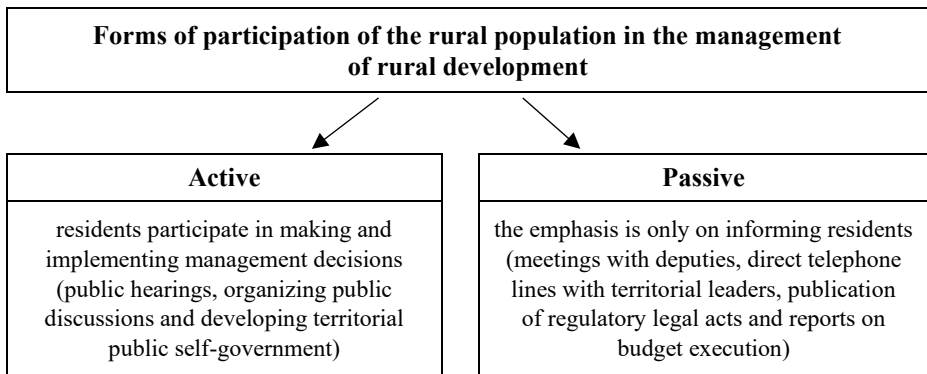


Figure 3 Forms of participation of the population in the management of rural development

Source: generated by the author

A necessary condition for improving the tools for the influence of local authorities on socioeconomic development is not only the assessment of the management process itself but also the determination of its effectiveness. Traditionally, when evaluating efficiency, the emphasis was placed on economic indicators, but modern approaches require an emphasis on social, environmental, and managerial aspects that directly affect the quality of life of the population.

In Ukraine, the process of adaptation of European methods for assessing the development of territories continues, but there is still no single comprehensive toolkit for analyzing the effectiveness of management of socio-economic development of communities. The existing system of statistical indicators does not fully consider the real needs of local communities, and sociological surveys often show discrepancies with official data.

In recent years, steps have been taken at the state level to improve the methods of monitoring the development of rural areas (Tymoshenko, 2024). In particular, the Ministry of Community Development and the State Statistics Service of Ukraine use indices of tax capacity of territorial communities, indicators of local budgets, assessments of the level of administrative services, and economic activity of the population. In addition, international initiatives are being implemented, including the LEADER, DOBRE, and U-LEAD programs with Europe, which include the assessment of social cohesion, employment levels, and the availability of medical, educational, and transport services in communities.

However, the modern approach to assessing the development of territories requires going beyond traditional economic indicators. To obtain objective analysis results, the following aspects must be considered:

- the opinion of the population regarding changes in the community and the level of satisfaction with services,
- availability of information on the activities of local authorities,
- the degree of interaction between government agencies, business, and civil society,
- Focus on finding innovative solutions in the development of territories (for example, digitalization, green energy, smart rural communities – Smart Villages).

Modern rural development management tools should consider not only current statistical indicators but also the complex impact of management decisions on the well-being of the population, social cohesion, and environmental sustainability of the community. This requires the development of new models for assessing efficiency, which will be based on international practices and adapted to the specifics of the development of the territories of Ukraine.

4.3. Modern concepts of formation of mechanisms for the development of rural areas

The development of rural areas of Ukraine is formed under the influence of global, national, and local factors that interact with each other, determining the features of economic, social, and environmental processes. Global trends, such as growing demand for food, technological progress, climate change, urbanization, and the strengthening of the role of sustainable development, create new challenges and opportunities for the transformation of the agricultural sector and rural communities. In turn, national factors, including state agrarian policy, land reform, regional decentralization, and European integration processes, determine the strategic directions of territorial development, their financial support, and institutional capacity.

Local factors, such as the level of economic activity of the population, natural resource potential, social cohesion of communities, the quality of local infrastructure, and the availability of state support, form direct conditions for the development of rural areas. The interaction of these levels of influence creates a complex system in which rural development is not a linear process but occurs through the adaptation of local communities to external changes and the use of existing opportunities.

According to institutional theories, institutional changes in rural space occur gradually through the interaction of formal and informal norms, management traditions, and cultural and socio-economic constraints. Formal institutions, such as legislative acts, state programs, financial support instruments, and regulatory mechanisms, determine the framework for the functioning of the agricultural sector and local self-government. Informal institutions, including customary law, traditional forms of management, social values, and local practices of interaction, affect the effectiveness of the implementation of reforms and the perception of changes in the community.

Globalization and integration of Ukraine into the European space require adaptation of the institutional environment to modern management standards, which provides for the digitalization of the agricultural sector, the introduction of sustainable technologies, the development of cooperation between communities, and the formation of a polycentric system of spatial development. Modern challenges, such as market liberalization, land reform, environmental constraints, demographic changes, and migration processes, require flexible management models that ensure the stability and self-sufficiency of rural areas.

Rural development is a dynamic process that depends on the ability of institutions to adapt to change and ensure a balance between economic efficiency, social stability, and environmental responsibility. This requires an integrated approach in which global, national, and local mechanisms are integrated, aimed at creating a sustainable and competitive rural economy.

Given the complexity and multidimensionality of the processes affecting rural development, modern governance mechanisms should be based on the integration of different approaches and tools (Adamowicz & Zwolińska-Ligaj, 2020). Traditional methods, which focused on agricultural production and administrative regulation, can no longer ensure sustainable development. Instead, it is necessary to introduce more flexible, adaptive models that consider the specifics of regional development, digital transformation, environmental challenges, and the needs of local communities.

Current trends in rural management require a transition from a narrow sectoral vision to an integrated approach, including the development of entrepreneurship, the expansion of local markets, the improvement of infrastructure, the introduction of innovative technologies, and the attraction of international resources. Of particular importance is the active role of communities, which should become initiators of local projects and effectively use financial support mechanisms.

In this context, it is important to analyze the key concepts on which modern mechanisms of rural development are based. They cover approaches to spatial planning, financial security, international cooperation, and the use of the latest technologies to create a sustainable and competitive rural economy.

4.4. Decentralization and strengthening the financial capacity of communities

The ongoing decentralization reform in Ukraine has become a key factor in transforming approaches to rural management. The transfer of financial and managerial powers from the central government to the local level has opened up new opportunities for communities for economic growth, social development, and infrastructure modernization. As a result, local communities ceased to be passive recipients of state subventions, but instead turned into independent business entities that can form their development strategies, attract additional financial resources, and effectively manage local budgets.

One of the main achievements of decentralization was the strengthening of the financial capacity of territorial communities. Thanks to the reform, there was a redistribution of tax revenues, which allowed local authorities to gain direct access to some taxes, in particular, personal income tax (60% remains in the community), land fees, single tax, and excise duty. This allowed municipalities to increase their budgets and allocate funds to development projects, modernization of communal infrastructure, social initiatives, education, and medicine.

However, for effective management of financial resources, the institutional capacity of communities is necessary – the availability of professional personnel capable of implementing local programs, managing budgets, planning investment projects, and ensuring the effective use of available funds. In this context, the creation of local development agencies (LDAs) – specialized structures that help communities develop and implement development strategies – plays a key role.

Local development agencies perform many essential functions, including the following:

- Attracting investments – contribute to cooperation with business, attracting private capital and international grants.
- Development and implementation of local development projects – from infrastructure construction to support for small businesses and agricultural cooperatives.
- Consulting support for the community – provision of expert services on financing, business planning, and territory management.
- Human capital development – organization of training programs for representatives of local self-government, entrepreneurs, farmers.

One of the key aspects of decentralization is the possibility of attracting international funding. Territorial communities have gained access to European grants, cross-border cooperation programs, and rural development support projects. In particular, municipalities can participate in LEADER, U-LEAD, DOBRE programs, the United Nations Development Program (UNDP), USAID, and other initiatives aimed at improving the effectiveness of local governance and job creation (Castro-Arce & Vanclay, 2020).

Municipalities also have the opportunity to implement public-private partnerships (PPP), which allow them to finance infrastructure and social projects together with businesses. For example, the development of local industrial parks, the construction of distribution centers, and the creation of enterprises

for the processing of agricultural products can become principal factors in the growth of the regional economy.

However, the financial autonomy of communities does not mean the absence of challenges. Communities with less economic activity, a low tax base, or unfavorable demographic conditions face risks of financial instability. In this case, horizontal equalization tools, such as state subsidies, subventions for infrastructure development, and special financial mechanisms to support low-income areas, become important.

Thus, decentralization and strengthening the financial capacity of communities create the basis for sustainable rural development. The use of these opportunities depends on the effectiveness of local governance and the ability of communities to attract investments, adapt to economic challenges, and implement modern mechanisms for financing local initiatives.

4.5. Integration into European rural development programs

The process of European integration of Ukraine determines modern approaches to the development of rural areas because the adaptation of the national agricultural policy to EU standards opens up new opportunities for financing, modernization of production, and implementation of environmental practices. A special role in this process is played by the Common Agricultural Policy of the European Union (CAP), which provides an integrated approach to supporting agriculture and territorial development based on sustainability, innovation, and competitiveness.

CAP is based on two principal areas:

- Direct support to farmers through subsidies and financial incentives to increase productivity, greening agricultural production, and ensuring food security.
- Rural development through support for cooperation, infrastructure projects, improving the quality of life of the population and integrating rural communities into global markets.

Ukraine is gradually introducing CAP tools into its rural development policy. This includes the development of small farms, the creation of cooperatives, the introduction of environmental standards in agriculture, and increased access to financing instruments from European funds. Of particular importance is the support of organic farming, ecological production, and the development of local food chains, which is in line with the principles of the European Green Deal.

One of the key EU programs that is being successfully implemented in Ukraine is LEADER (Liaison Entre Actions de Développement de l'Économie Rurale – Linkage between actions for the development of the rural economy). This initiative aims to increase the capacity of municipalities to self-manage development through local initiatives funded by the EU.

Basic principles of the LEADER program:

- Bottom-up approach – decisions are made directly by communities, not just by the central government.
- Local Action Groups (LAGs) are associations of representatives of government, business, and the public who jointly implement development projects.
- Innovation and cooperation are financial support for projects that contribute to the creation of new types of business, tourism development, and improving the quality of life.
- International cooperation is an opportunity to partner with other countries to exchange experience and implement joint initiatives.

Ukrainian communities that joined LEADER gained access to European experience in rural development, created cooperatives, improved infrastructure, and implemented effective management models.

The European Neighborhood Program for Agriculture and Rural Development (ENPARD) is aimed at supporting countries on the path of European integration in reforming their agricultural sectors and rural areas. For Ukraine, this means strengthening sustainable development policies, attracting additional funding, and supporting small and medium-sized farming.

The main objectives of ENPARD are:

- Expanding access to finance for small farmers and agribusinesses.
- Increasing food security through the development of local production systems.
- Creation of effective mechanisms for agricultural management by European standards.
- Support for agricultural cooperatives, development of local markets and rural tourism.

The implementation of ENPARD in Ukraine helps not only financially, but also through educational programs, consulting support, and adaptation of the legal environment to EU standards.

The Horizon Europe program is the largest funding instrument for research and innovation in the EU. It covers various areas, including the development of agricultural technologies, environmental modernization, and the digitalization of rural areas.

Horizon Europe's key areas in rural development:

- Innovative technologies in the agricultural sector (AgTech) – the development of precision farming, automation, the use of big data and artificial intelligence in agriculture.
- Bioeconomy and circular production models – stimulation of the use of renewable resources and processing of agricultural waste.
- Climate-resilient farming – adaptation to climate change, reduction of the use of pesticides and mineral fertilizers, and development of organic production.
- Support for Smart Villages – digitalization of rural areas, creation of "smart" management systems, improving access to digital technologies.

Ukrainian scientific institutions, agricultural enterprises, and communities have the opportunity to join Horizon Europe international consortia, receiving funding for research and innovative projects in agriculture and territorial development.

Integration into European rural development programs is a strategic priority for Ukraine as it opens access to financial resources, expert support, modern technologies, and effective management models. The LEADER, ENPARD, and Horizon Europe programs contribute to strengthening the local economy, supporting small agribusiness, introducing digital and environmental technologies, and forming new cluster models of community development.

Ukraine's participation in these initiatives allows it not only to receive financial support but also to adopt the best practices of the EU in the field of sustainable development, which is a major step towards European integration and building a modern competitive model of agriculture and regional governance.

4.6. The concept of "Smart Villages" is the digital transformation of rural areas

The concept of Smart Villages is one of the key areas of rural transformation in Europe and is gradually gaining relevance in Ukraine. It is based on the use of digital technologies, innovative solutions, and integrated management to improve the quality of life in communities, expand opportunities for economic activity, and create environmentally sustainable resource use systems. Production, as digitalization opens up new prospects for municipalities for entrepreneurship, educational initiatives, development of social services, and attracting investments. (Komorowski & Stanny, 2020).

The development of the digital economy in rural areas allows you to create additional employment opportunities and increase the level of income of the population. In the context of global digital transformation, local manufacturers can enter new markets using online commerce and digital platforms to sell products. This is especially important for farms, cooperatives, and small businesses, which get the opportunity to interact directly with end consumers, avoid intermediaries, and develop local food chains. Digital technologies also contribute to the development of rural tourism, agro-industry, and handicrafts, allowing communities to create additional sources of income. The introduction of precision farming technologies, such as remote crop monitoring, automated irrigation systems, and drones to monitor soil conditions, increases the efficiency of agricultural production, reducing costs and increasing yields.

A separate role in the digitalization of rural areas is played by e-governance, which simplifies administrative processes, reduces bureaucratic burdens, and increases the transparency of decision-making. The use of digital platforms for registering a business, applying for subsidies, applying for land, or participating in public discussions allows you to reduce the cost of time and resources, simplifying interaction between citizens and local authorities. The development of online services also contributes to increasing the level of civic engagement, as residents can participate in decision-making processes through electronic voting, consultations, and discussion of community development strategies.

The experience of European countries demonstrates the effectiveness of the implementation of the Smart Villages concept in improving the standard of living in rural areas. In the EU countries, it is actively implemented through comprehensive initiatives that combine the development of digital infrastructure, support for local entrepreneurship, and innovative approaches to the use

of resources (Fernández & Peek, 2023). For example, in France, online platforms have been created to support farmers; in Finland, automated agricultural parks and energy-saving technologies are being developed, and in Estonia, digital governance allows citizens to receive all the necessary administrative services online.

In Ukraine, the implementation of Smart Villages has already begun within the framework of the LEADER, Horizon Europe, and the "State in a Smartphone" initiative, which provide for the development of digital services in communities, the expansion of communication infrastructure, and the attraction of innovative solutions in the field of agriculture. Digitalization allows not only to simplify bureaucratic procedures but also to contribute to more efficient management of natural resources, the creation of a safe environment, and the development of modern business models in rural areas. In the future, the implementation of Smart Villages will contribute to the integration of Ukrainian communities into the European digital space, expand access to finance, increase the competitiveness of regional economies, and strengthen social cohesion. Thus, the digital transformation of rural areas is a crucial step toward the modernization of Ukrainian villages and their integration into the modern economy focused on innovation, efficiency, and sustainable development.

4.7. Green Transition and Ecological Development Models

The green transition and ecological development models play a key role in the modern processes of rural transformation, causing a change in approaches to production, the use of natural resources, and the overall strategy of economic development. The European Green Deal has become a defining benchmark for EU countries that are gradually changing the agricultural sector, integrating environmental standards, reducing greenhouse gas emissions, and introducing more sustainable business practices. Ukraine, moving towards European integration, has adapted these approaches, directing agricultural development towards environmental safety, rational use of resources, and the introduction of innovative technologies that reduce the negative impact on the environment.

In modern conditions, the greening of the agricultural sector is becoming not only a requirement of international partners but also an economic necessity because soil depletion, climate change, rising energy costs, and exacerbation of the problem of waste disposal force farmers to look for effective solutions.

An important direction is the development of organic production, which involves the rejection of synthetic fertilizers and pesticides, the use of natural methods of plant protection, the restoration of soil fertility, and the formation of environmentally friendly and safe agricultural landscapes. The demand for organic products in the world is steadily increasing, which opens up new prospects for small and medium-sized farms that can benefit from product certification and access to international markets (Dudiak, N et al., 2024).

A key step in the implementation of ecological development models is the introduction of precision farming technologies that minimize the use of chemicals and rationalize agrotechnical processes. The use of sensors, satellite monitoring, and automated resource management systems makes it possible to optimize the application of fertilizers and plant protection products, reduce water consumption, and increase the efficiency of land use. These technologies not only increase yields but also significantly reduce the environmental burden, making agricultural production less energy-intensive and more adaptable to climate change.

The development of the circular economy is becoming another critical area that allows rural communities to effectively use agro-industrial waste, turning it into a resource. Biogas plants, composting of organic waste, and recycling of crop waste contribute to the formation of closed cycles, in which waste becomes a source of energy or secondary raw materials for production. In combination with renewable energy sources, such as solar and wind farms, bioenergy complexes, and local energy cooperatives, this creates conditions for reducing the dependence of rural areas on fossil fuels and improving the energy security of communities.

Ukraine is already implementing some initiatives aimed at greening agriculture and developing a green economy. The introduction of financial support instruments for agricultural producers using environmentally friendly technologies, support for farmers engaged in organic farming, and stimulation of the development of bioenergy projects – all this is gradually changing the structure of the rural economy. At the same time, it is necessary to significantly intensify the processes of implementation of European standards of environmental management, improve monitoring of the ecological state of lands, and develop environmental programs that will contribute to the restoration of degraded areas.

The green transition is strategically important not only for agriculture but also for the overall economic development of the country. Investments in sus-

tainable technologies, the development of renewable energy, and the introduction of environmental standards contribute to increasing the competitiveness of the agricultural sector and Ukraine's integration into the European economic space. Greening the economy not only minimizes the negative impact on the environment but also creates new jobs, attracts investment, and promotes regional development, making rural areas more attractive for living and doing business.

4.8. Development of cooperatives and small farms

The development of cooperatives and small farms is one of the key areas of modernization of the agricultural sector and ensuring sustainable development of rural areas. In today's environment, when large agricultural holdings continue to dominate the market, it is becoming increasingly difficult for small farmers and local producers to compete for resources, sales channels, and financing. That is why supporting smallholder farming and cooperation is of strategic importance, as these models contribute to the economic diversification of regions, create jobs, stimulate local development, and increase the well-being of rural communities.

Government support programs for small farmers and agrarian cooperatives play a vital role in expanding opportunities for smallholder producers. They provide access to financial resources, grant programs, soft loans, and subsidies for the purchase of equipment, seeds, fertilizers, and mechanization. An important direction is to stimulate the creation of cooperatives that allow farmers to combine their efforts for the joint purchase of resources, increase production efficiency, reduce distribution costs, and expand access to markets. Cooperation allows small farms to avoid dependence on large traders and intermediaries, providing them with stable prices for products and the opportunity to develop their processing capacities.

In addition to government initiatives, international support programs that provide grants and consulting assistance to farmers to improve business processes, introduce environmentally friendly technologies, increase competitiveness, and enter European markets make a significant contribution to the development of small farms. Participation in such programs opens opportunities for small manufacturers to modernize production, improve product quality, and be certified by international standards.

One of the key areas of development is the support of family farms, which play a significant role in the formation of a sustainable food system, providing the local population with high-quality and safe products. Grant programs for family farms allow farmers to invest in expanding activities, building greenhouses, purchasing modern equipment, creating processing plants, and developing new areas of production, such as organic farming or agritourism. This contributes to increasing the level of employment in rural areas, reducing the migration of young people to cities, and the formation of economically self-sufficient communities.

The development of cooperatives and small farms is also essential for the environmental sustainability of agriculture. Due to the small scale of production and orientation to local markets, small farmers and cooperatives are more flexible in implementing environmentally friendly technologies, reducing the use of chemicals, and preserving agrobiodiversity. They are an essential element of the food security strategy as they ensure the diversity of agricultural products, support traditional farming methods, and contribute to the development of sustainable farming.

The effective development of cooperation and small farms requires not only financial support but also the creation of a favorable institutional environment. An important condition for the successful implementation of support programs is the simplification of procedures for access to funding, the provision of legal and advisory assistance, and the creation of a network of training centres and platforms for the exchange of experience. It is also important to develop local initiatives and partnership projects between communities, which will help increase trust in the cooperative movement and expand opportunities for interaction between farmers, businesses, and scientific institutions.

Therefore, support for small farms and agrarian cooperatives is a principal factor in the sustainable development of rural areas, which ensures economic growth, strengthening food security, preserving the environment, and improving the standard of living of the rural population. Systemic state support in combination with international initiatives allows the creation of favourable conditions for the development of the local economy, attracting investments, increasing the efficiency of agricultural production, and improving the well-being of communities.

Thus, modern mechanisms for rural development in Ukraine are based on the institutional restructuring of local self-government, integration into European programs, digitalization, and sustainable economic development. In-

stead of passively waiting for state support, territorial communities become active participants in economic development using modern financial instruments, attracting investments and international cooperation.

4.9. Mechanisms of differentiation of rural areas of the region

Institutional support for the management of Ukrainian rural areas is represented by a set of institutions necessary to manage the economy and social life of the rural population. Local self-government bodies and executive authorities are an integral part of it. A schematic representation of the synergistic interaction of formal and informal institutions and institutions of rural development management is shown in Fig. 4.

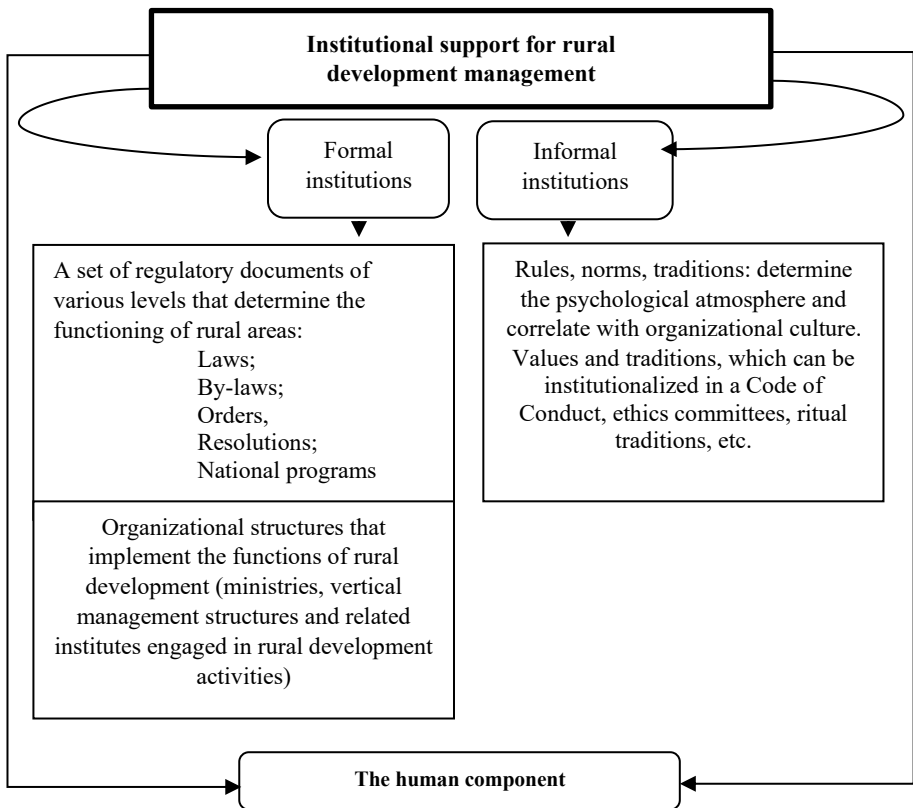


Figure 4. Institutional support for the management of rural development

Source: generated by the author

As can be seen from the figure, the system of institutional support of managerial activity in the countryside is based on the normative-legal and value-ethical subsystems. That is, the institutional support for the management of rural development is formed by the current formal and informal norms, rules, and values.

Formal institutions include:

- 1) a set of normative documents of various levels (laws, orders, standards, programs) that determine the functioning of rural areas in Ukraine.
- 2) organizational structures that implement the functions of rural development management.

Informal rules and norms, values, and traditions: characterize socio-psychological behavior and correlate with organizational culture. At the same time, values and traditions are institutionalized in codes of conduct, ethical norms (principles), ritual events, etc. The functioning of rural development in Ukraine is facilitated by such management mechanisms as institutional rules and certain kinds of restrictions, which, in turn, are divided into formal and informal (Fig. 5).

The norms, rules of conduct and interaction of economic entities, institutions of management and regulation at the local level, and individual members of the rural community, as well as organizations that implement this behavior and interaction in the rural economy, reflect the existing institutional infrastructure at the local level.

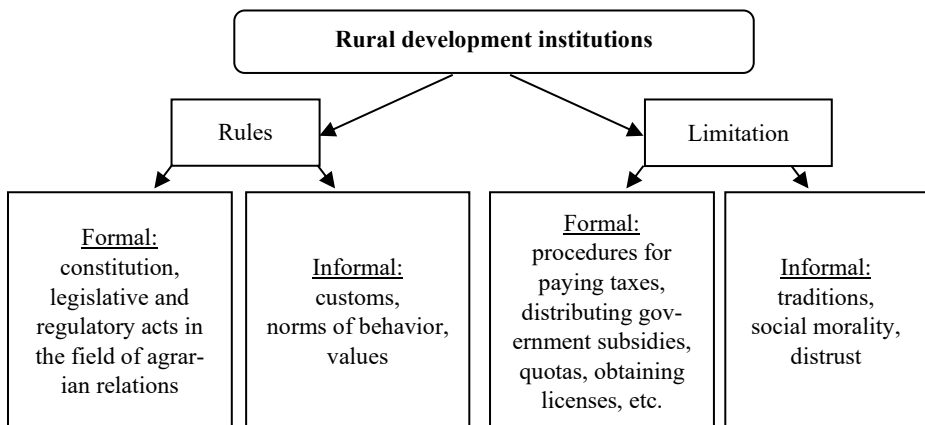


Figure 5. Classification of rural development institutions

Source: generated by the author

The modern institutional system of management of rural development in Ukraine has undergone a significant transformation because of decentralization reforms, financial autonomy of communities, and the introduction of international mechanisms to support regional development. Despite the positive developments, several problems remain that limit the effectiveness of state policy in this area. One of the key challenges is the low institutional capacity of some communities, which complicates the implementation of strategic development programs, the introduction of innovative models of the economy, and ensuring the efficient use of local resources.

Although the system of state support for agriculture and regional development has changed, many mechanisms are still based on approaches that do not consider modern challenges. The impact of the traditional sectoral approach, which considers rural development through the prism of agro-industrial production, is still tangible, while international practice demonstrates the need for a multifunctional approach, which includes the development of non-agricultural business, infrastructure, tourism, and environmental initiatives.

Financing for rural development has taken on new forms thanks to international technical assistance programs, including ENPARD, LEADER, and grant initiatives of the European Union, USAID, and the World Bank. However, the problem of inefficient use of public funds, complex procedures for obtaining funding, and the lack of an effective mechanism for monitoring the implementation of support programs remains. An important problem is that even with the availability of financial resources, communities often do not have sufficient human and institutional capacities for their effective development.

An additional challenge was the opening of the land market, which changed the structure of agricultural production and required innovative approaches to land management. At the same time, the war has significantly changed the priorities of state policy, causing the need to restore destroyed infrastructure, support IDPs, integrate social programs into the rural economy, and strengthen food security.

The lack of a clear system for monitoring rural development remains a significant problem, which complicates the analysis of resource efficiency and policy adjustment according to the real needs of communities. In the face of modern challenges, it is necessary to further reform the rural development management system, introduce digital platforms for monitoring and evaluating the effectiveness of support programs, integrate Ukrainian communities into

European sustainable development initiatives, and strengthen the role of local self-government in determining rural development strategies.

The formation of an effective legislative framework remains a key element of institutional changes in the field of rural development. All transformation processes depend on the regulatory environment because it is the legislative norms that determine the framework of economic activity, mechanisms for supporting regions, the procedure for the functioning of the land market, and the rules for business interaction with local communities. According to international organizations, the success of reforms in countries with economies in transition depends on the quality of the institutional structure, the stability of the legal field, and the effectiveness of the implementation of regulatory norms.

In recent years, Ukraine has taken significant steps in the field of regulation of rural development. Decentralization has allowed communities to independently manage resources and form development strategies. The opening of the land market has changed the balance of economic interests in the agricultural sector, expanding opportunities for farmers and small businesses. At the same time, the adaptation of legislation to EU standards has opened access to European funding programs, which allows municipalities to attract resources for development projects, support for small businesses, and the introduction of environmental technologies and digital solutions.

Despite significant changes, serious challenges remain that limit the effectiveness of state policy in the field of rural development. Numerous regulations and support programs often do not achieve their goal due to insufficiently clearly defined priorities, an unclear system of management, and control over their implementation. Insufficient coordination between central and local authorities, complexity of funding procedures, and lack of mechanisms for monitoring and evaluating performance led to the fact that a significant part of initiatives remains declarative or partially implemented.

Although funding for the agricultural sector has increased, there is still an imbalance between supporting large agricultural producers and small farmers, which poses challenges for the development of family farms and cooperatives. In addition, the war has significantly changed the emphasis of state policy, necessitating the allocation of a significant part of resources to the restoration of destroyed rural areas, support for internally displaced persons, and ensuring the country's food security.

The attitude of rural communities to state support programs remains ambiguous. On the one hand, the historical experience of unfulfilled reforms has formed a certain scepticism; on the other hand, more communities are taking

advantage of the opportunities of international programs, attracting grant resources, and introducing new development models. Digitalization, the development of cooperation, the use of renewable energy, and environmental technologies are becoming new vectors of change that give communities more autonomy and economic prospects.

The lack of a unified system for monitoring the effectiveness of state programs remains a significant problem that needs to be addressed. The modern development of the agricultural sector should be accompanied by the introduction of digital solutions to track real indicators of change, improve the analytical base, and create tools for public control over the use of resources. In this context, it is necessary to further reform financing mechanisms, attract investments, and implement European standards of transparency and accountability in the field of rural development.

The modern system of management of rural development in Ukraine still faces the problem of insufficiently clear delineation of functions between various levels of government, which is especially noticeable in the areas of natural resources management, implementation of environmental programs, and ensuring economic self-sufficiency of communities. Decentralization has significantly changed the approach to territorial governance, but coordination between central executive bodies, regional administrations, and local self-government bodies needs further improvement.

A separate challenge remains in ensuring control over the rational use of natural resources at the local level. Despite the expansion of the powers of communities, there is a shortage of effective mechanisms for the supervision of land, water resources, and the ecological state of territories. Rural communities often do not have sufficient leverage over these processes due to the complexity of procedures, lack of qualified personnel, or insufficient support from government agencies.

Informal institutions in rural development play an increasingly significant role as they contribute to the establishment of interaction between residents, farmers' associations, cooperatives, and authorities. Civil society and initiative groups are becoming active participants in the development process, which changes traditional management models. However, the level of trust between the population and the authorities remains unstable, which is a consequence of historical experience and long-term disregard for the interests of rural communities at the state level.

Studies in recent years show that citizen participation in public organizations and volunteer movements has increased significantly, which is a positive

trend in the context of rural development (Kovalchuk, 2021). At the same time, distrust of state support programs and mechanisms for distributing financial resources is still high. The main reasons for this are the complexity of procedures for obtaining funding, insufficient transparency in the use of budget funds, and the lack of an effective mechanism of public control over the implementation of state programs.

Further strengthening of trust between citizens and authorities is possible through the development of public engagement mechanisms, transparent budget planning, digitalization of management, and active implementation of European standards of local self-government. An important task remains to increase the institutional capacity of communities, which includes training local managers, improving strategic planning procedures, and introducing tools for monitoring the effectiveness of state programs. Only under the conditions of well-established interaction between the state, local governments, citizens, and businesses is it possible to achieve high-quality development of rural areas and ensure their competitiveness in modern economic conditions.

The development of rural areas of Ukraine depends on institutional reforms, which include simplification of bureaucratic procedures, increased transparency of management, introduction of digital technologies, and increased public participation in decision-making processes. The cumbersome nature of permitting procedures, the opacity of the regulatory environment, and weak institutional support for smallholder farming have long limited opportunities for economic growth in rural areas. However, in recent years, significant steps have been taken to digitalize public services, simplify registration procedures, introduce electronic document management, and implement anti-corruption initiatives that contribute to improving the business climate in the agricultural sector.

One of the key factors of successful development is the effective information provision of rural communities, which allows increasing the level of trust in the authorities, promoting the involvement of residents in local self-government, and improving coordination between business, government agencies, and public organizations. Despite the growing access to digital technologies, local authorities, in particular village councils, often remain insufficiently adapted to the use of modern information resources, which complicates the effective management of territorial development. International technical assistance programs, in particular EU initiatives, are aimed at overcoming the digital isolation of rural areas, but the problem of staffing and digital literacy of local managers remains relevant.

In the field of institutional support of rural development, there is still a considerable influence of informal interaction mechanisms that compensate for gaps in the formal management system. In some cases, this leads to shadow schemes in land relations, evasion of legal norms, and the spread of unofficial market practices. At the same time, due to the active development of civil society, a significant part of informal initiatives is gaining positive importance, contributing to the establishment of cooperation between communities, entrepreneurs, and local authorities.

An important condition for sustainable rural development is the strengthening of citizens' influence on decision-making processes. Decentralization has opened new opportunities for municipalities to manage resources and implement local initiatives, but the level of public involvement in these processes is still insufficient. For formal institutions to become effective development tools, it is necessary to expand the mechanisms of public participation, create open platforms for interaction between citizens and the authorities, strengthen public control over the use of budget funds, and introduce models of participatory governance.

Thus, the institutional features of the management of rural development in Ukraine are characterized by the need to further improve regulatory and legal support, expand digital services, develop public initiatives, and strengthen trust between the authorities and citizens. The formation of an effective management system is possible only with an integrated approach, which includes simplification of regulatory procedures, activation of civic participation, integration of modern technologies, and transparent use of resources. Only such a strategy will ensure the sustainable development of rural areas and their competitiveness in the modern economic system.

4.10 Conclusions

According to the results of the study, it was found that the development of rural areas in Ukraine is determined by institutional, economic, and social factors. It is revealed that the traditional model of rural management, which is based on a centralized approach and sectoral regulation, has shown its ineffectiveness in the context of modern challenges. Despite the implementation of reforms, in particular decentralization, the rural development management system remains fragmented and insufficiently adapted to the real needs of communities.

It has been determined that the key problem remains the low institutional capacity of local self-government bodies, which complicates the effective use of financial resources, management of natural and land resources, and the implementation of development programs. The lack of a systematic approach to financing local development and the dispersion of budget flows lead to the ineffectiveness of state support programs. Insufficient integration of local strategies with national development programs limits opportunities for attracting investments and using modern tools for economic growth.

A revision of approaches to the formation of rural development policy is proposed, considering a multidimensional approach, which includes economic, social, environmental, and managerial aspects. The need to strengthen the financial autonomy of communities and improve state support mechanisms to adapt them to the real needs of the regions was emphasized. The digital transformation of rural areas is identified as an important direction, particularly the introduction of the Smart Villages concept, which allows an increase in the level of managerial efficiency, improves access to markets, and promotes the development of small and medium-sized businesses.

The need to expand the participation of citizens in decision-making processes on the development of rural areas is substantiated. Insufficient involvement of the population, low level of trust in state institutions, and weak development of public control mechanisms hinder the processes of modernization and reform. It is proposed to strengthen institutional mechanisms of public participation, create platforms for communication between citizens and authorities, and introduce open tools for monitoring and evaluating the effectiveness of state programs.

It has been proven that a significant factor in the economic development of rural areas is the support of small and medium-sized agricultural businesses, the development of the cooperative movement, and the stimulation of entrepreneurship. The use of European financing mechanisms, in particular the LEADER, ENPARD programs, and other international initiatives, can contribute to the diversification of the rural economy, job creation, and sustainable development.

The need for transition to ecologically oriented models of rural development has been confirmed. Ukraine's integration into the European Green Deal opens new opportunities for the introduction of sustainable agricultural technologies, the development of organic production, and the reduction of the negative impact of the agricultural sector on the environment. It is proposed to improve the mechanisms for stimulating ecological farming, to introduce a system

of "green" grants for small agricultural producers, and to increase the level of environmental responsibility of large agricultural enterprises.

Thus, the proposed solutions are aimed at overcoming institutional, financial, and social barriers in rural development. The use of an integrated approach to management, community activation, support for entrepreneurial initiative, and the introduction of innovative development models will allow the formation of an effective management system that will meet modern challenges and contribute to the sustainable development of rural areas in Ukraine.

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WINE TOURISM AS A TOOL FOR ECONOMIC DEVELOPMENT AND EFFECTIVE MANAGEMENT IN THE CONTEXT OF GLOBALIZATION

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5.1. Introduction

In the context of globalization, tourism is one of the important factors of economic development, contributing to income growth, job creation, and development of regional infrastructure. One of the promising areas of the tourism industry is wine tourism, which combines gastronomic traditions, cultural heritage, and agro-industrial production. It becomes a key element in shaping the tourist attractiveness of regions and contributes to their socio-economic development.

The development of wine tourism is an important aspect of the modern economy, as it integrates several industries – viticulture, winemaking, tourism and marketing. In the context of increasing competition in the international tourism market, the country's regions strive to develop unique tourist products based on local resources. Wine tourism can become a powerful driver of economic growth, attracting investment and expanding opportunities for the export of wine products. This is especially true for Ukraine, which has favorable climatic conditions for viticulture and significant potential for developing tourism infrastructure.

The purpose of this study is to define the role of wine tourism as a tool for economic development and effective management in the context of globalization, as well as to identify the main trends affecting its development. The

study aims to analyze modern approaches to developing wine tourism, studying its impact on the regional economy, and developing recommendations for increasing the efficiency of this industry in Ukraine.

To achieve this goal, it is necessary to solve the following tasks:

- determine the theoretical foundations of wine tourism as a component of economic development;
- investigate the state and prospects for developing the wine industry as a basis for the formation of wine tourism;
- analyze the international experience of wine tourism development and the possibilities of its adaptation to Ukrainian realities;
- develop recommendations for increasing the competitiveness of wine tourism in Ukraine.

The scientific novelty of the study lies in the comprehensive analysis of wine tourism as a tool for economic growth, as well as in the recommendations for its effective development.

The study has both theoretical and practical significance. The theoretical significance lies in the systematization of knowledge about wine tourism as an economic phenomenon, determining its place in the tourism and winemaking industries. The practical significance of the study lies in the possibility of using its results to create strategies for developing wine tourism in Ukraine, attracting investment and improving the country's image in the international tourism market.

5.2. Theoretical foundations of wine tourism development, its economic impact and role in shaping sustainable market trends

Today, wine tourism is considered a worthwhile endeavor in all wine-producing regions worldwide, as it contributes to the promotion of local alcoholic beverage producers and the advancement of the regional tourism product, yielding additional economic and social benefits from wine enthusiasts.

The development of specialized services within this type of tourism allows for the extension of the tourist season in the region, enhances the tourism image of the area, increases the number of tourist arrivals, and enriches and diversifies the local tourism offering by introducing wine tours, festivals, excursions, tastings, and presentations.

Wine tourism is a form of tourism that involves traveling to wine-producing regions to familiarize oneself with the wine production process, partake in wine tastings, and participate in cultural events related to wine. This form of tourism is becoming increasingly popular globally as it combines elements of gastronomic and cultural tourism, attracting tourists interested in unique experiences and local traditions. One of the main components of wine tourism is visiting wine regions where tourists can explore vineyards, wineries, and learn about the history of winemaking in a specific area. A key element is the organization of tastings, where visitors can sample different types of wines, learn about their characteristics, production techniques, and food pairings.

Furthermore, wine tourism includes participation in wine festivals, where large-scale events are organized to showcase local wines, host competitions, masterclasses on winemaking, and lectures. These festivals are often accompanied by cultural events, concerts, and traditional celebrations, allowing visitors to experience the atmosphere of the region. Another component is participation in educational programs, where tourists can gain knowledge about the history of winemaking, the specifics of winemaking techniques, and the culture of wine consumption. Wine tourism also encompasses visits to wine museums and historical landmarks, which provide a deeper understanding of the cultural heritage of a particular area.

Additionally, specialized tours can be organized for tourists, combining wine tourism with other activities, such as cycling or hiking through vineyards, visiting local restaurants where regional dishes, harmonizing with local wines, can be sampled. Thus, wine tourism combines various cultural, educational, and gastronomic elements, creating a unique experience for tourists.

Enotourism, or wine tourism, includes a broad range of services provided to tourists who wish to explore the winemaking traditions and cultures of different countries. The classification of enotouristic services can be divided into several main categories (fig. 1).

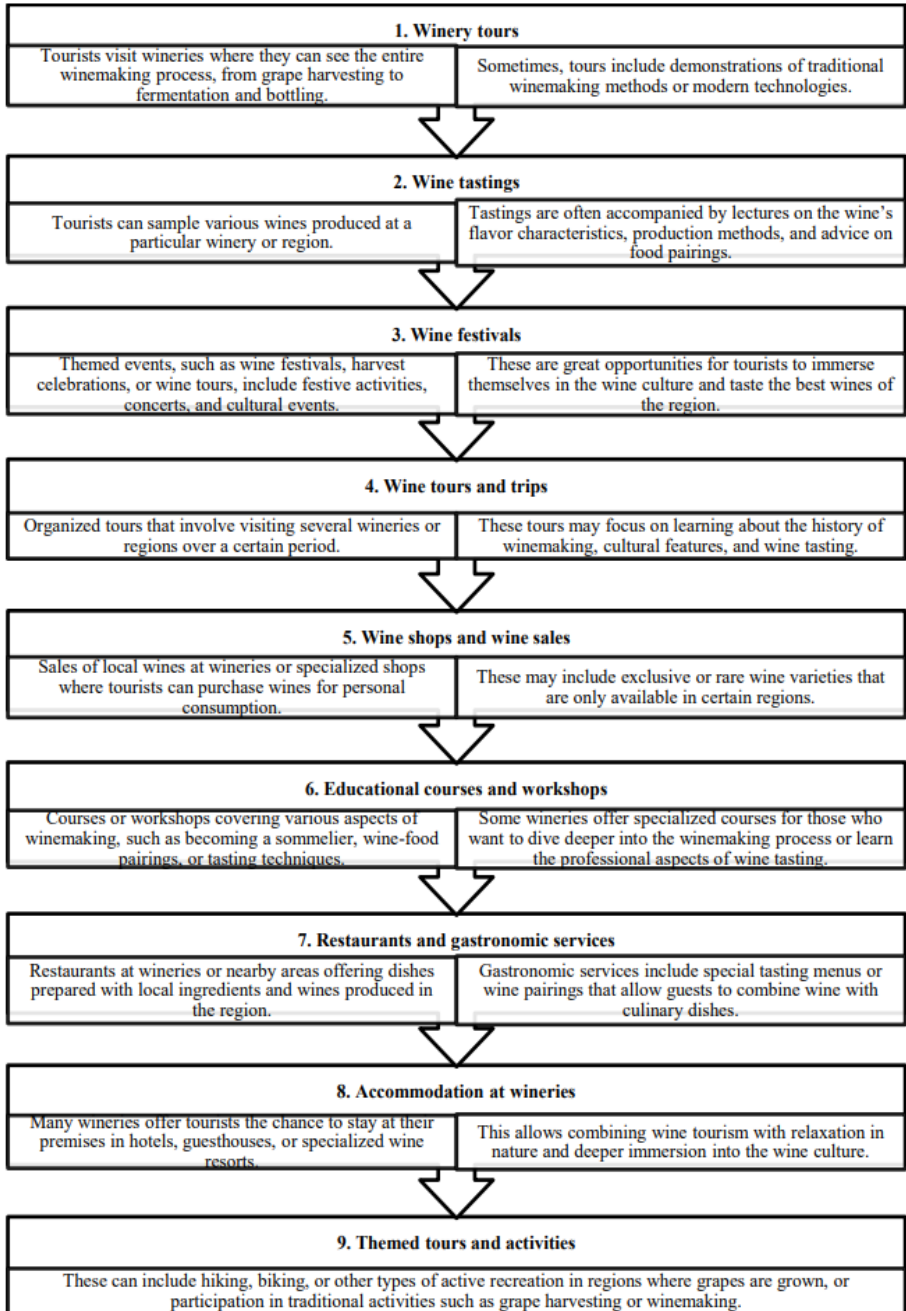


Figure 1. Classification of wine tourism services

Source: compiled by the author

Wine tourism can take various forms and types, among which an important place is occupied by enogastronomic tours, which involve the careful pairing of wine with various dishes to achieve a harmonious taste combination. During such tours, tourists have the opportunity to explore the culture of wine consumption and its pairing with other gastronomic products, including cheeses, meat, and fish delicacies. Typically, these journeys include visits to wine-producing regions, where tourists can observe the winemaking process, tour wine cellars, and interact with local producers.

The most common form of wine tourism is excursions to wineries with wine tastings in tasting rooms. Here, visitors can sample wines and brandies with a guarantee of quality and authenticity. During these excursions, guests learn a wealth of interesting information about the region's wines, the history of winemaking, and gain skills in proper wine consumption. Tourists are invited to familiarize themselves with the production process, descend into cellars filled with large vats and barrels, and discover the secrets of wine aging. They also learn about the unique traditions and assortment of wines and spirits offered by the specific winery.

As a special thematic direction within cultural and educational tourism, enogastronomic tours should be considered (a system of rules for the proper pairing of wine with various dishes to achieve a harmonious taste combination). During such a journey, tourists familiarize themselves with the culture of wine consumption and its pairing with other gastronomic products and dishes, most commonly with cheese, meat, and fish delicacies.

Another type of wine tourism is recreational and therapeutic tourism, which is based on the provision of services for therapeutic, preventive, and cosmetic purposes, using wine and grapes for treatment (vinotherapy, enotherapy, and ampelotherapy) in wellness and medical facilities.

If we consider each of the subtypes, it can be said that **vinotherapy** is a comprehensive set of therapeutic, wellness, and cosmetic techniques based on the healing properties of wine. Vinotherapy primarily involves the controlled consumption of red and white wines. Modern studies have shown that the therapeutic effect of vinotherapy is linked to the presence of polyphenols in the wine, which have antioxidant properties. Various vinotherapy procedures help eliminate toxins from the body, normalize blood circulation, and strengthen blood vessels. Additionally, wine-based masks, massages, and wraps improve blood microcirculation, saturate the skin with trace elements, hydrate and soften it, and restore youthfulness and elasticity.

Interest in **ampelotherapy** – the use of fresh grapes and grape juice for treating various diseases, predominantly chronic ones – has also grown. It has been proven that grape seeds contain a high concentration of active compounds, particularly polyphenols, which have a unique ability to bind free radicals that form in the body due to factors such as sunlight exposure, cigarette smoke, stress, and polluted air. Free radicals are one of the primary causes of aging and the development of malignant and cardiovascular diseases.

Enotherapy, or wine therapy, has a history spanning millennia. Even Plato compared wine to milk for elderly people, while the French claim that wine cures everything except alcoholism. The Babylonians, in the 6th century BCE, recognized the medicinal properties of wine, and ancient physicians used it as a primary means of restoring vitality. Wine contains components that help the body combat harmful environmental influences such as polluted air, stress, and cigarette smoke.

Wine tourism is an important part of cultural and gastronomic heritage and several fundamental principles can be distinguished for its development:

1. Preservation of traditions, which emphasizes local customs, methods of wine production, historical aspects of winemaking, as well as the culture of wine consumption. This principle is important for preserving the inheritance of winemaking and attracting tourists who want to dive into local culture and history.
2. Wine quality – wine farms should constantly strive to improve production technology, vineyard selection and improve quality standards. Tourists who come for tasting expect the best wine, and this is what provides their interest in travel.
3. The educational component is an important component of wine tourism. It can be manifested through excursions to winemaking, tasting workshops, as well as lectures on the history of wine and its features. The educational component adds additional value to experience and helps tourists better understand the culture and process of wine.
4. Ecological sustainability, since wine tourism is paying more and more attention to ecological purity. Winemaking uses organic methods of grape growing, minimizing the negative impact on the environment. Sustainable development also includes the use of eco-materials for packaging and doing responsible business.
5. Involvement of local communities to support local entrepreneurs, farmers, restaurants, hotels, and other participants in tourism infrastructure

helps them to develop the region and promote sustainable economic development.

6. Integration with other types of tourism. Wine tourism is often combined with other types of tourism, such as gastronomic, cultural, environmental or adventure. This allows businesses to offer tourists more diverse experiences and increase the attractiveness of the region.

Considering the trends of wine tourism, it can be noted that this type of tourism is gaining popularity among wine connoisseurs. Wine tours allow tourists to gain unique experience, which includes visiting the wine cellars, communication with manufacturers, acquaintance with the traditions of winemaking, and the purchase of unique wines directly from manufacturers. In addition, the wine tours are given the opportunity to study the history and culture of winemaking, as well as to expand the outlook on gastronomy and enoenotherapy.

Instead, it is also important to consider the inclusive aspects of organizing such tours to ensure the availability of wine tourism for persons with different physical restrictions, regardless of their social status or health. For example, winery companies should be equipped with accessible routes for wheelchairs, special systems for people with visual impairment, and communication for people with hearing impaired people, which will make this type of tourism more democratic and accessible to a wide range of tourists.

Wine tourism includes:

- visiting grape plantations, agricultural winery enterprises;
- familiarizing with the technology of production of alcoholic beverages directly in production;
- familiarizing with the history of winemaking, brewing, and national traditions of alcohol; visiting specialized museums and exhibitions;
- visiting tasting halls and basements, tasting of local grape varieties;
- visiting restaurants offering wine tasting services;
- participating in wine festivals and thematic holidays;
- participating in specialized exhibitions, forums, conferences, competitions, auctions, and workshops.

5.3. The wine-growing industry and its role in the formation and development of wine tourism in Ukraine and the world

Viticulture and winemaking in Ukraine have always been highly developed, profitable industries and have occupied a significant place in the structure of processing enterprises and the agricultural sector of the economy. Wine production is a relatively simple process if we consider it through the prism of the basic concept of producing this drink. First, grapes are turned into juice, which is then fermented and, after some time, wine is obtained. It is the fermentation process that is crucial in winemaking, as the taste, color, and aroma of this drink depend on it.

It is not only wine connoisseurs who want to see vineyards with their own eyes, visit wineries and taste the original taste of barrel wines. Tourists who previously visited other countries for sightseeing are now increasingly seeking to get acquainted with the winemaking process and taste famous wine brands (Boiko, V. 2022):

The war unleashed by Russia has had a significant impact on the wine industry in Ukraine. However, despite the difficult conditions, no winemaking enterprise intends to stop its activities, and farmers are forced to adapt to new realities. As Ukrainian winemakers say, they share the Bulgarian proverb: “The vine does not need words, but requires work,” so even during air raids or shelling, they continue to take care of their vineyards.

Today, winemaking has become an important industry that has an impact not only on wine production, but also on the development of local regions, the economy, the image of the country, and the environment. Wineries are gradually turning into centers of culture, tourism, and sustainable development. An important part of this industry is the viticulture industry, which requires a lot of labor and knowledge, but at the same time becomes an important source of income for local residents. Wine tourism is also a powerful stimulus for the economic development of regions, attracting tourists interested in the process of wine production, as well as exploring the culture and traditions of winemaking (Boiko, L., Boiko, V. 2024).

In 2022, the area of vineyards in Ukraine amounted to 30 thousand hectares, which is 3.6 times less than in 2000 (Fig. 2). In the structure of grape plantations, about 89% of the area is planted with industrial varieties, and 11% with table varieties.

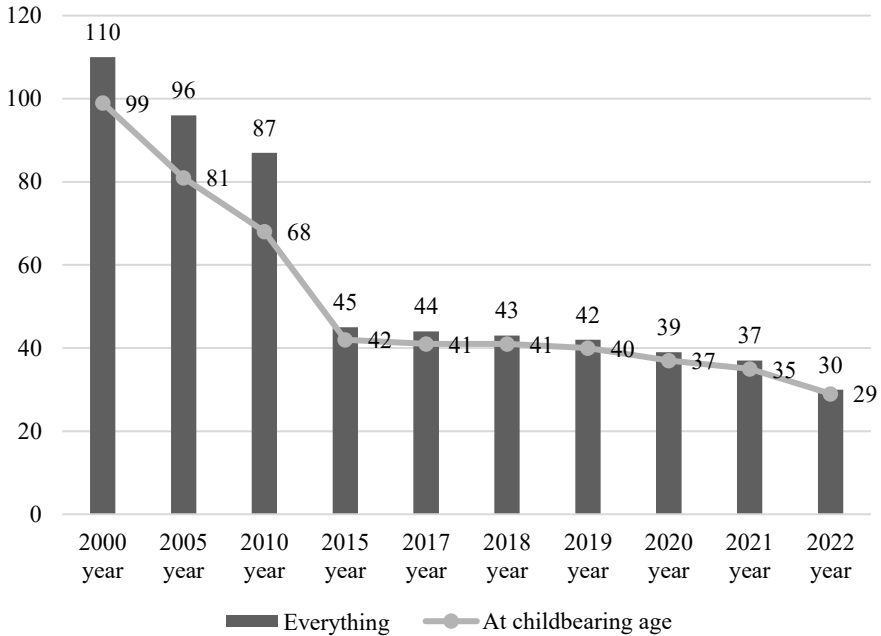


Figure 2. Dynamics of vineyard areas (since 2014, excluding the Autonomous Republic of Crimea), thousand hectares

Source: own elaborations based on Derzhavna sluzhba statyky Ukrainy. Available at: <https://www.google.com/search?client=opera&q=держстат+україні&sourceid=opera&ie=UTF-8&oe=UTF-8>

The wine industry of Ukraine lost almost half of its plantations for production as a result of the Russian invasion. Today, the area in the controlled territory of Ukraine is about 26 thousand hectares, but the harvest, despite all the events in 2022, was quite good – 258 thousand tons with an average yield of 8.93 t/ha. (Fig. 3). The largest gross grape harvest was obtained in Odessa region – 158.3 thousand tons. The wine-growing Odessa region is 24 thousand vineyards or 60% of the total in the entire country. 200 agricultural enterprises and 49 wineries are involved in the process of growing grapes in Odessa region. In Mykolaiv region, 34.5 thousand tons were obtained, in Transcarpathia – 30.8 thousand tons.

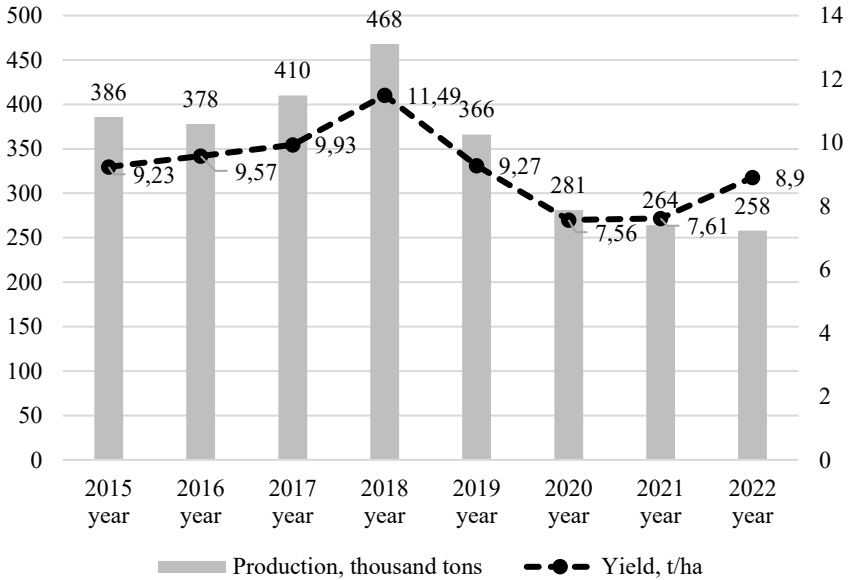


Figure 3. Productivity of the viticulture industry in Ukraine

Source: own elaborations based on Derzhavna sluzhba statystryky Ukrainy. Available at: <https://www.google.com/search?client=opera&q=держстат+україни&sourceid=opera&ie=UTF-8&oe=UTF-8>

The reasons for low productivity in the viticulture sector are primarily the decrease in the share of industrial grape plantations in enterprises and the insufficient introduction of modern technologies in households. In 2022, according to estimates by the State Statistics Service, about 68% of vineyard plantations were in small-scale households, while enterprises accounted for only 32% (Boiko, Boiko 2024).

In 2023, over 50.33 thousand tons of grapes were processed into wine materials in Ukraine (see Fig. 4). This is 14.9% less than in 2022 and 39% less than in 2021. For comparison: in 2022, over 59.12 thousand tons of grapes were processed into wine materials, and in 2021 – over 82.46 thousand tons. In 2023, 3.86 million decaliters of wine materials were produced, which is 5.2% more than in 2022, but 33.6% less than in 2021. In 2022, the production of wine materials amounted to over 3.67 million decaliters, and in 2021 – over 5.81 million decaliters.

At the end of 2022, the value of imported alcoholic and non-alcoholic beverages to Ukraine amounted to 490 million US dollars, which is 32% less than in 2021. However, in the first half of 2023, these figures increased by 61%

in volume and almost doubled in value. This indicates a recovery in demand for alcoholic beverages, which opens up new opportunities for developing wine tourism.

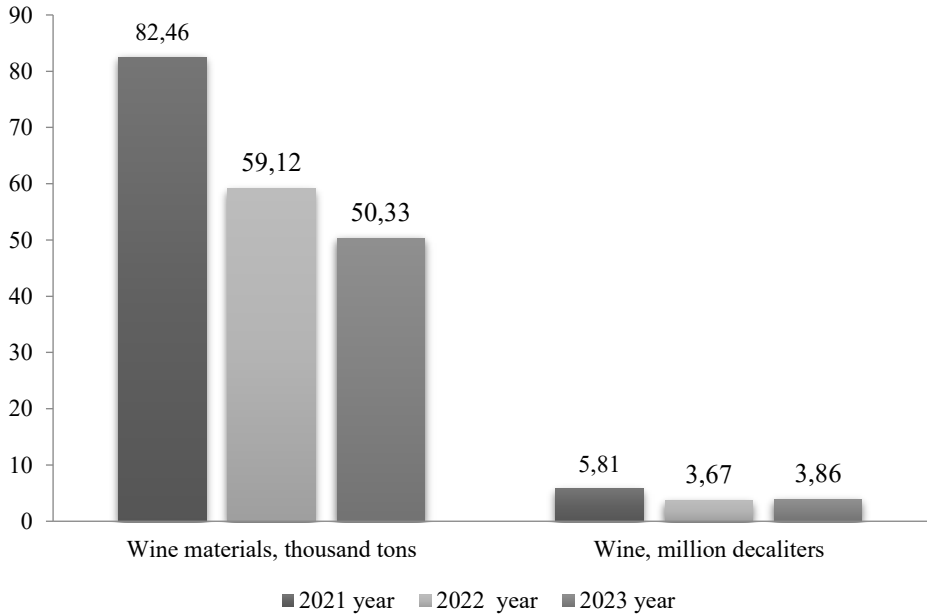


Figure 4. Production of wine and wine materials in Ukraine

Source: In 2023, 50 thousand tons of grapes were processed into wine materials. How much, how much? Available at: <https://skilky-skilky.info/u-2023-rotsi-na-vynomaterialy-pererobleno-50-tys-tonn-vynohradu/>

Wine exports in Ukraine are of great economic importance, as they contribute to developing the wine industry and provide access to high-quality foreign products. Imports of wine from different countries allow Ukrainian consumers to enjoy a variety of tastes and styles, which increases the culture of consumption. In addition, wine exports contribute to creating new jobs and developing infrastructure related to the distribution and sale of beverages. The growth of imports also has a positive impact on the restaurant and hotel business in Ukraine, as quality wine is an important element of gastronomic culture.

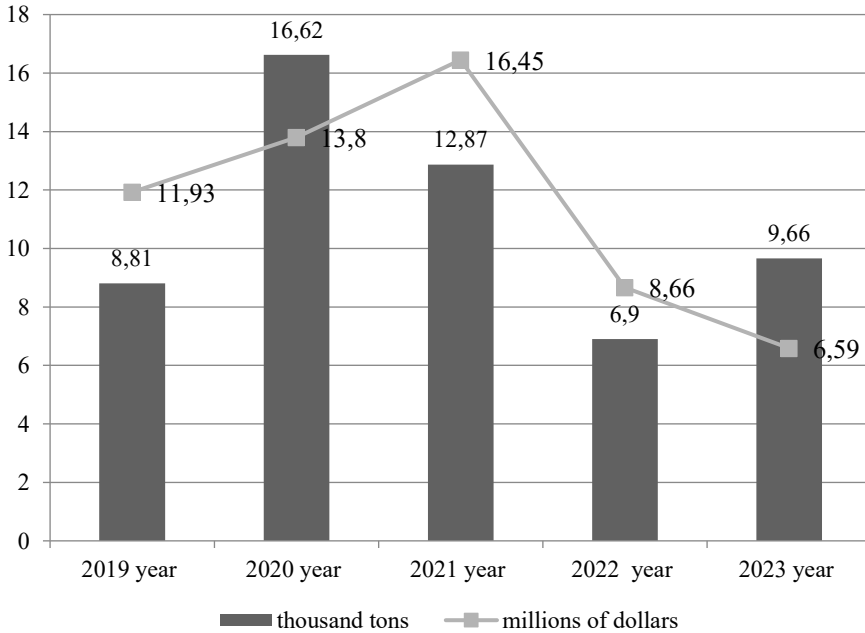


Figure 5. Wine exports in Ukraine, 2019-2023 (*9 months of 2023)

Source: In the first 9 months of 2023, 9.7 thousand tons of wine were exported. How much, how much? Available at: <https://skilky-skilky.info/za-9-misiatsiv-2023-eksportovano-9-7-tys-t-vyna/>

In January–September 2023, Ukraine exported 9.66 thousand tons of grape wine worth 6.59 million USD. Ukrainian wine was exported mainly to Romania – 2.28 million USD (34.58%) and Moldova – 0.53 million USD (7.98%). Wine worth 0.80 million USD (12.10%) was sent to unspecified countries. In 2022, 6.90 thousand tons of wine worth 8.66 million USD were exported, in 2021 – 12.87 thousand tons worth 16.45 million USD, in 2020 – 16.62 thousand tons worth 13.08 million USD, and in 2019 – 8.81 thousand tons worth 11.93 million USD (In the first 9 months of 2023, 9.7 thousand tons of wine were exported. How much, how much? Available at: <https://skilky-skilky.info/za-9-misiatsiv-2023-eksportovano-9-7-tys-t-vyna/>).

Importing wine into Ukraine allows the country to expand the range and meet the demand for high-quality international brands. This contributes to increased competition in the market, which in turn improves the quality of domestic products and allows consumers to choose from a wide range of options.

According to the results of 2022, the value of imported alcoholic and non-alcoholic beverages to Ukraine amounted to 490 million USD, which is

32% less than the figure for 2021. However, in the same period of 2023, this figure increased by 61% in volume and almost doubled in value. [10].

The main problem is interrupted logistical connections between production, suppliers of materials, and consumers. But today there are social networks that play one of the most important roles using the latest scientific and technical achievements that improve the principles and methods of marketing manufactured products and services. Stimulating the sale of goods using Internet marketing methods is becoming widespread. Business has new opportunities to communicate more meaningfully with consumers and potential customers through social platforms. Wine tourism is a form of grape and wine marketing. It can be combined with all types of activities that accompany grape growing, the promotion of grape raw materials and wine materials from agricultural producers and wineries to end consumers. Wine tourism also increases the effectiveness of marketing communications and branding of both business entities in the domestic and foreign markets of grape and wine products, and in general, the wine-growing regions of Ukraine.

According to the International Organization of Vine and Wine (OIV), world wine production in 2024 is estimated at 227–235 million hectoliters, with an average projection of 231 million hectoliters. This is 2% less than the poor 2023 harvest and 13% less than the average yield over the past 10 years. Thus, world wine production in 2024 is expected to be the lowest since 1961, when 220 million hectoliters were produced (International Organization of Vine and Wine (OIV). Available at: <https://www.oiv.int/ru/node>).

The decline in production is mainly observed in countries in the Southern Hemisphere, particularly in Australia, Argentina, Chile, South Africa, and Brazil, where production has decreased by 4–21% compared to the average of the last 5 years. In addition, most countries of the European Union have recorded low yields. In contrast, some regions, in particular the USA and several countries of Eastern Europe, such as Hungary, Georgia, and Moldova, have been able to achieve favorable climatic conditions, which allowed them to maintain or exceed the average level of production.

It is worth noting that extreme weather conditions such as early frosts, heavy rainfall, and prolonged drought continue to have a significant impact on vineyard yields, leading to a decrease in overall wine production at a global level. These factors, together with the global decline in wine consumption and high levels of inventories, contribute to a decrease in wine production for the second consecutive year. However, this may lead to market equilibrium and

mitigate the immediate economic consequences for individual regions or producers.

France is the largest wine producer in the world. Every year, the French produce 7–8 billion bottles. There are 12 wine-producing regions in France, the main ones being Bordeaux, Champagne, Provence, and Beaujolais. France's success in winemaking is legendary, with France owning 10% of the world's vineyards and a share of wine production of 17%. This is the number one sector in agriculture and the one that provides the most jobs. There are 142,000 winemakers in France, and French wine is the most expensive in the world. Wine exports in 2018 reached €8.9 billion, and in 2022 they will reach €17.2 billion.

Despite the fact that sales volumes fell, the increase in prices caused by inflation allowed for a historic export result. In 2023, the government allocated 200 million euros to destroy surplus wine and support producers. But 2024 was a turning point for the country, as 211 wineries declared bankruptcy. This is 75 cases more than in 2023. In the wine sector, bankruptcies became three times more than the national average. While overall growth in France was 17%, in winemaking – 55%. The French wine industry is starting to face serious problems, as young consumers drink less red wine and prefer healthier options, in particular non-alcoholic beverages. White, rosé and, sparkling wines are ahead of red wines in popularity, and the number of the latter has been decreasing over the past 20 years (Original support for producers: France to spend 200 million euros on destroying wine stocks. . 24 business. Available at: https://24tv.ua/business/frantsiyi-znishhennya-vina-vidilili-200-milyoniv-yevro_n2379706).

Italy is rightly considered one of the world centers of wine tourism: its history has almost a hundred years, and the number of people visiting Italian wineries per year can exceed 10,000 for one farm alone. There are 20 wine-growing regions in the country. In Central Italy, the most famous wine-growing region is Tuscany. The most famous wine of this region and of Italy as a whole is Chianti – a dry red wine aged in oak barrels.

Wine tourism is currently the most popular in Portugal, and it is not only about getting to know wines and tasting them. There are 29 wine regions in Portugal, each region is known for its 293 special recipes and grape varieties. Entire tourist complexes have sprung up around the vineyards, where you can relax and enjoy yourself. Portugal topped the list of the best countries in the world for wine tourism with a score of 8.83/10 (Fig. 6). The analysis was conducted on the consumption and production of wine in the country according to

the following indicators: area of vineyards (as a % of the country's area), number of visits and tastings, average cost of a bottle, the result is determined in points. The Portuguese produce a wide variety of different types of wine, the most famous of which is port wine, named after the city of Porto. 2.09% of the country's territory is occupied by vineyards, the most famous wine-producing region is the Douro Valley, located in the north of the country, as well as the regions of Dao, Alentejo, and Vinho Verde.

In second place is Moldova, which is well known for its excellent wine. Moldova's vineyards cover 3.6% of the country's area, more than any other country in this ranking. The Codru region, located in the central part of Moldova, is one of the country's most important and historically significant wine-producing areas. Italy and Spain rank third and fourth, followed by Georgia and France. Of the ten countries in the top ten, only two are not located in Europe: New Zealand (8th place) and Chile (10th place).

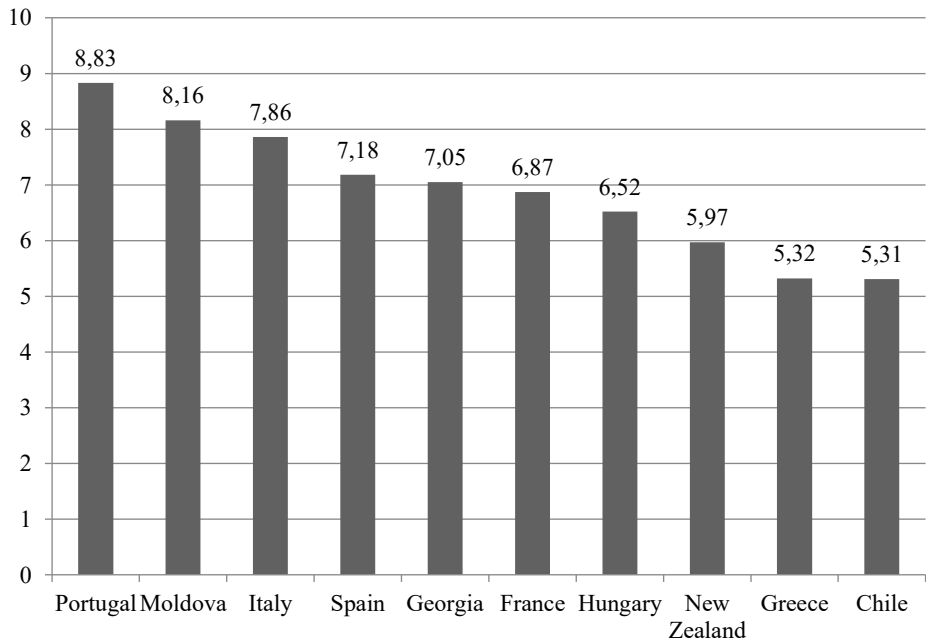


Figure 6. Top 10 countries for wine tourism, scores

Source: Neighbors on the list of the best: Top 10 countries for wine tourism named (Neighbors on the list of the best: Top 10 countries for wine tourism named. 24 abroad. Available at: https://24tv.ua/zakordon24/de-naykrashhe-vino-nazvali-10-krayin_n2658081).

What is important in developing wine tourism is that both large and small wineries can effectively use wine tours to increase loyalty to their brand, increase the effectiveness of the marketing complex, promote their own products on domestic and international markets, and raise wine sales.

World wine producers such as France, Italy, and Spain are leaders in the international market, thanks to their rich traditions and high quality products. However, Ukraine has significant potential for developing winemaking, in particular due to its unique climatic conditions and variety of soils. Wine tourism in Ukraine can become an important economic sector, attracting tourists not only for tastings, but also to learn about the history of winemaking in the country.

One of the main challenges for Ukrainian winemakers is the war, which has caused significant problems for infrastructure, logistics, and access to markets. However, even in the conditions of war, Ukrainian winemakers continue to adapt to new realities, maintaining resilience and working to restore their production. Another challenge is global climate change, which reduces vineyard yields due to extreme weather conditions such as droughts or frosts.

Despite these challenges, there are significant opportunities for the development of the wine industry. Wine tourism is becoming an important driver for local economies, as it allows attracting tourists who are interested not only in wine production, but also in the cultural and historical aspects of this process. This trend allows businesses not only to popularize local brands, but also to attract investment to the regions, contributing to economic development.

Wine tours often include visits to picturesque vineyards and wineries, allowing tourists to enjoy the natural beauty of the wine-growing regions. Such tours can also be complemented by excursions and lectures from industry professionals, who provide tourists with in-depth knowledge of the winemaking processes, the history of winemaking traditions and the specifics of regional wine varieties.

In addition, wine tourism offers tourists the opportunity to purchase products directly from producers – wine, cognacs, and souvenirs that reflect local winemaking traditions. Thus, wine tourism not only contributes to the development of the industry, but also ensures the deepening of cultural exchange and the popularization of traditional crafts.

An important aspect is that wine tourism has become an important part of the wine industry, where one of the most common forms is excursions to wineries with tasting products in specialized tasting rooms. During such events, tourists receive detailed information about local wines, technological processes

of their production, and the traditions and culture of wine consumption, which contributes to preserving authenticity and increasing awareness of the specifics of a particular wine-growing region.

One example of a winery that demonstrates a high level of attention to sustainable development and wine tourism is Chateau Chizay in Ukraine (Table 1). This winery has participated in a large-scale scientific study that addressed these aspects. Such actions indicate that the winery owners understand the importance of preserving nature and developing the region, freeing the land from large-scale mass production, increasing the value of the land, and attracting tourists (Boyko, Boyko 2024).

Table 1. Best practices of wine tourism in Ukraine

Winery complex “Chizay”	Chateau Chizay is a popular tourist attraction. Every day, it hosts tours of the wine-making town and tastings of several formats, including non-alcoholic ones, and organizes wine tours and children's quests. In 2019, the Winemaker Chiza Museum was opened at Chateau Chizay as a tribute to the history of the region, the culture of viticulture and winemaking, and an investment in education. Chateau Chizay develops the wine tourism industry, facilitates the culture of wine consumption and high-quality local products, actively promotes Ukrainian wines in the world, and professes uncompromising product quality and respect for the consumer.
Winery “Kolonist”	Family winery. Odesa region, Bolgrad district, Krynychne village. Wine production, excursions (tours of vineyards, production workshops, and wine cellars), wine tasting and Bulgarian cuisine, sale of own wines.
“Slyvyno Winery”	Family winery. Mykolaiv region, Slyvyne village. Excursions will allow tourists to see all the processes of making natural wine step by step, from the composition of the soil in the vineyards to storing wine in the cellar.
“Shabo” Winery	“Shabo Wine Culture Center”. Odesa region, Bilhorod-Dnistrovskiyi district, Shabo village. A tourist attraction in Ukraine, where vineyards and a wine complex are located, a large high-tech enterprise, two-hundred-year-old wine cellars, wine storage facilities with a total area of 10 thousand m ² , a unique museum, the art ensemble “Trilogy of the Grapevine”, modern tasting rooms, original architectural complexes, and a landscape design exhibition. Tours to “Shabo” are exciting and diverse. Visitors have the opportunity to take part in wine and family trips, educational programs to improve the culture of wine consumption, and weekend tours.
Family winery “Beikush”	Mykolaiv region, Ochakiv district, Chornomorka village. The “Beikush” winery participates in festivals and competitions, where tourists can try and buy a bottle of their favorite drink. The winery offers tours and organizes delicious tastings.

Karl Schosch Winery	Zakarpattia region, Berehivskiy district, Kidosh village. The private wine cellar of the Shosh family is a well-known place among connoisseurs of good Transcarpathian wine. Following traditional technologies, white and red dry and dessert wines are produced here, using both old recipes and those developed by themselves. Drinks are aged in oak barrels. To appreciate the taste and aroma of about twenty types of Transcarpathian wines, guests are invited to the tasting room next to the wine cellar. Before the tasting, guests will be taken to the wine cellar and told about the Shosh family and the history of the winery.
Tasting cellar “Old cellar”	Zakarpattia region, the city of Berehove. The tasting cellar “Old cellar” is located in the territory of the city of Berehove, on whose slopes grapes have been grown since time immemorial. This cellar was carved into the rock more than three hundred years ago. Excursions are held along the corridors of the wine cellar, where guests are introduced to production technologies, after which they can stay for a tasting of Berehove wines and listen to interesting stories about wine and its varieties.
Winery “Leanka”	Zakarpattia region, Uzhhorod district, Seredne village. The company “Leanka” was created on the basis of the “Seredniansky” factory. The ancient Seredniansky wine cellars are located on the territory of the factory. They were founded by captured Turks back in 1557 as underground storage facilities. Due to the appropriate temperature conditions, the cellars began to be used as wine cellars. The total length of the caves is more than four kilometers. Excursions are held here for guests, during which they can walk along the long corridors of the caves, see huge oak barrels in which wine is stored, and taste the best drinks. After the excursion, guests can purchase the products they like in the company store.
Grande Vallee Winery	Odesa region, Ovidiopol district, Velykodolynske village. The Grande Vallee brand is new to the Ukrainian market, and the winery itself opened for visits recently. To see and appreciate the scale of production, everyone is invited to take a tour of the Vyntrest factory. A program has been developed for guests, which includes tours of the factory, located very close to the vineyards, wine tasting accompanied by a sommelier, and in good weather, relaxation on the summer terrace.

Source: compiled by the author

The prospects for wine tourism in Ukraine and the world are very promising. Wine tours not only allow tourists to get acquainted with the winemaking process, but also contribute to the development of the local economy and improve the country's image in the global market. Given the growing interest in sustainable development and environmental standards, wineries can take advantage of the opportunity to preserve environmentally friendly vineyards and promote their products as part of the green economy.

Thus, winemaking in Ukraine and the world has significant potential, but it is necessary to overcome the challenges of war, climate change, and economic instability to succeed. At the same time, developing wine tourism and

a sustainable approach to wine production can become powerful tools for the recovery and prosperity of the industry.

5.4. International experience in developing wine tourism as a tool for economic growth

Wine tourism is one of the most promising areas of developing the tourism industry. Modern wine tourism covers a wide range of activities: visiting vineyards and plantations, tasting local grape varieties, getting acquainted with the technology of production of various types of alcoholic beverages at the enterprises themselves, and visiting tasting rooms and cellars. In addition, this type of tourism includes getting acquainted with the history of winemaking, visiting specialized museums and exhibitions, restaurants where one can taste wines and take part in master classes from sommeliers, as well as participating in wine festivals and thematic events. No less important are visits to specialized exhibitions, forums, conferences, competitions, and auctions dedicated to the art of wine (Wine tourism: a textbook for students of higher educational institutions / Ivanov S.V., Domaretsky V.O., Basiuk D.I. and others. Kamianets-Podilskyi: FOP Sysyn O.V., 2012. 472 p).

In modern conditions of economic development, wine tourism is actively developing in various regions of the world, particularly in Europe. It is an important source of income, as it can be combined with other types of tourism and complement tourist programs and routes for adult vacationers. In addition, wine tourism is of great importance in cultural, educational, and gastronomic contexts. Winemaking is an ancient tradition of many peoples, and, through wine tourism, each country can popularize its culture, customs, and national gastronomic features. This also contributes to developing backward agrarian regions of Europe and the world, and also provides additional financial revenues to local budgets, which is also relevant for Ukraine (Patiychuk, Obolonchuk 2014).

Wine tourism as an independent area of specialized tourism emerged at the beginning of the past century in Italy and France. However, in recent years there has been a real boom in wine tours in Europe, America, and Asia. This phenomenon is becoming especially relevant in light of the forecasts indicating a reduction in the time that people will devote to recreation. As a result, tourists are looking for products that offer maximum impressions in a short period of time. According to international news agencies, the demand for wine tourism

is growing. In particular, in Italy there are about five million active wine tourists, and the profit from this business is approximately 2.5 billion euros annually. Experts believe that wine tourism uses only 20% of its potential and has every chance of significantly increasing turnover in the near future (World Tourism Organization (2019), UNWTO Tourism Definitions: UNWTO: Madrid: [website]. Available at: <https://www.e-unwto.org/doi/epdf/10.18111/9789284420858>).

The world's largest wine producer is Italy, which produces more than 5 billion liters of wine per year (about 20% of the world's volume), annually competing with another winemaking giant, France (Fig. 7).

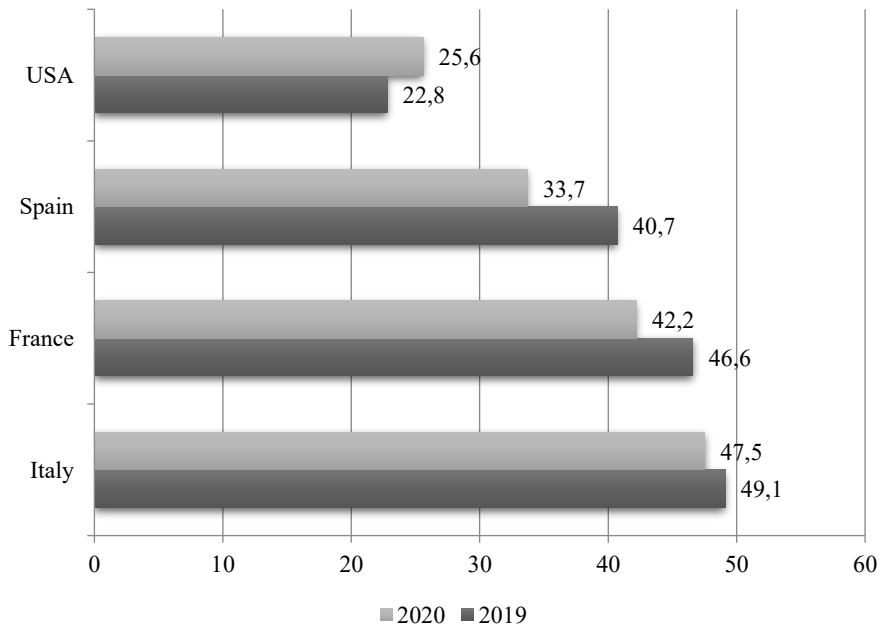


Figure 7. Wine production of leading world countries in 2019-2020 (million hectoliters).

Greek settlers began cultivating the grapevine around 800 BC. The Greeks called Italy “Oenotria”, i.e., “the land of wine”. Since then, wine has been inextricably linked with Italian history, starting with the orgies of generations of Roman emperors. In his works, the Roman philosopher and writer Pliny, back in the first century AD, proposed the first concepts of winemaking, methods of choosing climatic conditions, and pairing wine with food, many of

which are still relevant today (Italian wine. Available at: https://uk.wikipedia.org/wiki/Італійське_вино).

In the 1990s, wine tourism in Italy had not yet emerged as a distinct segment of the tourism market. International tourists came to the country mainly for art, history, nature, and gastronomy. Wine was also part of their itineraries, but only a few wineries were willing to welcome visitors. Changes began in the late 1990s, when Italian wine consortia realized the potential of wine tourism and began to actively promote their regions as popular wine travel destinations. The first excursions resembled a real adventure: there were few signs, no navigation apps, and almost no organized tours. It was a time when everything was done thanks to the enthusiasm and passion of the participants.

According to the Nomisma-Wine Monitor (2024), wine tourism in Italy is booming, attracting around 15 million tourists annually and generating €2.9 billion in revenue. This success is due not only to the popularity of Italian wines, but also to their inextricable link with the local territories. Wineries have been transformed from simple production sites into hubs of wine experiences, offering a variety of leisure activities for connoisseurs. Investment in hospitality has become a key focus for wineries, offering a wide range of services: from tastings in barrel rooms and picnics in the vineyards to meetings with the owners and dinners with Michelin-starred chefs.

In addition to traditional wine tastings, wineries today offer a wider range of experiences that explore the culture and heritage of the region. These can include cooking workshops on local dishes, educational vineyard tours with experienced winemakers, or gourmet culinary events hosted by renowned chefs. Thematic wine routes are gaining popularity, focusing on specific grape varieties or historical events in the region. Travelers have the opportunity to visit wine museums, participate in the harvest, and even create their own unique blend under the supervision of a professional winemaker.

The development of wine tourism has a positive impact on the region's economy. It contributes to creating new jobs for local residents, improving infrastructure, and the emergence of new hotels, restaurants, and cultural spaces. Wine tours help local people open up little-known corners of the country for tourists, while supporting the preservation of local traditions and cultural heritage. Wineries are increasingly focusing on the issues of environmental responsibility. Many of them are switching to organic or biodynamic production methods, offering guests not only a tasting of natural wines, but also an introduction to the features of their production in conditions of sustainable development. Italy has become one of the leading countries in the field of wine tourism thanks

to its ancient winemaking traditions, unique cultural heritage, and modern approaches to tour organization. This trend continues to grow dynamically, attracting tourists with original formats of recreation and acquaintance with the variety of local wines and regional features (Burlachenko 2024).

France has always competed with Italy in wine production and is a leader in wine tourism. Every year, the French produce 7–8 billion bottles. There are 12 wine-producing regions in France, the main of which are Bordeaux, Champagne, Provence, and Beaujolais. France's success in winemaking is legendary, France owns 10% of the world's vineyards, and its share in wine production reaches 17%. This is the number one sector in agriculture and the one that provides the most jobs. There are 142 thousand winemakers in France, while French wine is the most expensive in the world and is deservedly considered one of the most famous and high-quality in the world. Hundreds of grape varieties grown in different parts of the country are used for their production. Winemaking in France is one of the oldest and most prestigious crafts, which is passed down from generation to generation. Here, both small family farms and large winemaking companies are engaged in wine production. Traveling through the wine regions of France, you can enjoy exciting excursions, picturesque landscapes, and authentic French wines, the taste of which will remain in your memory for a long time (Winemaking in France. Available at: <https://travelyourway.com.ua/ua/strany/franciya/vinnyj-otdyh-vo-francii/>).

A wine tour to Champagne and Burgundy is about meeting local winemakers and kilometers of wine cellars of iconic champagne houses, about Louis 14's favorite wine and truffle hunting, the charm of medieval Europe, and the most beautiful villages of France. It was in the Burgundy region, about fifty years ago, that the world-famous festival of young wine, “Beaujolais Nouveau,” was born. Traditionally, the celebration begins in the town of Beaujeu on the third Wednesday of November, on the night before Thursday. The evening before is marked by a festival called Sarmantel, which is translated as “full barrels,” where guests are treated to wines from previous years. The main event comes at midnight, when the first barrels of young Beaujolais are solemnly opened.

After that, a festive procession with torches heads to the central square of the city, where the corks are symbolically broken on the barrels of new wine, starting its triumphal journey through France and the world. In the morning, on the third Thursday of November, the young wine of this year's harvest officially goes on sale. Lovers of this drink gather in bars and restaurants from the very morning to be the first to enjoy its fresh, fruity taste and aroma. Today, the

Beaujolais Nouveau festival has become popular far beyond France and unites wine lovers around the world. France remains the benchmark for wine tourism, demonstrating how the combination of history, tradition, and innovation can create a unique tourist product. France's experience serves as an example for other countries that seek to turn winemaking into an important element of regional economic development and an attractive tourist destination (Burgundy, Champagne or Provence? Burgundy! Learn all about Burgundian wines in their homeland. Available at: <https://www.zagorye.ua/travel/burgundiya-shampan-abo-provans-burgundiya-diznajtes-use-pro-burgundski-vyna-na-yihnij-bat-kivshhyni.html>).

Winemaking in Germany has a centuries-old history, which has become an integral part of the country's culture and way of life. The traditions of wine-making are deeply rooted in the everyday life of Germans, reflected in their language, crafts, and cultural landscape. Wine holidays, festivals, and customs have become an important part of the national identity, attracting thousands of tourists from all over the world.

Germany has 13 wine-growing regions, each with its own unique characteristics that define the local character and culture. Life in these regions is closely linked to the wine production cycle, which shapes the identity of each territory. In particular, numerous festivals and celebrations play an important role in the development of winemaking and its promotion. The most famous include the Almond Blossom Festival, the German Grape Festival, and the Frankfurt Rheingau Festival. After a break in 2020 due to the pandemic, these events have become traditional again in 2021.

Every year, around 50 million tourists visit Germany's wine-growing regions, and they are mainly attracted by the wine itself. Spending around 5.5 billion euros, these tourists make a significant contribution to the country's economy. Wine tourism is an important source of income for more than 86,000 people employed in this industry. Wine road trips are popular among tourists, in particular the German Wine Road, which is one of the most visited in the country (Tvarynska 2021).

Wine tourism is now in fashion in Portugal. It is not only about getting to know wines and tasting them. There are 29 wine regions in Portugal, the most popular are seven regions – Vinho Verde, Dão, Douro, Alentejo, Madeira, Trás-os-Montes, and Bairrada. Each region is known for its special recipes and grape varieties. Entire tourist complexes have sprung up around the vineyards, where one can relax and enjoy themselves.

Portugal is known for its ancient winemaking traditions, including the legendary Port wine, which is produced in the Douro Valley, one of the oldest wine-producing regions in the world and a UNESCO World Heritage Site. Today, Portugal offers tourists not only high-quality wine tastings, but also the opportunity to visit vineyards and wineries, participate in the harvest, learn the intricacies of pairing wine with local cuisine, and relax among picturesque landscapes.

Wine routes span different parts of the country, from the wide grape plains of Alentejo to the green hills of Vinho Verde. Wine tourism has become an important sustainable development area for Portugal, as it not only attracts tourists but also supports local communities, preserves traditions, and promotes national culture internationally (Fastovets 2024).

Unlike its neighboring countries, wine tourism in Spain has not yet managed to reach the same level of popularity and development. Despite the fact that Spain is one of the largest wine producers in the world and has more than 70 wine regions, including the famous Rioja, Ribera del Duero, and Sherry, wine tourism here has long remained less organized and has not been strategically developed at the national level. The reasons for this state were insufficient tourist infrastructure in certain wine regions, weak international promotion of wine routes, and competition from more popular holiday destinations in Spain – such as beach tourism or cultural routes.

However, in recent years, the situation has been gradually changing. More and more wineries are opening their doors to tourists, creating modern tasting rooms, organizing gastronomic events and festivals. Spain has great potential in the field of wine tourism, and if this industry is actively developed, it can take a worthy place among the leaders of world wine tourism (Valencian and Alicante wine tourism – from history to the present. Available at: <https://estate-spain.com/blog/vinniy-turizm-v-ispanii-v-provincii-valensia-i-alicante-istoria-i-sovremennost>).

A few years ago, the UK was almost not included among the popular wine tourism destinations, giving way to the traditional leaders of the industry. However, recently the country has been rapidly gaining popularity in this segment due to the active development of winemaking, an increase in the number of modern wineries and vineyards, as well as the expansion of tourist services. Today, the UK is increasingly attracting guests, offering not only quality wines, but also rich excursion programs, tastings, gastronomic events, and opportunities for relaxation among picturesque landscapes.

WineGB has released its first comprehensive report on the development of wine tourism in the UK, which has shown a rapid increase in the popularity of visits to the country's vineyards and wineries. According to the data, the number of visitors has increased by 55% in the past two years. According to the report, last year alone, British wineries and vineyards welcomed 1.5 million visitors, which provided around 25% of their total revenue. The industry predicts further growth and attracting new investment, and WineGB expects the wine tourism sector to expand actively in the coming years.

According to the results of the WineGB survey for 2024, in which more than 130 producers took part (providing more than 90% of British wine), today there are about 300 wineries operating in the UK, which are actively developing the tourism sector.

Among the most popular offers for guests:

- 275 tasting rooms and wine shops;
- 260 tasting tours;
- 103 rented venues for events;
- 97 routes for independent walks;
- 92 facilities with accommodation and catering;
- 38 specially equipped picnic areas.

Interestingly, 42% of visitors noted an increased interest in winery tours. At the same time, according to VisitBritain, the potential audience of wine tourism could reach 16 million guests if the right conditions are created. The report also emphasizes the importance of the economic effect of developing wine tourism, as the industry demonstrates significant potential for growth. Thus, 60% of market participants expect an increase in the number of visitors by more than 20% over five years. In addition, the same amount is planned to invest in the development of tourism services, particularly in organizing gastronomic events, expanding event programs, and creating new accommodation options for guests (Wine tourism is gaining popularity in the UK. Available at: <https://tech-drinks.info/u-velykij-brytaniyi-populyarnosti-nabuvaye-vynnyj-turyzm/>).

Wine tourism in Europe has long been an important part of cultural and economic activity, as the continent has a centuries-old winemaking tradition. With the development of global tourism, this interest has begun to spread to other continents, particularly to Australia, where wine-growing regions have gained popularity due to their unique climatic conditions and variety of wine varieties. Australia ranks sixth in the world in terms of wine sales, second only to European leaders, as well as Argentina and the USA. Although geographical

remoteness creates difficulties and increases the cost of transporting products, it is precisely thanks to the unpredictable climate of Australia that unique wines emerge changing our ideas about traditional varieties. The country's wine-growing regions attract the attention of tourists who seek new experiences by learning more about local wines and the culture of their production.

Australia grows over 100 grape varieties in 65 different wine regions, providing an incredible variety of wine products. The country is relatively young in winemaking, which allows Australian winemakers to introduce innovative methods and adapt to changing climatic conditions. The influence of French winemaking tradition helps Australian producers create new styles of wine, characterized by an experimental approach and high quality, which attracts wine tourists and connoisseurs from around the world.

The history of winemaking in New South Wales dates back nearly 180 years, making the region one of Australia's oldest wine regions. The Hunter Valley wine region is home to traditional Australian grape varieties such as Chardonnay, Shiraz, and Semillon. For connoisseurs of subtle in particular, the textural and mineral Semillon from this region is a real discovery. The wines made from the 100-year-old Tyrrell family vines are particularly distinguished by their exclusivity. Hunter Valley Semillon is renowned for its chalky minerality and aromatic notes of lemon and pink grapefruit, giving the wine a solid character that lasts for decades. With age, up to fifty years, the wine acquires flavors of almond and dried apricot, which underlines its uniqueness and ability to develop over time (Wine regions of Australia. Available at: <https://drinks.ua/news/vinni-regioni-avstralii/>).

Wine tourism in New South Wales is rapidly developing due to the combination of rich winemaking traditions with the latest technologies and innovative methods of grape growing. The Hunter Valley and Orange regions offer visitors not only high-quality wines, but also a unique opportunity to learn about the production process, visit wineries, and enjoy the taste characteristics of local wines. This allows tourists to get a full impression of the culture of winemaking, as well as feel the connection between the local climate, soils, and wines produced in this region.

Wine tourism in Australia is an important destination for tourists who seek not only to taste wines, but also to gain a deeper understanding of the production process and history of local wine regions. Regions such as Victoria, South Australia, and Tasmania offer unique opportunities to combine gastronomic tourism with the exploration of wine culture, which is an integral part of

Australia's national identity. Visitors can enjoy not only high-quality wines, but also get acquainted with the traditions, winemaking methods, and natural conditions that shape the character of local wines, which makes this experience even more exciting and informative (Wine regions of Australia. Available at: <https://drinks.ua/news/vinni-regioni-avstralii/>).

Chile is actively leading the world wine market. While in 2009–2010 the country ranked 9th–10th among exporters, since 2020 it has ranked fourth in wine exports, behind only Italy, France, and Spain. Chilean wine is exported to 157 countries around the world, and the main markets for bottled wine are China, Brazil, the UK, Japan, and the USA. Every hour, 350 glasses of Chilean wine are drunk worldwide.

The widespread distribution of Chilean wine in most countries of the world and its accessibility create favorable conditions for developing wine tourism. The main principle of this type of tourism is to taste wine directly at the place of its production. High brand recognition, accessibility, and popularity of Chilean wine among consumers ensure a stable flow of wine tourists, which is becoming an important factor for the further development of this segment (Canelo, J. Wine tourism in Chile. FEDETUR. Retrieved April 26, 2023, from Available at: https://fedetur.cl/turismo_chile/chiles-competitive-advantage-wine-tourism).

Wine and gastronomic tourism occupy an important place among the tourist services in the country. A powerful impetus for its development was the implementation of the multi-regional strategic program for sustainable wine tourism – a public-private initiative that unites leading wine-producing regions and the tourism industry. Today, 339 wineries (86%) are available for visiting, of which 50 are certified as environmentally friendly, which emphasizes the focus on sustainable development and environmental protection. These initiatives not only contribute to the popularization of local wines and cultural traditions, but also attract tourists looking for new, environmentally conscious experiences.

Among the most popular services of world wine tourism, the following can be distinguished: wine tastings (83%); excursions to wineries (75%); enogastronomic lunches and dinners (40%); accommodation in specialized hotels (29%); visits to cultural monuments and entertainment (2%); visits to specialized exhibitions (17%) and museums (10%); specialized wine SPAs (4%). In Chile, the leading places are occupied by excursions to vineyards and wineries, as well as tastings. As for specialized accommodation facilities, restaurants, and wine therapy centers, there is a shortage of such facilities, but their

growth is provided for by state programs for developing wine tourism, which are already being successfully implemented. The basis of the country's success lies in the harmonization of legislation, clear standards, successful implementation of innovative projects, and state programs for developing wine tourism (But, Fokin, Kucherenko, 2023).

An analysis of the US wine market shows the significant role of this country in the global wine industry. The US is one of the largest wine producers in the world, and California is the leading wine-producing region, responsible for more than 90% of the country's wine production. In addition, the US has numerous emerging wine-producing regions, such as Oregon, Washington, and New York, which are gradually gaining popularity in the global market due to the high quality of their products.

Consumers in the US are increasingly interested in environmentally friendly and organic products. Wineries that implement sustainable practices and use a minimum of chemicals have become increasingly popular among consumers. In recent years, the US market has seen an increase in interest in local wines, indicating a shift in focus from traditional wine-producing countries (France, Italy, Spain) to domestic production. This is also due to the increasing interest in wine tourism, where tourists have the opportunity to visit local wineries and taste unique wines.

Variety of Wine Varieties and Styles: The United States is known for its wide range of wine grape varieties, from classic Cabernet Sauvignon and Chardonnay to lesser-known varieties like Petit Verdot and Zinfandel. This allows wine producers to offer a wide range of products to suit a variety of consumer tastes.

Wine tourism in the United States is actively developing, particularly in wine-producing regions such as California (Napa, Sonoma), Oregon, Washington, and New York. These regions attract tourists not only due to high-quality wines, but also due to magnificent natural landscapes, opportunities for tastings, excursions, and a wide range of gastronomic and cultural services.

The U.S. wine market is expected to continue to grow, driven by the development of new wine regions, innovative production approaches, and increasing interest in organic and biodynamic wines. However, competition from international producers and climate change may pose challenges for the industry (Analysis of the size and share of the US wine market – growth trends and forecasts (2024–2029). Available at: <https://www.mordorintelligence.com/ru/industry-reports/united-states-wine-market>)

Brazil has a relatively large number of vineyards, a significant portion of which produce table grapes, and only a few produce Brazilian wine. Since much of Brazil is located near the equator, much of the country is unsuitable for viticulture due to the heat and humidity. Most of Brazil's wine production is concentrated in the south of the country, far from the equator, in the state of Rio Grande do Sul, at about the 29th parallel, near Uruguay and Argentina. In this area, many vineyards take advantage of the cooler mesoclimate at higher altitudes, largely in the Serra Gaucha region. Although higher quality wines (vinho fino) are produced from the European grape vine *Vitis vinifera*, in 2003 only about 5,000 hectares of the 68,000 hectares were planted with such vines (Wine-making in Brazil. Available at: https://uk.wikipedia.org/wiki/Виноробство_в_Бразилії).

Wine tourism in Brazil offers tourists not only tastings and winery tours, but also cultural events such as wine festivals, gastronomic tours, and local cooking traditions. Wine routes include visits to wine cellars, where one can learn about the technology of wine production, as well as enjoy the incredible scenery surrounding the vineyards. Wineries in Brazil often offer wine tasting tours, which allow guests to learn about different varieties of wine, as well as observe the production process. Cities such as Bento Gonçalves regularly host wine festivals, where one can taste the best local wines, as well as enjoy music and traditional dishes.

Brazil combines wine with excellent local cuisine, offering tourists not only wines, but also traditional dishes that go well with wine. Wine tourism in Brazil is not yet as developed as in famous wine-producing countries, but it is actively growing, which gives tourists new opportunities to get acquainted with the culture and winemaking tradition of the country (Dereviankina 2024).

Wine tourism is also developing in Asia, although it is not as widespread as in Europe or America. However, several countries in the region have begun to develop this sector confidently, and it is becoming more popular every year. China has become one of the main wine producers in Asia in recent decades, and wine tourism is widespread in such wine-producing regions as Shanxi, Ningxia, and Shandong.

Japan has a long tradition of winemaking, particularly in areas such as Yamanashi and Hokkaido. Japan produces high-quality wines, especially from local grape varieties such as Koshu. Wine tourism involves vineyard tours, tastings, and learning about the traditional Japanese method of winemaking. Wine tourism in India is gradually gaining popularity. The country's largest wine-

producing regions are Maharashtra and Goa, both of which offer several wineries producing local wines. South Korea, although not a traditional wine-producing region, is also actively developing wine tourism. The country grows several grape varieties, and some wineries offer tours for visitors.

Taiwan is not a major wine producer, but there are several wineries that produce wines from local varieties, and offer tours, tastings, and cultural events. Vietnam is also developing wine tourism, particularly in the Dalat region, where the climate is conducive to growing grapes. Tourists can visit wineries that produce wines from local varieties. Lebanon is one of the oldest wine-producing countries, and although it is located on the border between Asia and the Middle East, its wine tourism is important. The Bekaa Valley wine region is famous for its winemaking history and has many tourist routes.

Overall, wine tourism in Asia has significant potential for development, and, in the coming years, we can expect an increase in the number of tourists seeking new experiences from local wine regions. Asia can also become an important player in the global wine tourism market due to its unique regions, cultural aspects, and ability to combine winemaking traditions with the latest technologies. Tourists from all over the world will have the opportunity to gain new experiences and enjoy unique Asian wines and cultural traditions.

Wine tourism is becoming more than just a way to try new wines, but an entire experience that encompasses culture, history, gastronomy, and nature. It is an opportunity to immerse oneself in a world where the taste and aroma of wine become the key to understanding the multifaceted heritage of a particular region, making wine tourism a unique and exciting direction in the world of tourism (Komar, Uniat 2015).

International experience in developing wine tourism shows its significant potential as an effective tool for economic growth for many countries. Wine tourism contributes not only to increasing the popularity of wine-producing regions, but also to creating new jobs, developing infrastructure, stimulating the local economy, and increasing tourism revenues.

Countries with rich winemaking traditions, such as France, Italy, Spain, Germany, Chile, and Australia, have become examples of successful implementation of wine tourism at the national level. They use festivals, tastings, excursions, and specialized tourist routes to attract tourists, which actively contributes to the growth of the regional economy. For example, Germany and France have long integrated wine tourism into their economies, while developing countries, such as Chile and Australia, are actively using the potential of this sector to promote their wines in the international market and attract tourists.

Wine tourism is an important tool for preserving cultural heritage and developing local communities, creating opportunities for small businesses, and developing eco-tourism. It also helps countries to ensure sustainable growth, considering the preservation of natural resources and the support of local traditions.

Thus, international experience confirms that wine tourism is not only a factor of cultural exchange, but also an important engine of economic development, which should be actively developed and used as an effective tool for the growth of national and regional economies.

5.5. Conclusions

Wine tourism is a promising area of entrepreneurial activity in Ukraine that can attract foreign visitors and contribute to the economic development of wine-producing regions. Ukraine has a rich winemaking tradition and unique grape varieties that may interest wine enthusiasts from around the world. Wine routes captivate tourists not only with the taste of the drink but also with the picturesque vineyards, the architecture of wineries, and the local cultural charm. Moreover, visitors have the opportunity to deepen their knowledge of Ukrainian culture by interacting with local residents and discovering winemaking traditions.

The development of wine tourism can generate additional income for both local businesses and communities, stimulating the growth of the hospitality industry, restaurant businesses, and souvenir production. Promoting wine regions will help Ukraine enhance its international reputation in the winemaking industry and expand the export of exclusive wines.

For wineries, wine tourism serves as an effective tool for promoting their products and increasing brand recognition. Organizing tours allows for showcasing production traditions and establishing closer relationships with customers, fostering consumer loyalty, and boosting sales. As a result, the growth of this sector positively impacts both the winemaking industry and the tourism sector as a whole.

To successfully develop wine tourism, it is essential to invest in advertising campaigns, improve infrastructure, create attractive tourist routes, and ensure high-quality wine production and exceptional customer service.

Recommendations for increasing the competitiveness of wine tourism in Ukraine:

1. *Infrastructure and logistics development.* Improving transport accessibility of wine-growing regions (roads, rail, and air connections). Expanding the network of hotels, restaurants, and thematic eco-complexes in wine-growing areas.
2. *State support and legislative regulation.* Simplifying licensing procedures for small wineries. Stimulating public and private investments in wine tourism.
3. *Marketing and international promotion.* Developing a national brand of wine tourism in Ukraine. Participating in international exhibitions, festivals and fairs. Cooperating with foreign tour operators and platforms (Booking, Airbnb, Tripadvisor).
4. *Innovative approaches and digitalization.* Implementing online platforms for booking wine tours and tastings. Using VR/AR technologies for virtual tours of wineries.
5. *Education and training.* Training specialists in the field of wine tourism, marketing, and sommeliers. Conducting educational programs for wine-makers on creating tourist products.
6. *Developing unique tourist products.* Creating proprietary routes, tasting programs, and thematic events. Combining wine tourism with gastronomic, cultural, and ecotourism.
7. *Environmental responsibility and sustainable development.* Popularizing organic winemaking. Using ecological methods in production and tourism.

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FINANCIAL ACCOUNTING AND DOCUMENT MANAGEMENT OF LAND RESOURCES IN THE AGRICULTURAL SECTOR: PROBLEMS OF NORMATIVE ASSESSMENT, CLASSIFICATION, AND DIGITALIZATION

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6.1. Introduction

Financial accounting and document management of land resources in the agricultural sector are key components of effective land asset management. In a market economy and amid continuous improvements in the legislative framework, issues of normative assessment, classification, and digitalization of land resources are of particular importance. These aspects play a crucial role in forming objective information about land assets, influencing managerial decision-making, the development of agricultural production, and ensuring the country's food security.

The relevance of this study is driven by the need to improve financial accounting and document management of land resources in the context of modern digital transformation. Land resources are a strategic asset of the agricultural sector that require efficient accounting, transparent classification, and well-grounded normative assessment. At the same time, the current land accounting system faces several challenges, including a fragmented legal framework, a lack of unified assessment standards, and an insufficient level of digitalization. The imperfection of document processing and accounting procedures complicates financial analysis and monitoring of land resource utilization.

The aim of this article is to improve methodological and organizational approaches to accounting for land resources in agriculture, considering modern challenges such as the consequences of military actions, changes in land legislation, and the need for transparent land fund management. To achieve this goal, the following objectives are set: analyze existing approaches to land resource accounting and identify key shortcomings that hinder the effective use of land in agriculture, examine the impact of military actions on land resource accounting and assessment, particularly regarding temporarily occupied, damaged, and mined land plots. Justify the need to improve land classification in accounting, considering ownership rights, the degree of use in production activities, and the potential for restoration after military actions. Develop recommendations for supplementing the working chart of accounts with new sub-accounts to reflect land plots with special usage conditions (occupied, mined, withdrawn from circulation). Propose updated approaches to land resource valuation and reporting, including information on land utilization levels, physical condition, and normative monetary valuation. Substantiate the need to harmonize accounting data with the State Land Cadasters to ensure the reliability of land fund information. Develop proposals for the implementation of standardized primary documents for recording land resource transactions, including land condition, ownership rights, and economic use. The implementation of these objectives will contribute to enhancing the efficiency of land resource accounting in agriculture, reducing financial risks for enterprises, and ensuring the rational use of land resources.

The novelty of this research lies in the comprehensive analysis of financial accounting and document management of land resources in the agricultural sector, considering modern digital technologies. The study examines contemporary methodologies for normative land assessment, their compliance with international standards, and the possibilities for automating classification processes and documentation management. Particular attention is given to the prospects of using blockchain technology, geographic information systems (GIS), and intelligent analytical platforms in land management.

In the process of studying financial accounting and document management of land resources in the agricultural sector, the following methods are applied: **general scientific methods, analysis, and synthesis** – to examine the components of financial accounting and document management of land resources, as well as to identify issues related to normative assessment, classification, and digitalization; **induction and deduction** – to draw conclusions re-

garding the effectiveness of existing approaches to land accounting and document management in the agricultural sector; **abstraction and generalization** – to develop proposals for improving the system of normative assessment and digitalization of land accounting.

Empirical methods include monitoring the regulatory framework (analyzing legislative and subordinate acts that regulate land resource accounting) and comparative analysis (assessing financial land accounting practices in different countries and regions of Ukraine). Statistical methods involve analyzing the dynamics of indicators (evaluating changes in financial accounting of land resources over specific periods) and digital technology methods (exploring the possibilities of digitalizing land document management in the agricultural sector). Applying a comprehensive approach allows for a thorough assessment of existing issues and the development of practical recommendations for improving financial accounting and document management of land resources. The significance of this study is determined by its practical focus on enhancing financial accounting and document management of land resources. The proposed approaches will contribute to increasing transparency in accounting processes, reducing corruption risks in land relations, and forming a reliable information base for strategic decision-making in agriculture. The obtained results can be used both in the scientific field and in practice-by government authorities, agricultural enterprises, and financial institutions working with land assets.

6.2. Financial accounting of land resources in the agricultural sector: issues of normative assessment, classification, and legal regulation

Nivievskiy, O., Neiter, R., Yurchenko, E., et al. (2024) state that the total area of land registered in the State Land Cadastre amounts to 44.9 million hectares, which represents 74.4% of Ukraine's total land area. At the same time, the area of registered agricultural land is 33.0 million hectares (77.2%). This indicates a high level of cadastral registration of agricultural land, contributing to the transparency and efficiency of the land market. The average normative monetary valuation of arable land is 28,924 UAH/ha. This is an important indicator used for determining tax liabilities, rental payments, and the market value of land plots. The weighted average rental payment for agricultural land is 8,458 UAH/ha, indicating a relatively high liquidity of the land market and strong demand for land leasing. The weighted average purchase price of agricultural land is 45,128 UAH/ha. This figure is calculated considering plot areas

and excluding the top 1% of the most expensive and cheapest transactions to avoid price distortions. The high price per hectare reflects significant interest in land as an asset. Between January 1, 2024, and October 1, 2024, a total of 283,096 land purchase agreements were concluded, with a total area of sold land plots amounting to 634,576 hectares. This demonstrates an active agricultural land market. The average size of a sold land plot is 2.24 hectares, which may indicate demand for small and medium-sized plots for agricultural business purposes.

Overall, although the land market continues to recover after its complete halt due to the full-scale invasion, the pace of recovery is gradually slowing down, and the volumes remain lower than the levels recorded before February 2022. In the six months leading up to the invasion, the average monthly market volume was **32.2 thousand hectares**. In the second half of **2022**, this figure decreased to **8.8 thousand hectares**, in **2023** it increased to **14.9 thousand hectares**, and in **2024**, it reached **20.3 thousand hectares**. Currently, the average monthly volume of transactions in the land market remains approximately 37% lower than before the full-scale war. Furthermore, due to the occupation since 2022, the area of land transactions has decreased by about 22%. The land market in regions located near active combat zones operates under significant restrictions, and agricultural land transactions in Kherson, Zaporizhzhia, and Donetsk regions are almost nonexistent due to high security risks.

One of the potential indicators of the future market potential is the share of agricultural land in circulation. In developed countries, approximately 1% of the total area of such land is transacted annually. If we extrapolate the data from the first nine months of 2024 to the entire year, excluding regions where the market is restricted due to combat actions, this figure will be 0.78%, which is 28% lower than the levels in developed markets. Given the ongoing military actions and the occupation of part of Ukraine's territory, significant growth in land market volumes in the near term seems unlikely. However, the mid-term prospects for development remain, as before the war, the average monthly transaction volume exceeded 32.2 thousand hectares. Throughout the entire period of the land market's existence in Ukraine, 1.53% of the total area of agricultural land has been put into circulation. Excluding the territories where combat actions complicate buying and selling, this figure increases to 1.87%. Over more than three years of the land market's operation, Ukraine significantly lags behind developed countries in terms of land turnover, largely due to military aggression.

According to preliminary analytical estimates, about 120,000 transactions were not completed due to the war, covering a total area of 355,500 hectares, or an additional 0.86% of the total area of agricultural land. At the same time, in regions with the most developed land markets, the turnover indicators are generally in line with the levels of developed economies. For example, in the Poltava region, over three years, the turnover of agricultural land reached 3.24% of the total area, which is the highest figure among all regions. In addition to Poltava, six other regions have a total turnover rate exceeding 2%: Khmelnytskyi (2.65%), Dnipropetrovsk (2.59%), Kharkiv (2.47%), Kirovohrad (2.41%), Vinnytsia (2.20%), and Sumy (2.06%) regions. On the other hand, the lowest turnover of agricultural land is observed in regions significantly affected by the full-scale war, specifically Luhansk (0.33%), Donetsk (0.43%), and Zaporizhzhia (0.57%) regions. A low turnover rate is also typical for regions with small land plot sizes, which lead to high transaction costs during the buying and selling process, such as in Lviv (0.69%) and Ivano-Frankivsk (0.64%) regions.

The effective use of land resources in agriculture is one of the key factors for the sustainable development of the agricultural sector. However, the current system of accounting for land plots has significant shortcomings, including the lack of a unified classification of land within fixed assets, insufficient detail regarding their legal status, monetary valuation, usage degree, and physical condition. The impact of military actions has further complicated the situation, causing the temporary occupation of some lands, their land mining, and destruction, which creates new challenges for accounting and valuing these assets. Currently, the accounting policy of agricultural enterprises lacks a clear mechanism for reflecting land resources in financial reporting, making effective management impossible. The imperfection of the legal and regulatory framework, along with the absence of specialized accounting accounts for land in combat zones or temporarily removed from circulation, complicates the assessment of economic losses and the development of measures to restore agricultural production. Therefore, there is a need to develop an updated methodology for accounting land resources, taking into account the specifics of their use, classification by legal status, and the influence of external factors, including military actions. This will enhance the informativeness of accounting data, improve the effectiveness of land usage control, and facilitate the adoption of well-grounded management decisions.

The problems of improving land resource accounting in agriculture have been studied by Ukrainian scholars such as Kuzmin (2023), who examines the

theoretical and methodological foundations of the functioning and development of land relations in agricultural enterprises. Kolotukha, Melnyk, and Huzar (2020) analyze the issues of land resource accounting and propose ways to improve it in agricultural enterprises. Yemets, Hryhoriv, and Chumychkina (2022) analyzed the current issues of land plot accounting, specifically the classification, valuation, and rational use of land. They proposed improvements to the approaches to land accounting in farms. Ivaniuk, Balaniuk (2022) They studied the impact of decentralization on the functioning of the agricultural land market, identified deficiencies in the regulatory and legal framework, and proposed solutions for their resolution to ensure the effective use of the land fund. Balaniuk, Shelenko, Leskiv, Ivaniuk, T. L. (2020) in your research they substantiated methodological approaches to the assessment and accounting of land plots and proposed the introduction of a unified land accounting information system, which will contribute to transparency and efficient land resource management. Ivaniuk, Savka, and Balaniuk (2020) analyzed methodological approaches to the study of land relations in farming enterprises and proposed new approaches to their classification and the assessment of land use efficiency. Blahun, Suduk (2022) they studied the role of land resources in shaping the economic potential of the state, identified the main issues of land accounting, and proposed measures for their improvement at the macroeconomic level. Termets, (2025) an improved system of indicators for assessing the efficiency of land use in agriculture was proposed, incorporating economic, environmental, and social aspects. The analysis of recent scientific studies indicates active research on issues related to land resource accounting, valuation, efficient use, and regulatory aspects. The main challenges remain the absence of a unified land accounting information system, the complexity of land valuation, and issues in regulating the land market under decentralization conditions. **Shepel, Vintoniak, Lytvynenko** (2023) it explores methods for assessing agricultural land in the context of market relations, emphasizing their economic efficiency and impact on the land market. **Kaminetska, Siroshtan, Kocherihin** (2022) they analyze the management of land and resource potential of territories, determining its impact on the population's well-being and proposing ways to improve it. Ivanchenko (2020) examines the organizational and institutional aspects of sustainable entrepreneurship development in the agricultural sector, exploring mechanisms for its support and growth. Despite existing research on land resource accounting in agriculture, several unresolved issues require further scientific justification and practical implementation.

In particular, there is no standardized approach to classifying land resources in accounting, as the current accounting system does not provide separate accounts for lands temporarily out of use due to occupation, landmines, or other circumstances, which complicates the assessment of enterprise assets. There is also a lack of information regarding the physical condition of land and the absence of financial reporting indicators reflecting the degree of land use, the level of degradation, or damage caused by military actions. This results in a distorted representation of the real state of assets in the agricultural sector. Existing monetary valuation methods do not consider losses caused by military actions, pollution, or other negative factors, making it impossible to determine the real value of land and related damages. Furthermore, there is no coordinated mechanism for synchronizing data between the state land cadastre and the accounting records of agricultural enterprises, complicating the control of legal status and land use. The absence of unified requirements for primary documentation on land resource accounting creates challenges in enterprise accounting policies and makes it impossible to maintain clear control over land asset movements.

Current financial reports lack separate columns for reflecting occupied, mined, or temporarily decommissioned land plots, complicating decision-making regarding land fund restoration. Thus, there is an urgent need for a comprehensive improvement in the methodology of land resource accounting, particularly through the development of new approaches to classification, valuation, and reporting that take into account the modern challenges of the agricultural sector.

Existing monetary valuation methods do not account for losses caused by military actions, pollution, or other negative factors, making it impossible to determine the real value of land and the associated damages. There is no coordinated mechanism for synchronizing data between the state land cadastre and the accounting records of agricultural enterprises, which complicates the control of the legal status and use of land. The absence of unified requirements for primary documentation on land resource accounting creates challenges in enterprise accounting policies and makes it impossible to maintain clear control over land asset movements. Current financial reports do not include separate columns for reflecting occupied, mined, or temporarily decommissioned land plots, which complicates decision-making regarding land fund restoration. Thus, there is an urgent need for a comprehensive improvement in the methodology of land resource accounting, particularly through the development of new

approaches to classification, valuation, and reporting that take into account the modern challenges of the agricultural sector.

For effective accounting, registration, and control of economic assets, it is essential to have a clear and well-founded classification. However, the current accounting system lacks a structured classification of land resources, highlighting the need to develop a scientifically justified approach to their classification. Considering the potential targeted use of land in production activities, it is advisable to divide it into two main groups: 1) Land used for cultivation (owned, leased on financial or operational terms, subleased, or pledged). 2) Land removed from the production process. This approach will enable the generation of analytical data on the directions of land use in agricultural enterprises. To align economic accounting with the land cadastre, it is proposed to group land resources according to their designated purpose. Thus, certain land-related transactions can be classified as investment activities of an enterprise. According to paragraph 4 of Accounting Standard (Provision) 32 "Investment Property," investment property includes land plots that are owned or held under a finance lease and are maintained for the purpose of generating rental income or capital appreciation rather than being used for production needs, supply of goods, provision of services, administrative purposes, or sale within the ordinary course of business. If an enterprise uses land resources in its production activities that are owned by the enterprise or held under a finance lease, such land is classified as operational real estate. According to International Accounting Standard (IAS) 40 "**Investment Property**", investment property is land or buildings (or a combination of both) held by the owner or lessee under a finance lease agreement for the purpose of earning rental income, capital appreciation, or both (International Financial Reporting Standards (IFRS). https://zakon.rada.gov.ua/laws/show/929_010#Text). At the same time, they should not be used in production processes, the supply of goods, the provision of services, administrative tasks, or sales as part of ordinary business activities. Thus, land plots are recognized as property, plant, and equipment (PPE) under International Accounting Standard (IAS) 16 "Property, Plant and Equipment" if they are directly involved in the operational activities of the enterprise. Meanwhile, land resources are classified as investment property if they are intended to generate economic benefits in the long term. The accounting treatment of leased land plots is addressed in International Accounting Standard (IAS) 17 "Leases", where their recognition depends on the type of lease-finance lease or operating lease. According to paragraph 55 of International Accounting Standard (IAS) 41 "Agriculture", an enterprise must account for land resources in accordance

with the requirements of either IAS 16 "Property, Plant and Equipment" or IAS 40 "Investment Property", depending on which standard is most appropriate in the specific situation. Thus, at both the national and international levels, land possesses all the characteristics of a long-term resource and an enterprise asset, allowing it to be classified as property, plant, and equipment (PPE). However, the current accounting system lacks a detailed classification of land resources within this category. Since land resources have a complex structure, there is a need for their systematic grouping based on specific criteria. This will facilitate the organization of information, ensure control over the condition and movement of land, and accelerate the adoption of well-grounded management decisions regarding its efficient use in business activities. Within the accounting and analytical process, land resources can be classified according to the following criteria: ownership entities, form of use and possession, level of involvement in production and business activities, industry affiliation, and participation in mortgage lending mechanisms (Table 1). The application of these criteria will allow for an assessment of how each factor influences the specifics of land resource accounting.

In modern conditions, the issue of rational and efficient use of land resources is of particular importance. To enhance the control function of accounting and improve information support, it is proposed to classify land resources based on their level of involvement in cultivation: land used in production (own land, as well as land under financial or operational lease, sublease, or pledged as collateral); land withdrawn from the production process (land transferred for operational lease or sublease; other land not in use, including those temporarily or permanently non-functional as enterprise assets due to environmental issues, pollution, or other restrictions). The proposed classification will facilitate the acquisition of analytical information regarding the use of land resources in the economic activities of agricultural enterprises.

To align accounting with cadastral land records, it is advisable to simultaneously group land according to its primary designated purpose as defined by the Land code. Particular attention should be paid to the impact of military actions on land resource classification. Due to hostilities, significant areas of land may be temporarily or permanently withdrawn from economic circulation due to landmines, soil cover destruction, contamination with hazardous substances, or other factors that prevent their use for the original purpose. This necessitates an adaptation of land classification, including the introduction of a separate category for land requiring reclamation or demining, as well as the consideration of economic losses associated with their withdrawal from use. The formation

of high-quality accounting and analytical support for the use of agricultural land resources, taking into account ownership rights, disposal, and usage, as well as quantitative and qualitative characteristics, will allow identifying deficiencies in the distribution of land resources both at the level of individual enterprises and within a specific region. This will create the necessary prerequisites for more efficient management and rational use of land.

Table 1. General classification of land resources in the accounting and analytical process

Classification feature	Grouping	Use of classification in the accounting and analytical process
By Ownership Entities	<ol style="list-style-type: none"> 1) Private Ownership 2) Municipal Ownership 3) State Ownership 	For the development of methodological foundations for reflecting land resources as part of property, plant, and equipment in the accounting of economic entities, including budgetary institutions and enterprises of various forms of ownership.
By Form of Use and Ownership	<ol style="list-style-type: none"> 1) Owned 1) In Permanent Use 2) Leased (finance lease, operating Lease) 3) Acquired by the right of land servitude 	To determine the methodology for accounting for land resources, in particular their recognition or derecognition in the company's balance sheet, recording on off-balance accounts, formation of expenses related to acquisition, valuation in the accounting system, as well as documentary confirmation of land ownership rights.
By Level of Involvement in Business Activities	<ol style="list-style-type: none"> 1) Lands involved in production 2) Conserved lands and reserve lands 3) Lands not involved in production 	Ensures the acquisition of analytical information on land resource utilization, assessment of the need for capital improvements, possibilities for changing land use categories, revaluation, or temporary exclusion of land plots from the company's assets.
By Industry Affiliation	Agricultural land; industrial land; transport land; communication land; land of water and forest funds, and others.	For the development of the Working Chart of Accounts for accounting and the organization of the inventory process in accordance with the requirements of cadastral land registration.
By Participation in Mortgage Lending	Land under mortgage, land not involved in mortgage lending.	Allows assessing the financial condition of the enterprise and forecasting its future activities.

Source: results of own scientific research.

Effective information support for the land resource management system involves solving several important tasks, including: organizing the land resource accounting system; analyzing the efficiency of land use and identifying reserves to increase productivity; developing and implementing management decisions aimed at optimizing land use. Currently, Ukraine lacks a clearly defined approach to classifying land plots in the accounting system. Given market conditions and the multifunctionality of land resources in agriculture, there is a need to develop a comprehensive system of accounts that reflects the specifics of land resources and ensures effective control and management (Table 2).

Table 2. Disadvantages of the current methodology for organizing the accounting of agricultural land resources

Accounting direction	Characteristic of the drawback
Documentation	The current accounting system lacks specialized forms for recording land resources, as well as an insufficient number of indicators that fully reflect the characteristics of agricultural land. This complicates the process of monitoring land use, assessing productivity, and making effective management decisions.
Inventory	Inventory records of land plots lack information on documentary confirmation of ownership and land use rights, monetary valuation, designated purpose, and actual use of land resources. This complicates the process of land fund management, assessment, and effective control over land use.
Accounting accounts	The current accounting system for land resources is based on general principles of recording land plots as part of an enterprise's fixed assets. However, it does not take into account their classification by land type, legal ownership status, or specific use in production activities. This approach complicates the analysis of land use efficiency, valuation, and control.
Assessment	Regulatory monetary valuation is used for taxation, determining rental payments, calculating state duties, assessing losses due to land withdrawal, and other purposes. Expert monetary valuation is applied in land purchase and sale transactions, mortgage lending, and investment attractiveness assessment, taking market factors into account. Many land plots lack an up-to-date regulatory valuation or are not included in the State land cadaster. The loss or damage of documents due to war complicates the confirmation of ownership rights and the valuation process.
Reporting	As of today, the existing land resource reporting has significant gaps, including: lack of information on the actual use of land (it is not specified whether land plots are used in the production process or remain uncultivated); absence of data on the reasons for non-use (such as landmines, contamination, or temporary occupation).

Source: results of own scientific research.

The lack of a unified approach to accounting for agricultural land may lead to inaccuracies in financial reporting, complicate inventory processes, and hinder land valuation. To improve information support for land resource management, it is necessary to develop standardized accounting forms that consider the specifics of the agricultural sector, as well as to enhance the system of indicators for detailed analysis and control. Additionally, in wartime conditions, significant challenges arise that make land resource inventory impossible or significantly more difficult. In particular, large areas may be temporarily inaccessible due to hostilities, infrastructure destruction, or changes in ownership. A major threat is the mining of agricultural land, which not only prevents its use but also poses a serious danger to any accounting and inventory activities. Furthermore, the destruction or damage of cadastral documentation, property rights registers, and other critical data may result in legal conflicts and difficulties in restoring land ownership rights. In such conditions, the implementation of modern digital accounting methods is essential, including the use of remote sensing, satellite imagery, and electronic cadasters, which can partially compensate for the limitations caused by military actions. Given modern challenges, particularly military actions, it is advisable to introduce additional subaccounts into the Chart of accounts to provide a more detailed representation of land resources in accounting: **land plots in temporarily occupied territories** (includes land temporarily beyond the enterprise's control and unavailable for use in production activities); **land plots affected by landmines or other war-related damage** (includes areas rendered unsuitable for agricultural use due to mining, destruction, or contamination with hazardous substances); **land plots withdrawn from circulation** (covers land that cannot be used for economic activities due to environmental, technological, or military factors). The introduction of such subaccounts will allow for a more accurate assessment of the actual condition of the enterprise's land assets and support informed management decisions. Land plots located in temporarily occupied areas or rendered unusable due to military actions may be exempt from taxation or subject to preferential tax treatment. This requires corresponding changes in tax legislation and tax administration mechanisms. For a more detailed accounting of land plots, considering their condition, legal status, and potential usage restrictions, the following fourth-level subaccounts can be proposed under account 101, "Land Plots" (Table 3).

The introduction of such subaccounts will allow: a more detailed representation of the condition of land plots in accounting records; tracking the impact of military actions and other factors on land assets; controlling the usability

of land resources, assessing losses and forming reserves for land restoration. Current issues in land valuation arise due to the impact of military actions: a significant portion of land is located in combat zones or temporarily occupied territories, making valuation impossible. Mined land and areas contaminated with explosive objects lose their economic value. The destruction of infrastructure and logistical routes reduces land value in certain regions. There are also issues with cadastral data accuracy: many land plots lack an up-to-date regulatory valuation or are not included in the State land cadaster, the loss or damage of documents due to war complicates ownership confirmation and valuation processes.

Table 3. Proposed accounts to be included in the chart of accounts

Account name	Proposed subaccounts
101.1 – Land plots used in economic activities	101.1.1 – Land owned by the enterprise. 101.1.2 – Land in use (lease, sublease). 101.1.3 – Land leased to third parties
101.2 – Land plots not used in production activities 101.3 – Land plots in temporarily occupied territories	101.2.1 – Land temporarily withdrawn from circulation (conservation, environmental restrictions). 101.2.2 – Land subject to legal disputes. 101.3.1 – Land owned by the enterprise (Temporarily occupied territory). 101.3.2 – Land in use by the enterprise (Temporarily occupied territory)
101.4 – Land plots affected by military actions	101.4.1 – Land plots with landmines. 101.4.2 – Land plots that have suffered physical damage (craters, trenches, construction debris) 101.4.3 – Land plots affected by chemical contamination
101.5 – Land plots requiring restoration	101.5.1 – Degraded lands subject to reclamation 101.5.2 – Lands requiring demining and restoration 101.5.3 – Lands being restored after military damage

Source: results of own scientific research.

Due to uncertainty regarding the future use of land, land prices may fluctuate sharply, making objective expert valuation difficult. Additionally, **limited access to financing** (loans, mortgages) negatively affects the market valuation of land. Legislative regulation issues arise due to the lack of clear mechanisms for assessing land affected by military actions and the need for new assessment methodologies that consider risks and the potential for land restoration. To address these issues, it is necessary to update land assessment methodologies by

incorporating military risks, improve cadastral accounting, introduce compensation mechanisms for owners of damaged or contaminated land, and create preferential conditions for restoring agricultural use of affected areas. Existing financial reporting formats for land plots do not account for the risks of military actions (reports do not include data on the degree of land damage due to military actions, there is no record of temporarily occupied or mined territories, which affects the real value and usability of the land).

It is recommended to introduce a new reporting format for land resources or expand the existing one by including the following columns: **general characteristics of the land plot** (cadastral number, area (ha), land category (arable land, forest, water fund, etc.), form of ownership (state, municipal, private)). **Economic indicators of land use** (normative monetary valuation (UAH/ha), soil bonitet score, value indicators (market valuation, book value)). **Degree of land utilization** (whether it is used for production (yes/no), reason for non-use (mining, contamination, temporary occupation, lack of access), type of tillage (traditional, minimal, zero)). **Military risk factors** to be included in financial reporting or explanatory notes (degree of damage (no damage, partial damage, complete destruction), whether the land plot is located in an occupied territory (yes/no), risk of landmines (yes/no), need for reclamation (yes/no, cost estimation)). The introduction of such detailed reporting will enhance the transparency of land resource accounting, contribute to their effective management, and take into account the impact of military actions on land use.

The research results indicate that land resource accounting should be organized in a way that ensures the accumulation and systematization of information for each land user and landowner. This will enable effective control over compliance with land ownership rights, its designated use, and adherence to regulatory requirements. Such an approach is driven by significant changes in the structure of landowners and users, as a substantial portion of agricultural land has been transferred to the ownership of agricultural enterprises and citizens. As a result, a large number of business entities with different organizational and legal forms have emerged, leading to an active redistribution of land plots among land users. At the same time, the lack of standardized requirements for the organization of primary and analytical accounting of land resources in agriculture has created a situation where the accounting policies of agricultural enterprises do not contain a clearly defined procedure for reflecting land plots in financial documents. This particularly concerns the working chart of accounts, the document flow schedule, orders on land inventory, and specialized accounting forms.

Analytical land accounting, which was previously conducted through land books, cadastral maps, plans, and crop rotation schedules, has effectively ceased to function. Currently, data on land area and composition are recorded in accounting documents of arbitrary form, making it difficult to reconcile them with information contained in state cadasters. The insufficient coordination between the accounting of agricultural enterprises and the state land registration significantly complicates the control over the use of land resources. An additional issue is the unreliability of statistical reporting, caused by the irregularity of land inventory processes for land plots involved in production. This highlights the urgent need to improve the methodology and organization of land resource accounting, which will enhance the transparency of their use and contribute to the efficient management of enterprises' land funds.

The imperfection of land resource classification in accounting complicates the control over their condition, use, and legal status. A detailed classification of land based on the degree of utilization, legal status, and involvement in production activities has been proposed. Military actions have significantly affected Ukraine's land fund, leading to temporary occupation, land mining, and physical damage to land plots. This necessitates supplementing the working chart of accounts with new sub-accounts to reflect such plots, as well as developing specialized reporting forms. Land resource valuation requires updated approaches, as existing methodologies do not consider the specifics of mined, degraded, and temporarily unsuitable land. It is proposed to expand the list of valuation indicators to include the environmental condition and the potential for land restoration.

The primary accounting of land plots remains fragmented, making it difficult to reconcile information between accounting data and the State Land Cadaster. The need for standardizing the documentation of land rights and creating a unified accounting system has been justified. The existing reporting format does not take into account modern challenges, including the level of land utilization, its physical condition, and normative monetary valuation. A new reporting format has been proposed, which includes indicators for mined, damaged, and temporarily occupied land plots. The harmonization of land resource accounting with cadastral records is critically important for ensuring the accuracy and transparency of land fund management. The implementation of digital technologies and data integration will contribute to improving accounting efficiency. Thus, to enhance land resource management in agriculture, it is necessary to update the accounting methodology, improve the classification, reporting, and valuation system, and ensure synchronization of accounting data with

state cadasters. This will promote more efficient land use, increase the economic stability of agricultural enterprises, and improve control over the legal status of land.

A necessary condition for the reliable representation of land resources in accounting is a unified principle of their monetary valuation. Among all types of valuations, fair value is of particular importance in market conditions. However, in the current environment, where the land market is not yet fully operational, it is proposed to use the calculated land value for determining fair value and accurately reflecting land resource transactions in accounting and enterprise balance sheets. This calculated land value is based on normative monetary valuation using capitalized rental income, adjusted for a set of factors that directly influence the market value of a land plot, including inflation index, location relative to product markets, and soil bonito characteristics.

6.3. Regulation of land resource document flow in agriculture: problems and ways of improvement

Regulation of land resource document flow in agriculture: problems and ways of improvement. Currently, in accordance with the applicable legislation, information on land resources in accounting is formed based on expert land valuation, which serves as the basis for determining the fair (contractual) and historical value of a land plot. However, despite several advantages, this method also has certain drawbacks (Table 4). Among the key issues are the need for the customer to finance the valuation process, the absence of a stable land market, and the high labor intensity of the valuation procedure, which requires the involvement of highly qualified specialists.

The monetary valuation of land plots in Ukraine under martial law requires updating the land value (the valuation takes into account the current state of land use and potential restrictions due to military actions), the possibility of compensation for damages (the results of the valuation can be used to determine the damage caused to the agricultural sector and receive compensation), substantiated planning for recovery (determining the land value helps in distributing investments for further mine clearance and the restoration of agricultural territories), ensuring tax revenues (even in crisis conditions, the valuation allows for controlling the tax base and maintaining budget stability for communities).

Table 4. Disadvantages and advantages of land plot monetary valuation

Expert monetary valuation of land plots.	
Advantages of the valuation.	<ol style="list-style-type: none"> 1) Reflects the current market situation, taking into account the demand and supply ratio, and determines the starting value of the land. 2) Covers the valuation of both the land plot itself and the buildings located on it, considering them as a single property complex. 3) Considers improvements made to the land plot when determining its value.
Disadvantages of the valuation	<ol style="list-style-type: none"> 1) There is a possibility of a subjective approach by the appraisers. 2) The cost calculation is tied to specific conditions outlined in the agreement. 3) It requires significant financial expenditures from the enterprise. 4) The insufficient development of market infrastructure complicates the full application of the method of comparing prices for similar land plots. 5) The method of capitalizing net income is ineffective for loss-making enterprises in the agricultural sector. 6) The use of the method that takes into account the costs of land improvements is complicated under conditions of high inflation and unstable financial situations.
Regulatory monetary valuation of land.	
Advantages of the valuation.	<ol style="list-style-type: none"> 1) It is based on the rental income from the use of land plots, which is transformed into a monetary equivalent of the land value using a capitalization coefficient. 2) It includes the economic valuation of land resources. 3) It is a standardized and unified valuation method widely used by enterprises for calculating land tax and the single tax for group 4.
Disadvantages of the valuation	<ol style="list-style-type: none"> 1) It does not take into account market mechanisms, particularly the relationship between supply and demand. 2) The qualitative characteristics of the soil do not always adjust the land valuation. 3) The actual value of land is underestimated compared to similar land plots in more developed countries. 4) The valuation is based on the cultivation of cereal crops, whereas, under specific conditions, it would be economically more rational to consider crops that bring maximum profit, taking into account their share in crop rotation. 5) The land value indexation does not correspond to the increase in costs per hectare, changes in grain prices, as well as the decrease in yield and deterioration of soil quality. 6) The land plot valuation is carried out without considering the real estate located on it. Due to difficulties in calculating the value of agronomic soil groups, caused by significant diversity in soil cover in certain regions, a considerable error occurs in land valuation.

Source: results of own scientific research.

Additionally, we have identified some shortcomings of the valuation: significant errors in the valuation (due to the unstable situation, landmine contamination, and lack of access to certain land areas, the results of the valuation may be inaccurate), decreased market value (due to the risks of military actions and possible environmental consequences such as soil contamination and the destruction of irrigation systems, the value of land plots significantly decreases), limitations of valuation methods (classical methodologies based on market mechanisms may be ineffective due to the lack of an active land market), high mine clearance costs (land valuation in regions that have experienced combat actions must include mine clearance costs, which makes it significantly more expensive), and uncertainty about long-term use (some lands may only be suitable for use after long-term reclamation, which complicates their valuation). In the current conditions, the monetary valuation of land is a necessary tool, but its effectiveness is significantly limited by the factors of wartime.

At the same time, the valuation of land plots and their reflection in accounting depends not only on established standards. An analysis of national and international accounting standards allowed for the systematization and identification of additional methods for the valuation of land resources. These include: initial (historical) acquisition cost, market and fair value, investment valuation, as well as current and residual replacement cost. According to current legislation, transactions related to the acquisition of land resources in modern conditions are formalized using the «Act of acceptance-transfer (internal transfer) of fixed assets». However, the current form does not contain detailed information about the characteristics of specific land plots. In particular, this concerns data regarding land use rights (ownership, lease, sublease) and the type of title document, land area, fertility, type of plot, location, configuration, cadastral number, presence of buildings, as well as additional information such as explication, boundary plans, and information about the crop rotation system applied over the last 3-5 years.

In addition, when accounting for a land plot on the balance sheet of the enterprise, the unified form «Act of acceptance-transfer (internal transfer) of fixed assets» does not provide for the completion of such details as equipment, year of construction (release), depreciation rates, residual value, etc. A reasonable solution would be to introduce a specialized document, the «Act of acceptance-transfer of land plot (parcel)», which would include not only the characteristics of the land plot but also all the necessary information regarding its acquisition and subsequent use. This document could include: the details of the

enterprise transferring the land plot and the enterprise receiving it; the land category according to its intended use and type of land; qualitative soil characteristics; the location of the plot; data on expenses for land improvement; information about the person or enterprise to which the plot is assigned; the date the land was put into operation at the enterprise; the balance and normative monetary value of the plot; the order or contract that serves as the basis for the accounting or transfer of the land plot. Additionally, the document should specify the composition of the commission responsible for the acceptance-transfer and who signs the act. The specialized «Act of acceptance-transfer of land plot (parcel)» should also include sections that take into account the current situation in Ukraine, which is summarized in Table 5.

Table 5. Sections of the specialized «Act of acceptance and transfer of land plot (share)»

Sections	Description of the sections
Legal and security status of the land plot.	<ol style="list-style-type: none"> 1) Whether the land plot is located in a temporarily occupied territory. 2) Whether the plot is mined or contaminated with explosive objects (if relevant conclusions from military or sapper services are available). 3) Whether the plot has been damaged as a result of combat operations (including information on blast craters, trenches, foxholes, destruction of drainage systems, etc.).
Environmental and agronomic condition of the land	<ol style="list-style-type: none"> 1) Contamination of soils with toxic substances (fuel and lubricants, heavy metals, remnants of ammunition). 2) Presence of erosion processes, changes in soil structure due to mechanical damage or military actions. 3) Condition and functionality of irrigation and drainage systems, if available. 4) Assessment of the possibility of conducting agricultural work.
Financial and compensation aspects.	<ol style="list-style-type: none"> 1) Estimated costs for land demining and reclamation (based on preliminary calculations or according to state programs). 2) Availability of possible compensation or insurance payments due to damage or temporary inability to use the land. 3) Information about tax benefits or deferrals during the land restoration period.
Title documents and usage restrictions	<ol style="list-style-type: none"> 1) Are there any restrictions on the land parcel due to martial law (e.g., prohibition on transfer of use or sale). 2) Is it subject to any legal or administrative proceedings (e.g., regarding ownership rights or compensation for damages). 3) Is the land parcel part of a national or international land restoration program.

Source: results of own scientific research.

These additions will help to more accurately reflect the actual condition of land plots and provide the necessary legal, financial, and agronomic information for enterprises, government bodies, and potential investors. The proposed form of the document is advisable to use when accounting for land plots as assets of the enterprise and putting them into operation in case of acquisition through purchase, exchange, donation, etc. The Act of acceptance-transfer of the land plot should become a key document for making appropriate entries in the enterprise's accounting records and the land cadaster book. Given its importance, it is necessary to issue the Act in the presence of both parties, in at least two copies: one to be kept in the accounting department of the enterprise transferring the land plot, and the other in the accounting department of the receiving enterprise. If necessary, a third copy of the act can be made. It should include information about crop rotation, the boundary plan of the plot, and a copy of the explication, after which the document will be handed over to the agronomic service, which is interested in using this information.

In this regard, it is advisable to introduce an additional document into the accounting system – the «Act of acceptance-transfer of the land plot». The use of this document will prevent the duplication of records in the land acceptance-transfer acts and inventory cards, as this operation requires simultaneous reflection of the removal of a land plot from one category of land use and its transfer to another. The Act of acceptance-transfer of the land plot will include the following data: the reasons for changing the land category, cadastral characteristics of the plot, the assessment and classification of the land plot before and after the transfer, and the soil quality indicators at the time of the status change. The preparation of this document should occur simultaneously with the adoption of the relevant decision by local authorities regarding the transfer of the land plot from one type of land use to another. Additionally, particular attention should be given to documentation aspects when the land plot is allocated for military defense engineering structures. The aspects of documentation are grouped in Table 6.

Table 6. Characteristics of key aspects when allocating land for military defense engineering structures.

Specific issues	Which aspects require attention
Legal and legal issues	<ol style="list-style-type: none"> 1) Compliance with current legislation regarding the allocation of land (Land Code of Ukraine, Law "On Defense of Ukraine," etc.). 2) Availability of a decision from the relevant authorities regarding the allocation of land for military structures. 3) Determination of land usage terms (temporary or permanent use). 4) Clear documentation of the legal status of the land (cadaster number, ownership status, usage restrictions).
Technical parameters and purpose of the structures	<ol style="list-style-type: none"> 1) Type and characteristics of protective engineering structures (checkpoints, shelters, fortifications, warehouses, etc.). 2) Impact of construction on the surrounding infrastructure and the possibility of its future use. 3) Compliance with safety standards during construction and operation.
Environmental and land aspects.	<ol style="list-style-type: none"> 1) Characteristics of the soil and terrain for ensuring the reliability of the structures. 2) Impact of construction on the condition of land resources (erosion, destruction of the fertile soil layer). 3) Possibility of future land reclamation after the end of military operations.
Financial and compensation issues	<ol style="list-style-type: none"> 1) Sources of funding for construction and site development. 2) Definition of compensation mechanisms in case of land damage or removal from circulation. 3) Tax benefits for land users related to the allocation of land for defense purposes
Coordination between government authorities and military structures.	<ol style="list-style-type: none"> 1) Interaction between local authorities, land management agencies, and military units. 2) Monitoring compliance with the established legal regime and the use of land for its intended purpose.

Source: results of own scientific research.

Taking these factors into account will allow for the effective organization of the process of allocating land plots for military needs and ensure their proper use. To summarize data on each land plot, it is necessary to open an «Inventory card for fixed asset accounting», which serves as the main analytical register for fixed asset accounting. The use of such cards significantly simplifies the systematization of information about the condition, use, and movement of land plots in business activities. However, as with the fixed asset acceptance-transfer act, the standard form of inventory cards requires adaptation to the specifics of

land resource accounting, particularly for agricultural land, damaged, mined, or land located in combat zones. To improve the effectiveness of cadastral accounting and control over the condition and movement of land resources, it is advisable to expand the list of mandatory indicators in the cards (Table 7).

Table 7. Expansion of information in «Inventory cards for fixed asset accounting»

Information that requires clarification.	Options
Land cadastral number and its legal status	Ownership, lease, sublease
Land designation	Agricultural, forestry, built-up areas, etc.
Soil characteristics	Fertility, mechanical composition, pollution level.
Physical condition of the land plot	Presence of erosion processes, waterlogging, flooding.
Damage due to military actions	Destruction of crops, infrastructure damage, presence of craters and holes from explosions.
Landmine area	Data on inspection and demining, possibility of use in economic activities.
Land reclamation data	Need to restore soil fertility after military actions.
Presence of military or defensive structures:	Bunkers, trenches, fortifications
Historical and current value of the land plot:	Taking into account losses due to military actions.

Source: results of own scientific research.

The adaptation of inventory cards will enable more accurate accounting of land plots under current conditions, contribute to effective monitoring of their use, assess the damage caused, and plan actions for the restoration of land resources after the war. The inventory card provides a structure that allows the systematization of accounting data for a land plot:

- 1) General characteristics of the land plot or share – includes information on the location, area, soil quality, market and normative value, as well as the cadastral and inventory number.
- 2) Conditions for the disposal of the land plot – specifies the grounds for disposal, the relevant documentation, and the accounting correspondence of accounts.

- 3) Information on land improvement – includes the type of work performed, supporting documents for completed works, and the amounts of expenses related to improving the quality of the land.
- 4) Revaluation methodology – defines the mechanism for indexing the land plot's value on a specific date, the procedure for revaluation or depreciation due to changes in the plot's characteristics or macroeconomic factors (such as inflation or soil degradation).
- 5) Data on the transfer of land between types of land use – records the reasons for changing the land use category, as well as a comparative description of the land before and after the transfer.
- 6) Descriptive characteristics of the land plot – includes soil bonito, agronomic indicators, information on established usage restrictions (e.g., servitude rights or other legal aspects).

This approach ensures the completeness of accounting information, which contributes to effective land resource management, especially under conditions of legislative changes, environmental, and military factors. It is advisable to maintain inventory cards for land plots in the enterprise's accounting department in a single copy. The card is filled out based on acts of acceptance-transfer and supporting documents, such as the cadastral plan, legal documents for the land, etc. For each land plot or share, the card is formed under separate inventory numbers, which remain unchanged throughout the entire period of use of the land plot at the enterprise. In case of a change in the category of land, the relevant data is entered into the card based on the act of transferring the land plot to another category. The insufficient organization of analytical accounting in agricultural enterprises forces state services to monitor the land using data obtained from district land committees and village councils. At the same time, enterprises submit statistical reports, such as the "Report on the main economic indicators of agricultural enterprises," regarding land categories and the areas of land plots based on cadastral records. The effectiveness of land resource management can significantly increase if the information from the state land records is generated at the initial stage directly at the enterprise level. This is possible if analytical accounting is maintained using primary documents and conclusions from inventory commissions.

The introduction of additional control over the accounting of land resources by financial and accounting departments will not only help identify discrepancies between actual land areas and accounting data but also verify the correctness of documents confirming ownership rights, permanent use, or land lease, as well as its monetary valuation. Practice shows that most enterprises

conduct land inventories untimely and in violation of the requirements for filling out the relevant documents. As a result, inventory acts do not contain complete information about land resources, which complicates the detection of errors in accounting registers and accompanying documentation. Thus, the analysis of the current state of land resource accounting in agricultural enterprises confirms the need to improve the existing methodology for accounting for agricultural land. The procedure for reflecting the disposal of land plots and shares in analytical accounting has certain features, which are recorded in the relevant primary documents. When a land plot is transferred to another business entity (in particular, in case of sale, lease, exchange, gratuitous transfer, or contribution to the charter capital of another company), the «Act of acceptance-transfer of fixed assets» is used. For accounting land resources, it is advisable to apply the proposed «Act of acceptance-transfer of land plot (share)» When land plots are disposed of, the corresponding inventory cards are removed from the file, and necessary notations are made in the description of the cards. During martial law, special attention should be given to land plots that are located in combat zones, mined territories, or those that have suffered damage. In such cases, the actual condition of the land plot should be documented, confirming its loss or impossibility of use, as well as considering the possibility of restoration works after the end of hostilities. The disposal of fixed assets is carried out by issuing an «Act of disposal of fixed assets." At the same time, it is necessary to define the cases where land plots may be written off. Since land is a natural resource and is not subject to depreciation, the main reason for its removal from the enterprise's balance sheet is its transfer to another entity, which is recorded in the "Act of acceptance-transfer of land plot." However, land can only be written off as an asset if it is completely unsuitable for further use, particularly due to environmental disasters, technological accidents, or natural calamities (such as flooding or soil erosion). In the context of military operations, these reasons are supplemented by combat damage, landmines, destruction of infrastructure, or occupation, which makes business activities impossible. In such cases, the loss of the land plot or its temporary unavailability for use must be documented. To account for changes in the use of land plots, it is advisable to use the "Act of land use change."

The movement of fixed assets is accounted for using the "Fixed asset movement card," which contains data on the receipt and disposal of assets during the month. The information in the card is based on the inventory cards of the respective groups of assets and is used to compile analytical data for account 10, which is reflected in the journal order No. 13 for agricultural enterprises.

However, the use of this card is not mandatory for all enterprises, as it may duplicate entries made in other documents. In a state of martial law, it is important to supplement the card with information about damage to land plots, the consequences of military actions, demining activities, and the possibility of further use of the land after the area is restored. Analytical data in journal order No. 13 for agricultural enterprises are reflected for each synthetic account and subaccount based on primary documents, including the beginning-of-month balance, debit and credit turnovers, and the end-of-month balance. However, this generalized approach to accounting for land plots and shares in monetary terms in the journal order is not optimal for effective internal and external audits. This will contribute to increased transparency in the accounting of land assets and improved managerial control over their use.

The documentation under consideration mainly records changes in the quantitative indicators of land resources, while their qualitative characteristics are provided only as supplementary information. To comprehensively generalize and systematize data on the quantitative and qualitative condition of land, it is proposed to introduce the maintenance of a Register of Quantitative and Qualitative Characteristics of Land. This register will allow for the classification of land plots according to usage terms, reflect the physical and economic indicators of soil, and include the normative and economic evaluation of land resources. Additionally, the Register should highlight particularly valuable lands, conduct their functional distribution, and detail the land structure by types of land use. This approach will enhance the efficiency of control over land use and ensure more accurate accounting of land resources. The introduction of the Register of Quantitative and Qualitative Characteristics of Land will ensure the recording of both physical and monetary indicators for each type of land use. However, its implementation in agricultural enterprises may be accompanied by certain challenges. In particular, some indicators that determine land productivity may only be entered after additional soil surveys conducted by land management specialists. In light of this, it is advisable to implement a simplified version of the Land Resource Accounting Register in the analytical accounting, which will allow for the systematization of information based on two main criteria: land plots actively used in agricultural production and plots temporarily withdrawn from economic circulation. This approach will promote greater transparency and efficiency in land resource accounting.

Land plots that are temporarily not involved in the production process include areas undergoing reclamation measures or soil fertility restoration. This

category also includes unplowed areas of former orchards after uprooting, agricultural land plots prepared for the establishment of protective forest strips. Additionally, this group includes lands subject to temporary conservation to restore their productivity and improve environmental conditions. Contaminated lands that cannot be used in agricultural production due to the presence of harmful substances posing a threat to the environment and therefore withdrawn from economic circulation also belong to this category. A separate category consists of land plots affected by military actions. These may include areas contaminated with explosive objects (mines, shells, unexploded ordnance), lands destroyed as a result of combat operations or fortification arrangements, as well as territories exposed to radiation, chemical, or other hazardous contamination. Such plots require special measures for demining, reclamation, and ecological restoration before they can be reintegrated into economic circulation.

The accounting of land resources in the register is carried out based on land use categories, as well as considering forms of ownership and usage rights. The information is presented in both physical indicators and monetary terms, enabling its application in various accounting systems. Specifically, in land accounting, it is used for collecting and analyzing data on landowners and users; in tax accounting, for calculating land tax and the single tax of the fourth group; in financial accounting, for determining the balance sheet and off-balance sheet value of land plots, as well as verifying the accuracy of entries in the enterprise's General Ledger.

If the land resources register contains detailed information on both individual plots and the entire farm, it will allow managers to analyze the efficiency of land use. By utilizing data on production costs and crop yields across fields and crop rotations, they will be able to monitor the productivity of agricultural land. This will involve primary documents such as records of fertilizer and pesticide application, labor and work performance sheets, transportation and crop acceptance documents, machinery usage reports, and more.

In the conditions of military actions, the land accounting register should also include data on territories that have suffered damage or contamination as a result of hostilities. This applies to land requiring demining, reclamation, or soil fertility restoration due to physical damage, chemical, or radiation contamination. Recording such data will enable enterprises to plan land restoration measures, assess financial risks, and determine the necessary resources for reintegrating the land into economic circulation. Accumulating these indicators over several years will help not only analyze the dynamics of land use but also develop a long-term strategy for restoring agricultural production in affected

areas. The organization of land plot documentation in agricultural enterprises is a crucial element of effective land resource management. It includes maintaining primary documents, accounting registers, and specialized books for accumulating and analyzing information. Primary documents serve as the foundation for land resource accounting, reflecting all operations related to the acquisition, use, status changes, and disposal of land plots.

Under the current conditions, it is essential to maintain additional reports assessing land damage, the need for demining, and reclamation measures. Inventory cards and accounting registers are used for the systematization and storage of land plot information. To enhance accounting efficiency in the face of military risks, it is advisable to expand inventory cards with special markings regarding land conditions, including contamination, damage, the need for reclamation, and demining. The introduction of a Quantitative and Qualitative Land accounting book will facilitate the systematization of land plot information. In wartime conditions, this book should include a dedicated section assessing the impact of hostilities on land resources, specifically data on contaminated, destroyed, and unusable land. The organization of land plot documentation in agricultural enterprises must be clearly regulated and adapted to modern challenges. Proper management of primary documentation, the use of accounting registers, and the implementation of the Land accounting book will contribute to effective land resource management, risk minimization, and long-term business planning. During military actions, special attention should be given to the accounting of damaged and contaminated lands, allowing for an assessment of losses and the development of a strategy for their restoration.

6.4. Digital technologies in the organization of land resource accounting

The organization of accounting for land resources should align with the overall state land accounting system while also fully meeting the informational needs of both internal and external users for decision-making in land resource management. To improve the quality and reliability of information, financial accounting of land within the accounting and analytical information system should be structured into separate directions, including: **by types of land use** (ownership, possession, lease) in terms of land users or landowners; **by composition and types of land categories**; **by qualitative characteristics**, which can be generated using modern information systems. Accumulating data on land resources by ownership categories and land users will facilitate monitoring

the targeted use of land and compliance with usage terms. Moreover, high-quality analytical accounting of land resources by land composition will help track the economically efficient use of land in business activities across different forms of management and ensure its proper functional use. Scientific studies have extensively discussed conceptual approaches to land plot accounting, the documentation process for lease operations, and methods for reflecting the existing value of land in the accounting system, resulting in the development of several scientific and methodological approaches. However, an in-depth study is required on the procedures for analytical and synthetic accounting of land resources (both owned and leased), the calculation of lease payments, and the main deductions in accordance with the Tax Code of Ukraine, utilizing modern information systems.

Land resources are a source of national wealth, and their utilization directly influences the country's sustainable economic development, as well as the standard of living and public health. The representation of land plots as an object of accounting requires specific methods for generating accounting information, which collectively form the accounting methodology. The organization of land plot accounting should be conducted in physical quantitative measures while also considering qualitative parameters of land that characterize agricultural land based on its natural and acquired properties affecting fertility. These parameters must align with the cadastral data of Ukraine's registers. The documentary representation of land resources within the accounting system is governed by a set of regulatory and legal acts, as well as transactions related to settlements with landowners and co-owners of jointly owned property.

The procedures for documenting land resources are carried out based on the general principles of fixed asset accounting using primary documents, including: acts of acceptance and transfer (internal movement) of fixed assets; acts of acceptance and delivery of repaired and reconstructed (modernized) objects; acts for the disposal of fixed assets; inventory cards for fixed asset accounting; and Journal-Order No. 13. (Figure 1). The diagram presents proposals for improving the document flow of land plots, taking into account the maintenance of land inventory accounting. Primary documents should additionally include requisites that enable comprehensive control over the availability, condition, and movement of land based on the legal documents of owners and the qualitative cadastral indicators of the land plot. The presence of a separate synthetic account 101 "Land Plots" is crucial for organizing land accounting, as it facilitates the collection and processing of information regarding both the availability and movement of land as well as the assessment of its efficient use.

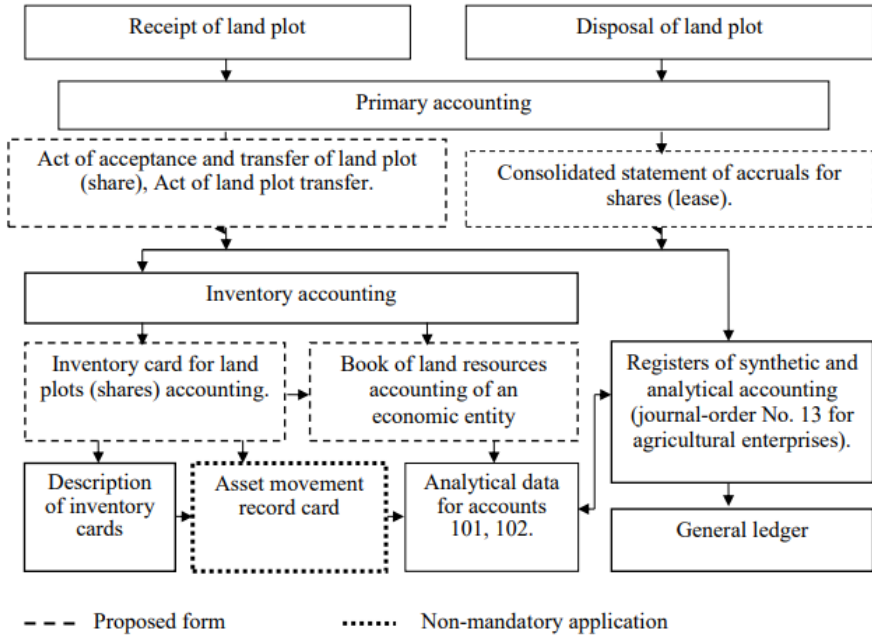


Figure 1. General diagram of land resource documentation flow

Source: systematized by the author based on data Yarmolyuk, Dmytrenko, Viter 2021.

However, an in-depth analysis of land utilization is only possible if managerial accounting is maintained through detailed analytical accounts that consider not only the types of land but also the specifics of land management on individual plots. In international practice, land resources are categorized based on various criteria. For instance, in France, land plots are recorded under the second-level account 211 "Land Plots" (undeveloped, developed, mineral deposits), which is part of the first-level account 21 "Tangible Fixed Assets." In the Anglo-American system (US GAAP), long-term assets include account 1610 "Land," according to which each enterprise independently develops its required account nomenclature. The "BAS AGRO. Accounting" software automates accounting for agricultural enterprises, including analytical and synthetic land accounting, as well as tax accounting of lease transactions. One of the key features of the "BAS AGRO. Accounting" program is a dedicated module for managing lease settlements related to land rental agreements.

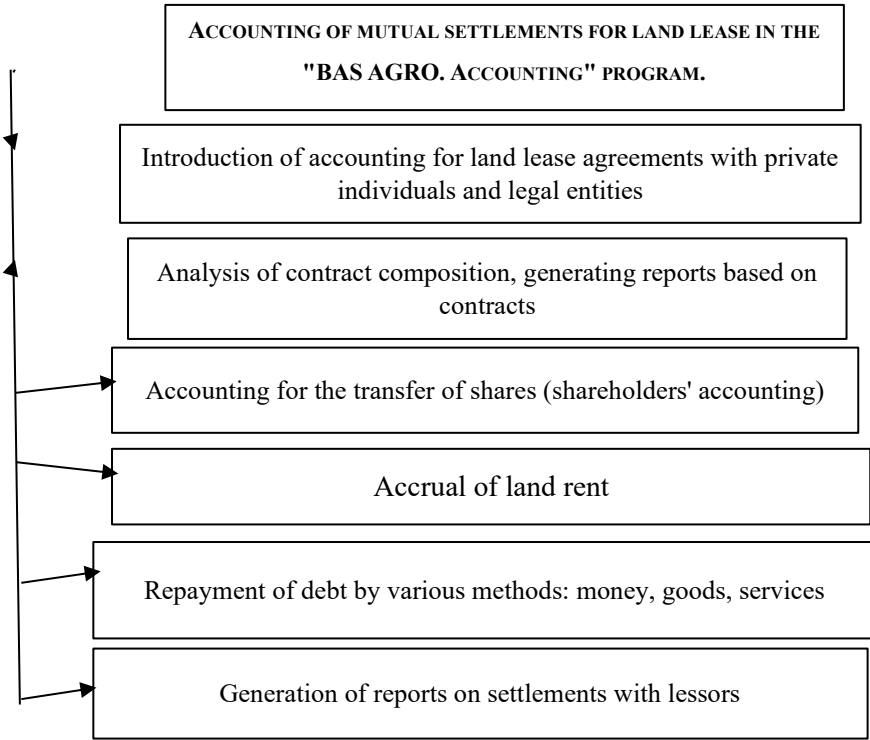


Figure 2. Key elements of accounting for land lease settlements in the "BAS AGRO Accounting" program

Source: compiled by the author based on the data (BAS Agro 2025)

The accounting of land resources and the calculation of lease payments under rental agreements can be carried out automatically using the unique Ukrainian software **Agri: Accounting**. This program enables the generation of data on land shareholders, the arithmetic representation of calculations, and the deduction of taxes in accordance with the **Tax Code of Ukraine** (Figure 3).

Modern software should incorporate quantitative and qualitative indicators to accurately reflect the characteristics of agricultural land in the accounting system, particularly for leased land. These indicators should include the number of hectares of arable land, pastures, and hayfields, cadastral numbers, lease contract durations, personal data of land shareholders, and their contact details. In the descriptions of leased land plots, it is advisable to include documented proof of ownership and land use rights, normative monetary valuation, designated purpose, and actual land use.

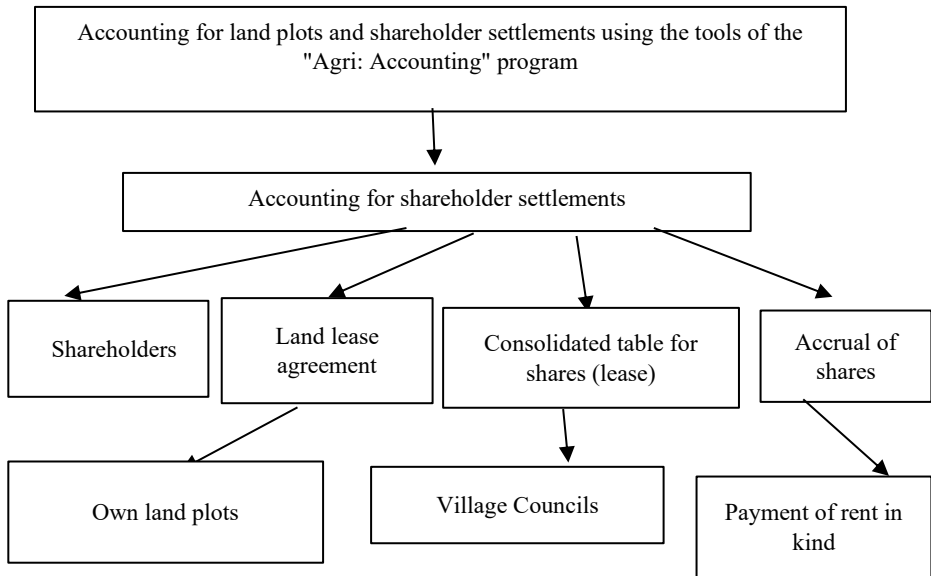


Figure 3. Key components of managing the accounting of land resources of an enterprise using information systems

Source: Compiled by the author based on the data Agri: Accounting software. (2025). https://agri-analytica.com/uk/products_farmer_ac

Additionally, it should specify whether future heirs exist and provide their contact details. We have summarized and analyzed the capabilities of the Agri: Accounting program in terms of generating analytical data on land plot accounting and synthetic accounting of shareholder contributions, as presented in Table 8.

In practice, transactions related to land lease payments in agricultural enterprises are recorded in Journal-Order No. 8 and reflected in Account 685 "Settlements with Various Creditors". The accounting department calculates lease payments under agreements using adapted document forms and withholds Personal Income Tax and Military Tax accordingly. Therefore, we recommend opening separate analytical accounts by land shareholders, such as Account 685.1 "Settlements with Various Creditors under Land Lease Agreements". Additionally, when leased land resources are used in the production process, a conflict arises between effective land use and environmentally sound, rational management, especially for land plots under short-term leases.

With the help of modern information systems and the Agri: Accounting program, it is possible to establish a general approach to the accounting of land plots as part of an enterprise's fixed assets, considering the classification of land

types, ownership rights, use in production activities, and the allocation of expenses to appropriate accounts.

Table 8. Characteristics and purpose of components for land plot accounting using the modern program Agri: accounting

Title	Purpose
Shareholders	Generates information for each shareholder (full name, personal details about the registration address and place of residence of the landowner, phone number, area, lease agreement (number and date of conclusion)). Analytical data about shareholders with the ability to modify agreements and terms of conclusion.
Land lease agreement	Contains information according to concluded agreements (date of conclusion, number, period), information about the identification of the land plot (land category (arable land, pastures, meadows)). Determines the procedure for calculating rent, normative monetary valuation, number of hectares, type, percentages. Provides information about the village councils where the land plot is registered.
Consolidated table for shares (lease).	Contains comprehensive data on leased shares of the farming enterprise (Farm, Limited Liability Company) with control over the start and end dates of lease agreements by Village Councils.
Own land plots	Information is generated about owned land plots, which are reflected in account 101 with the indication of analytical data (ownership rights, series, cadastral numbers of land plots, characteristics such as arable land, hayfields, pastures). The normative monetary assessment of the land plot is determined.
Accrual of shares	The arithmetic calculation of share payments is carried out according to lease agreements, specifying the lease periods, lease conditions, and tax withholding percentages (personal income tax – 18%, military tax – 5%). It allows for the generation of main accounting entries related to accruals and withholdings and reflecting the expense item (accounts 231, 232, and others).
Payment of rent in kind	Information on the payment of rent in kind is accumulated based on the details, issue date, and amounts throughout the period.
Village councils	A list of village councils is provided, with the option to select from the suggested list
Typical land lease agreement	It provides the opportunity to familiarize with the typical agreement, in accordance with the Resolution of the Cabinet of Ministers of Ukraine dated March 3, 2004, No. 220.

Source: compiled by the author based on the data. Agri: Accounting software. (2025). https://agrianalytica.com/uk/products_farmer_ac

Agricultural enterprises should develop all regulated documents that accounting departments rely on when organizing land resource accounting, including a working chart of accounts, document flow schedule, approved accounting document forms, and an order for conducting land inventory, among others. When organizing the accounting of leased land resources, it is necessary to ensure comprehensive information on the quantitative and qualitative characteristics of the plots, the enterprise's expenses related to land and share lease agreements, and the actual income from their use. This, in turn, allows for the calculation of the economic effect (potential profit) from attracting additional capital investments aimed at land improvement and expansion of land use. In Ukraine, agricultural enterprises use various information programs for land resource accounting, which automate processes related to land management, document flow, regulatory valuation, and financial accounting. The main programs are grouped in Table 9.

Table 9. Characteristics of the main platforms and information programs for land resource automation

Name	Characteristic	Capabilities	Usage priorities
Soft.Farm	This is a web platform for land resource management that includes modules for field accounting, mapping, document flow, and land parcel control.	An interactive map with the ability to import and analyze data. Land lease term control. Calculation of normative monetary valuation. Integration with BAS for accounting.	Convenient visualization of the land bank. Automation of lease agreements and term control. Relevant for large agroholdings and medium-sized farms.
AgroOffice	A comprehensive agricultural enterprise management system that includes modules for land resource accounting, finance, and production.	Accounting for banking operations and lease agreements. Planning and analysis of agrotechnical measures. Resource management (seeds, fertilizers, machinery). Financial accounting and interaction with tax systems.	The optimal choice for large agricultural enterprises. The ability to comprehensively account for all operations in the farm.

AgriControl	A land asset monitoring and management system that allows controlling and analyzing operations.	A geographic information system for land mapping. Control of crop rotation and soil conditions. Integration with state registers and cadastral maps. Automation of lease payment verification processes.	Convenient land asset analytics. Suitable for enterprises with large land areas.
LandStar	Software for cadastral land accounting and property rights management.	Cadastral accounting and land rights control. Visualization of land plots and their legal status. Integration with public cadastral data. Formation of legal documentation.	For agricultural enterprises actively working with cadastral documents. Useful for the legal departments of agricultural companies.
GIS-Agro	A specialized geoinformation system for agricultural land management.	Field mapping and management. Analysis of soil, terrain, and weather conditions. Optimization of crop rotation and yield accounting. Satellite monitoring of land.	Focused on precision farming. Useful for the agronomic and engineering departments of enterprises.

Source: results of own scientific research.

Ren, Song, Ye, et al (2023) state: «Systematic assessment of arable land use is a fundamental prerequisite to explore its sustainable development path. Agricultural infrastructure integrated with the tillage conditions and soil properties was used to evaluate the state of regional arable land use and its potential for sustainable productivity». The choice of software depends on the scale of the agricultural enterprise and its needs: for lease agreement and financial transaction accounting – Soft.Farm, AgroOffice; for comprehensive land resource management – AgriControl, LandStar; for analytics, geoinformation modeling, and precision farming – GIS-Agro. Agricultural enterprises should focus on comprehensive solutions that not only facilitate accounting but also enable analysis and forecasting of land resource utilization efficiency. Shelenko, Balaniuk, et al (2021) conduct a detailed study dedicated to forecasting the net profit of private enterprises in Ukraine using the STELLA software. The STELLA economic modeling program, which combines mathematical differential equations with an advanced graphical interface, enables the creation of a forecast model for private enterprises in Ukraine up to 2030.

FAOSTAT is a global statistical database that provides a wide range of data on agriculture, including information on land resources. Key indicators available include the total land area by country and continent, the area of arable land, pastures, forests, and other land categories, trends in land use changes, the impact of climate change on land resources, and data on soil degradation and erosion. This resource allows for comparative analysis between different countries and regions, tracking long-term trends, and assessing the impact of agricultural policies on land resources. Eurostat provides detailed statistics on land resources in European Union countries. Key data include: the area of land resources in the EU and individual countries, land use (agricultural land, urban areas, forests, etc.), land prices and rental costs of agricultural land, the impact of agriculture on the environment (soil erosion, pollution, etc.), data on sustainable land resource management. Eurostat is a key data source for analyzing sustainable development policies and effective land resource management in Europe. Both resources are essential for land resource research, but while FAOSTAT focuses on global trends, Eurostat provides detailed regional information on EU countries.

Wang, He, An et al. (2024) propose a methodology for land resource assessment that combines the concept of ecological footprint with the analysis of ecosystem service value to more accurately determine their quantity and value. Land resources are the material basis for human survival and development. Rapid economic development in the past has resulted in the over-utilization of land, and the undervaluation of land in market transactions has further exacerbated the loss of land benefits. This calls for monitoring the quantity and quality of land and reversing the undervaluation of land to reduce the waste of land resources. Based on this, a scientific natural capital accounting system of land resources should be established to understand the quantity and value of land resources in time. In order to provide a comprehensive evaluation of land utilization, this paper introduces the idea of compiling the land resources balance sheet. First, the physical quantity of land is calculated through the ecological footprint method improved by net primary productivity. King, Agra, Zolyomi et al. (2024). Robust, regular and integrated evidence on the environment and its relationship with the economy and human well-being is needed to deliver effective environmental policy. This paper highlights the role the United Nations System of Environmental-Economic Accounting Ecosystem Accounting (SEEA EA) can play in delivering this ‘policy-ready’ evidence.

Bruzón, Arrogante-Funes. Martínez de Anguita et al. (2022) state: «Assessing the spatial and temporal changes in ecosystems is essential to account

for natural capital contribution to human well-being. However, various methods to quantify these changes challenge the development of reliable values which can be integrated into national statistical accounts. Following the international system of environmental-economic accounting framework, which recently adopts an ecosystem accounting standard. We present a novel approach to develop an ecosystem extent account from existing ecosystem classifications.

The process of land resource management is a complex system that involves the activities of state authorities and internal farm management structures aimed at the rational use of land. At the same time, a key role in forming a unified information database on land resources is played by their owners and users-agricultural enterprises. They are responsible for recording, analyzing, and transmitting data on the legal status, quantitative and qualitative characteristics, as well as the level of natural soil fertility, to higher management levels through an established system of accounting and reporting. The military actions in Ukraine have significantly impacted the financial accounting and document flow system of land resources in the agricultural sector, creating numerous challenges and problems that complicate business operations. Firstly, the destruction of infrastructure, loss of access to land plots, land mining of territories, and destruction of cadastral documents have significantly complicated land accounting and control over land use. In many cases, landowners and land users have lost the ability to maintain full financial accounting of their assets due to the physical loss of documents confirming ownership or lease rights. Secondly, as a result of military actions, the system for registering land plots in the State land cadaster and the Unified state register of property rights has been disrupted. This leads to delays in land purchase and lease transactions, as well as in the processes of normative monetary valuation.

Thirdly, due to economic instability and war-related risks, agricultural enterprises face difficulties in financial reporting and asset valuation. In particular, land resource accounting requires new approaches to determining the fair value of land, as military actions have significantly reduced the investment attractiveness and market value of agricultural land. Fourthly, the process of digitalizing land accounting has significantly slowed down due to the need to protect information and the limited access to electronic registries in active combat zones. This has complicated data updates, ownership verification, and land resource auditing. In the context of restoring the agricultural sector, it is essential to establish effective mechanisms for verifying and updating data on land plots, developing digital backup copies of cadastral information, and implementing

special support programs for farmers affected by the war. Additionally, improving the regulatory framework for recording land fund losses and establishing compensation mechanisms for damages is crucial. Thus, military actions have significantly complicated financial accounting and document management of land resources, requiring a comprehensive approach to restoring the accounting system, digitalization, and adapting regulatory frameworks to the conditions of wartime and post-war recovery.

6.5. Conclusions

Based on the conducted research, the following conclusions can be drawn:

1. Financial accounting of land resources is a key tool for managing the agricultural sector, ensuring effective control and analysis of land assets. The main issues in normative valuation include the heterogeneity of methodological approaches, outdated legislative acts, and insufficient compliance with international standards. The imperfection of land classification complicates the analysis of their utilization efficiency, affecting agricultural production planning. The implementation of digital technologies, such as GIS systems, blockchain, and automated cadastral registries, significantly improves the transparency and efficiency of accounting processes.
2. To ensure proper accounting of business transactions related to land resources, primary and analytical documentation forms have been developed for land plot accounting. In particular, it is proposed to use the "Land plot (share) transfer and acceptance act", which includes information on the quantitative and qualitative characteristics of the land, its origin, future use, location, as well as details on improvements made and the introduction of the plot into operation at the enterprise. Additionally, this document contains data on the monetary valuation of the land plot. In the process of agricultural sector reform and the transfer of land plots into private ownership, significant changes are occurring in the structure of land categories. In this regard, it is advisable to introduce an additional accounting document-the "Land plot reclassification act." Its application will allow for recording the reasons for land category changes, cadastral characteristics, the type and valuation of the plot, as well as its qualitative

condition at the time of reclassification from one land category to another.

3. To organize the analytical accounting of land resources, it is proposed to use the **"Inventory card for land plot (share) accounting,"** in which information is systematized into the following sections: data on land plot (share) acquisition; reasons for land plot (share) disposal; information on improvements made; revaluation results (value indexation, appreciation, or depreciation); records of land reclassification between land categories; general characteristics of the asset. To summarize and structure information on the quantitative and qualitative composition of land resources, it is advisable to maintain the **"Land accounting book of the business entity,"** where land plots are grouped based on ownership or usage rights and land categories.
4. We have developed recommendations aimed at improving the legislative framework for normative land valuation by simplifying procedures and harmonizing them with European standards. It is advisable to develop a unified classification of land resources based on modern analytical methods and international experience. The active implementation of digital technologies in land resource documentation is necessary to automate key accounting processes. It is recommended to strengthen state control over land asset utilization by creating integrated information platforms. Future research prospects require monitoring and analyzing the potential for artificial intelligence implementation in land accounting, as well as studying the impact of digital transformation on Ukraine's land market. Additionally, integrating and examining international experience in cadastral register automation, adapting it to Ukrainian conditions, and developing mechanisms for integrating land accounting with other financial management systems in agricultural enterprises are essential.

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URBAN AGRICULTURAL SYSTEMS AS A COMPONENT OF SUSTAINABLE ECONOMIC DEVELOPMENT OF TERRITORIAL COMMUNITIES

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7.1. Introduction

Modern urbanized areas, given the dynamic growth of the population and the growth of climatic anomalies, face several critical challenges. First, the growth of the anthropogenic load on the environment requires the introduction of highly efficient and environmentally balanced forms of management. In particular, in the context of rapid urbanization, when the number of urban populations exceeds the capabilities of existing infrastructure systems, there is an urgent need to optimize spatial planning, diversify food supply sources, and form added value within urban agglomerations. Second, the impact of climate change (sharp temperature fluctuations, droughts, rising sea levels, decline in biodiversity, etc.) requires the application of adaptation strategies that can support the economic resilience and food security of communities.

In this context, urban agricultural systems act as an effective mechanism not only for providing urban residents with fresh agricultural products but also for providing some important environmental and economic functions: reducing logistics costs, stimulating the development of small and medium-sized businesses, reducing the carbon footprint, and optimizing the use of water and land resources. At the same time, there is a need for a scientific justification of the economic feasibility of such systems because only thanks to clearly developed financial, organizational, and legal mechanisms is it possible to ensure their

long-term payback and integration into urban sustainable development strategies.

The relevance of the study is due to the need to develop scientifically grounded methods for assessing the economic efficiency of urban agricultural systems, which will not only determine their competitiveness but will also contribute to the formation of a favorable economic environment for their development. In the context of transformational changes in land relations, changes in the paradigm of land use in cities, and growing demand for local food initiatives, the task of determining the potential of urban agricultural systems as a driver of economic growth of territorial communities. In addition, their development is directly related to employment problems, the formation of local value chains, and the diversification of sources of income in the urban environment. The topic is of particular importance in the context of the reconstruction of the infrastructure and economy of Ukrainian cities after military destruction. The introduction of urban agricultural systems that meet the principles of economic profitability, social cohesion, and environmental safety can become a catalyst for accelerated recovery. These include new jobs, stimulation of domestic investment, and the introduction of innovative technologies with zero or minimal negative impact on the environment. At the same time, there is a growing need to develop a methodologically clear approach to assessing and comparatively analyzing the effectiveness of various forms of urban agricultural production, in particular for the formation of sound management decisions and areas of state or municipal support.

The purpose of the study is to scientifically and methodologically substantiate the economic efficiency of urban agricultural systems and develop recommendations for their integration into the spatial and economic structure of cities, considering the principles of sustainable development.

To achieve this goal, the following tasks have been formulated:

- Analysis of the prerequisites for the development of urban agricultural systems in the context of global economic, environmental and urbanization trends.
- Substantiation of the concept, classification and role of urban agricultural systems in the modern economy, their place in agri-food systems and spatial development of cities.

- Substantiation of the effectiveness of the methodology for assessing the efficiency of urban agricultural systems "Index of Sustainability of Urban Agricultural Systems" considering three key components: economic, environmental and social impact.
- Study of challenges and opportunities for the development of urban agricultural systems in Ukraine, analysis of financial, economic, environmental and organizational barriers that hinder the development of urban agricultural production.
- Formation of recommendations for the integration of urban agricultural systems into spatial planning, development of financial support mechanisms and promotion of investment in urban agricultural systems.

The scientific novelty of the study lies in the development of approaches to ensuring the financial and economic stability of urban agricultural systems through the adaptation of business models that consider social activity, environmental responsibility and diversification of funding sources. Strategies for supporting urban agricultural systems in the restoration of Ukrainian cities through attracting investments, financial incentive mechanisms and innovative approaches to management have been further developed.

The significance of the study lies in its practical orientation and the possibility of applying the results obtained in various areas of economic management and spatial development of cities. The developed approaches can be used by state authorities and local governments to form strategies to support urban agricultural production, develop financial and institutional incentive mechanisms, and integrate urban agricultural systems into the spatial planning of territorial communities. For enterprises and investors, the results of the study serve as an analytical basis for assessing the investment attractiveness of agribusiness in urban conditions, determining the level of profitability of production, assessing the financial stability of agricultural systems and forecasting their long-term impact on the economy of urban areas. NGOs and social initiatives can use the developed recommendations to expand the socio-economic role of urban agricultural systems in ensuring food security, creating new employment opportunities, stimulating social entrepreneurship and increasing the level of social cohesion of communities.

The results obtained will contribute to the improvement of economic approaches to the development of urban agricultural systems, increasing their efficiency and sustainability in the face of modern urban challenges. The research

also has the potential for further integration into international scientific discussions on urban agricultural production and its role in shaping new economic models for sustainable urban development.

7.2. Prerequisites for the development of urban agricultural systems

Climate change and urbanization processes are two key global trends that are radically transforming the economic, social and environmental systems of modern cities. They not only create new challenges for urban areas but also determine the prerequisites for adapting the urban environment to changing conditions, in particular through the introduction of urban agricultural systems. If climate change creates the need for environmentally sustainable models of food production and rational use of resources, then urbanization causes spatial and economic transformation, which requires innovative approaches to the integration of agricultural systems into the urban environment. Thus, the interaction of these two processes significantly affects the development of urban agricultural systems, determining their structural features, economic efficiency and spatial organization.

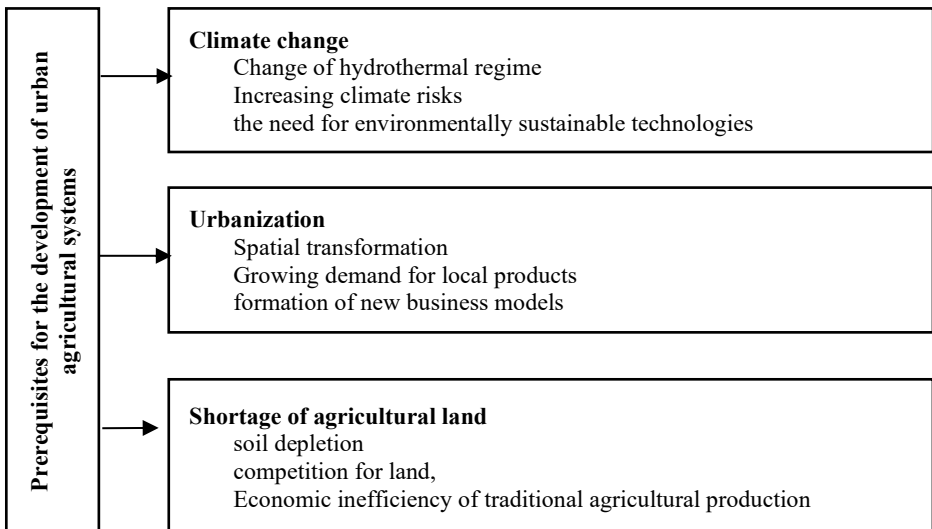


Figure 1. Prerequisites for the development of urban agricultural systems

Source: generated by the author

Climate change is a determining factor in the transformation of spatial planning, economic strategies and agricultural practices in urban areas. Rising average annual temperatures, precipitation instability, increased frequency of extreme weather events and degradation of natural resources create new challenges for the urban environment, in particular in the field of food security, water resources management and urban climate regulation. In the context of urban development, accompanied by an increase in building density, fragmentation of green spaces and an increase in anthropogenic load on the environment, urban agricultural systems are becoming an important element of adaptation to climate change and a tool for ensuring sustainable development of urban areas.

One of the key aspects of the impact of climate change on the prerequisites for the formation of urban agricultural systems is a change in the hydrothermal regime of urbanized areas. An increase in the average annual temperature in cities is accompanied by the effect of an urban heat island, characterized by abnormally high temperatures within urban areas compared to the surrounding rural areas. Decrease in the albedo coefficient and insufficient level of natural ventilation. The intensification of this process in the context of global warming causes an additional burden on urban infrastructure systems, increases the need for energy-efficient technologies and actualizes the need for the development of urban agroecosystems, which contribute to reducing overheating of territories, increasing air humidity and improving microclimatic conditions (Dudiak et al., 2024).

In addition, hydrological instability is essential, manifested in changes in the distribution of precipitation, the frequency of droughts and an increase in the level of evaporation from open surfaces. Urbanized areas are characterized by a high degree of impermeability of soils, which limits the possibilities of natural moisture absorption and causes rapid drainage of precipitation into drainage systems (Kernasiuk, 2021). As a result, the risks of urban floods are formed, causing significant economic losses and destabilizing the water balance of urban areas. The use of urban agricultural systems as an element of the green infrastructure framework of cities helps to reduce flood risks, improve water infiltration into the soil and create local mechanisms for the accumulation of precipitation for further use in agricultural needs.

The adaptive potential of urban agricultural systems is also due to their ecological function, which includes the regulation of the cycle of biogenic elements, the restoration of disturbed ecosystems and the increase in the level of biodiversity. Soil degradation and an increase in the level of atmospheric air

pollution in cities limit the possibilities of traditional agricultural production, which stimulates the development of innovative agricultural technologies, such as aeroponics, hydroponics and aquaponics. Agricultural systems allow for optimizing water consumption, reducing the use of pesticides and chemical fertilizers, and increasing the efficiency of food production in the face of growing climate risks (Langemeyer et al., 2021).

The increase in the frequency and intensity of extreme climatic events also affects the prerequisites for the development of urban agricultural systems. An increase in the number of days with extremely high temperatures, periods of prolonged droughts, severe hurricanes and hailstorms negatively affect the yield of traditional crops, which necessitates the use of adapted plant varieties that have increased resistance to climatic stresses. In addition, the development of vertical agricultural systems and closed ecosystems (greenhouses, urban farms based on artificial lighting) minimizes the risks of crop losses due to adverse climatic conditions and ensures the stability of agricultural production within cities.

In the context of food security, urban agricultural systems play a strategic role in creating local food supply chains, which reduces the dependence of urban areas on centralized imports of agricultural products. Climate change leads to the reduction of agricultural land due to soil degradation, land salinization and rising water scarcity, which stimulates the search for alternative models of food production. Compensating for the loss of agricultural production in traditional rural regions contributes to the diversification of food flows and increases the resilience of urban food systems to global climate risks (Skar et al., 2019).

In addition, climate change affects the socio-economic aspects of the development of urban agricultural systems, in particular, the structure of employment. Growing climate risks are creating a demand for new professions in the field of adaptive agriculture, environmental management, water resources management and innovative agricultural production, which contributes to the creation of jobs in the urban environment.

The current stage of global socio-economic development is accompanied by a rapid increase in the level of urbanization, which causes fundamental transformations in the spatial organization of cities, their resource base and economic structure. Urbanization, as a multifaceted process of concentration of population, capital and infrastructure in urban agglomerations, is a key factor influencing territorial food systems, the availability of natural resources, the configuration of land use and environmental Balance. The formation of meg-

acities, the expansion of suburban areas and the active development of industrial clusters create significant challenges for the agricultural sector, requiring the adaptation of food production models to the conditions of a limited urban spatial structure. In this context, urban agricultural systems are becoming a strategic tool for ensuring the food autonomy of cities, increasing the efficiency of the use of urban land resources and reducing the ecological footprint of urban agglomerations (Sonnino & Hanmer, 2023).

One of the defining aspects of the impact of urbanization on the development of urban agricultural systems is the transformation of spatial planning and land use. The growth of building density and the expansion of transport infrastructure and commercial zones contribute to the reduction of traditional agricultural land, which stimulates the need to rationalize the use of vacant land in the urban environment. The high level of competition for land resources between industrial, residential and recreational facilities forms the need for innovative forms of agricultural production that can be effectively integrated into urban development. In this context, vertical farms, hydroponic and aeroponic systems, rooftop greenhouses, agroparks and multifunctional green spaces play a key role in shaping sustainable urban land use patterns.

In addition, urbanization significantly affects the structure of food consumption and changes in consumer priorities of the population. The demographic growth of urban agglomerations is accompanied by a change in the structure of demand for food products, in particular, an increase in the consumption of ecologically clean, locally grown, organic products, which stimulates the development of urban agricultural production (Satterthwaite et al., 2020). In megacities, the concept of short food supply chains is being formed, which provides for minimizing logistics costs, reducing the carbon footprint of transporting products and ensuring the economic availability of fresh food for the urban population. This contributes to the active development of farmers' cooperatives, urban community gardens, local food initiatives and urban farming programs that ensure the sustainability of urban food systems in the face of global economic and environmental challenges.

Of particular importance in the process of urbanization is the economic aspect of the development of urban agricultural systems, which is determined by the high concentration of capital, innovative technologies and financial instruments in urban centers. The creation of agro-industrial clusters within urban areas contributes to the formation of new business models of urban farming, the development of startups in the field of agricultural technologies, the attraction of venture capital to sustainable farming projects and the introduction of digital

technologies in urban areas' agricultural production. The use of artificial intelligence, IoT solutions, automated climate control systems, biotechnology, and robotic mechanisms for growing plants increases the productivity of agricultural systems, minimizes production losses, and creates new economic opportunities for urban agricultural enterprises (Van Gerrewey et al., 2022).

Another significant consequence of urbanization is the increase in the energy burden on urban areas and the need to develop energy-efficient models of agricultural production. Traditional agricultural technologies are resource-intensive, which makes it impossible for them to be widely used in urban environments due to limited access to energy, water and land resources. In this context, urban agricultural systems focus on the use of renewable energy sources, the use of closed production cycles, the recycling of water resources and the integration of energy-saving technologies. This allows not only to reduce the environmental burden on the urban environment, but also to ensure the long-term economic efficiency of urban agricultural production.

Urbanization also causes significant social changes that directly affect the structure of employment and the formation of human capital in the field of urban agricultural production. Industrialization, automation, and digitalization of urban economies are accompanied by the displacement of traditional agricultural practices from the labor market, which creates a need for new professional competencies and specializations. The development of urban agricultural systems stimulates the creation of jobs in the field of ecological farming, agrotechnological engineering, food systems management and urban planning, which contributes to increasing the level of social stability in cities and ensures the sustainability of local economic systems.

In addition, urbanization processes stimulate the expansion of institutional mechanisms to support urban agricultural systems, including state subsidy programs, investment funds, tax incentives for ecological farming, grant initiatives, and financial mechanisms for sustainable development. The involvement of public and private capital in the development of urban agricultural production contributes to the formation of inclusive food policies, the strengthening of urban agricultural cooperatives and the development of multifunctional ecosystems of urban farming.

The global trend of agricultural land reduction is a critical factor that necessitates the transformation of agri-food systems, in particular through the integration of urban agricultural systems into the spatial structure of cities. The depletion of soil resources, the growth of urbanized areas, industrial expansion

and changes in land use cause a structural shortage of land suitable for agricultural activities, which, in turn, threatens food security and the sustainability of agricultural production. In conditions when agricultural landscapes are increasingly giving way to residential and industrial development, the development of urban agricultural systems is becoming a strategic direction for ensuring the food autonomy of cities, rationalizing the use of land resources and minimizing the negative impact of anthropogenic factors on ecosystems.

Separately, it should be noted that one of the determining factors in the reduction of agricultural land is the accelerated expansion of urbanized areas, which is accompanied by the intensive development of peripheral zones of cities. The economic attractiveness of urban lands, due to the high level of capitalization of real estate and the dynamic development of infrastructure, leads to competition between agricultural and non-agricultural use of land resources, which leads to their mass withdrawal from agricultural production. International organizations estimate that the annual loss of productive agricultural land due to urbanization is about 3.3 million hectares in the world, which is equivalent to the area of an average European country (FAO, 2023). In Ukraine, this problem is also becoming alarming, as intensive urbanization, expansion of transport routes, logistics hubs and industrial facilities cause a rapid reduction in agricultural land, especially in the suburbs of large agglomerations.

In addition to the urbanization factor, land degradation is another key factor in the formation of agricultural land shortages. Unfavorable climatic changes, soil erosion, desertification, salinization and depletion of agricultural landscapes cause a decrease in the productivity of traditional agricultural production, which increases the need to search for alternative models of agriculture. Soil depletion is especially relevant in countries with a high level of anthropogenic load, where intensive use of fertilizers, monoculture farming and irrational agricultural technologies lead to a decrease in organic matter in soils, which makes it impossible for them to be further used in traditional agriculture. In this context, urban agricultural systems based on soilless cultivation technologies, closed ecosystems and innovative methods of resource management make it possible to compensate for the loss of traditional agricultural land and ensure efficient food production within the urbanized space.

The shortage of agricultural land is also a consequence of the economic inefficiency of traditional agricultural production in regions with high capitalization of land resources. In cities and suburban areas, where the market value of land is extremely high, the use of land for traditional agriculture becomes unprofitable compared to other economic activities. This causes agricultural

production to be displaced from areas with a high level of urbanization, which in turn increases logistics costs, rising food prices and increasing dependence of urban food systems on foreign markets. The formation of urban agricultural systems allows for minimizing transport costs, ensuring the stability of food supplies and optimizing the use of urbanized space, which is critically important in the context of ensuring the economic efficiency of the urban food sector.

Another important factor is the growing role of ecological farming, which involves the limited use of chemical fertilizers, rational management of water resources and the reduction of greenhouse gas emissions. In the context of a shortage of agricultural land, traditional methods of extensive production become less effective, while urban agricultural systems offer closed production cycles, the use of alternative energy sources, the minimization of resource losses and adaptation to environmental challenges. This contributes to the development of "smart agriculture", digital management of agricultural production, automation of production processes and the use of precision farming technologies, which allows you to obtain stable yields under conditions of limited land resources.

Thus, climate change, urbanization and shortage of agricultural land are key prerequisites for the development of urban agricultural systems, forming the need to adapt food systems to modern global challenges. Increasing climate threats, including rising average annual temperatures, water imbalances and increasing frequency of extreme weather events, pose risks to traditional agriculture, which stimulates the search for innovative approaches to food cultivation. At the same time, urbanization processes entail spatial transformation, which is accompanied by a high level of competition for land resources, fragmentation of agricultural landscapes and an increase in demand for locally produced products. The shortage of agricultural land caused by urbanization, soil degradation and the economic unprofitability of traditional agricultural production in cities and suburbs requires a rethinking of land use models and the introduction of alternative cultivation methods. The interconnection of these factors forms an objective need for the development of urban agricultural systems that ensure the efficient use of urban space, the reduction of food supply chains, the reduction of the environmental burden and the increase of the sustainability of urban food systems. In this paradigm, urban agricultural systems act not only as a response to threats but also as a strategic tool to ensure the sustainable development of urbanized areas in the context of modern global transformations.

7.3. Concept, classification and role of urban agricultural systems

Urban agricultural systems are one of the key elements of modern urban transformation, combining economic, social and environmental aspects of the development of urban areas. Their concept was formed under the influence of global challenges, in particular climate change, growing urbanization, shortage of agricultural land and the need to ensure a sustainable food supply in conditions of limited natural resources. At the same time, urban agricultural systems should be considered not only as a means of food supply but also as a strategic tool of spatial planning that contributes to the creation of self-sufficient, environmentally sustainable and cost-effective urban environments.

In modern scientific research, urban agricultural systems are viewed through the prism of three main dimensions: environmental, economic, and social (Kumar & Yadav, 2023). In the context of environmental sustainability, they contribute to reducing the carbon footprint, optimizing the use of water and land resources, managing organic waste and reducing the negative impact of urbanization on the environment. The economic role of urban agricultural systems is manifested in the formation of local food chains, the creation of new jobs, the diversification of economic activities of cities and the stimulation of entrepreneurship in the field of urban farming. The social dimension includes the development of urban communities, ensuring food security, increasing the level of social cohesion and improving the quality of life of the urban population (Fanfani & Duží, 2022).

The growing interest in urban agricultural systems is explained by their institutional integration into urban development strategies. At the political level, they are seen as a tool for sustainable development, which allows reducing the dependence of cities on external food supplies, supporting local production and strengthening the ecosystem functions of urban spaces (Wesseler & von Braun, 2017). In many countries, including the Netherlands, the United States and Canada, urban agricultural systems are already part of strategic urban planning, which is confirmed by the provision of state subsidies, tax benefits and the creation of legal mechanisms for their integration into the spatial structure of urbanized areas.

Information support for urban agricultural systems also plays an important role in their development. The media popularize the concept of urban farming through the coverage of successful cases of urban farms, environmental initiatives and social projects, which contributes to the formation of a posi-

tive public attitude towards this practice. On the other hand, society increasingly considers urban agricultural systems not only as a food initiative but as a comprehensive mechanism for cities to adapt to global challenges, including the food crisis, climate change and social disintegration.

In international scientific practice, urban agricultural systems are defined through a wide range of terms, including "urban agriculture", "urban farming", "community gardening", "rooftop farming", each of which has a certain specificity depending on the territorial context, the level of integration into the urban environment and the target functionality. Despite the diversity of approaches to definition, the key characteristic of urban agricultural systems remains their integration into the urban environment to produce food, increase the resilience of cities and preserve the ecological balance.

Urban agricultural systems, as a complex phenomenon of modern urban development, form new paradigms of integration of agricultural activity into the urban environment, which necessitates their regulation. However, the domestic legal framework does not contain clearly defined mechanisms for promoting or regulating these activities, which creates numerous administrative and economic barriers to their development. One of the key problems is the lack of a coordinated terminological apparatus, which complicates the institutional integration of urban agricultural systems into spatial planning, agricultural policy and environmental strategies of the state.

The analysis of Ukrainian regulations shows that none of the current legislative documents contain a clear definition of urban agricultural systems or provisions regulating their activities (Barulina, 2024). The main legislative barriers are related to restrictions on the use of land resources within urban areas. In particular, the Land Code of Ukraine does not provide for a special legal regime for agricultural production in cities, which complicates the implementation of urban farming initiatives due to the need to change the purpose of land (Land Code of Ukraine, 2025). This significantly narrows the opportunities for attracting investment in this area, reduces the flexibility of legal regulation and hinders the institutional development of urban agricultural systems.

Also, the Law of Ukraine "On Farming" does not contain provisions that would take into account the specifics of urban farming (On Farming, 2024). The support mechanisms and legal conditions for the activities of farms defined in the law are not adapted to the specifics of urban agricultural systems, which complicates their access to financial instruments, subsidies and agribusiness support programs. A similar situation is observed in the Law of Ukraine "On Personal Farming", which regulates the activities of agricultural producers

only within agricultural land, not covering urban agricultural systems (On Personal Farming, 2024).

A separate problem is that urban planning legislation does not contain mechanisms for taking urban agricultural systems into account in spatial planning. Master plans of cities, as a rule, are focused on other land use priorities, while the Law of Ukraine "On Regulation of Urban Planning Activities" does not provide for regulatory provisions on the development of urban agricultural initiatives (On Regulation of Urban Planning Activities, 2025). The lack of integration of urban agricultural systems into urban planning documents leads to the fragmentation of their development and complicates the process of their legalization.

Instead, environmental legislation, in particular the Law of Ukraine "On Environmental Protection", contains provisions that can potentially contribute to the development of urban agricultural systems in the context of sustainable use of natural resources and rational management of organic waste (On Environmental Protection, 2024). However, these provisions are not directly related to the development of urban farming as a separate area of activity, which creates additional legal uncertainties.

In addition to legislative barriers, significant challenges are the imperfection of the terminological apparatus used in the Ukrainian scientific and legal field. In addition, there is terminological uncertainty, which greatly complicates the coherence between different regulations and scientific research. In the Ukrainian scientific discourse, different terms are used to refer to urban agricultural systems – "urban agriculture", "urban farming", "urban farming", "urban agriculture", "city farming" - which complicates their interpretation and implementation in the legal plane. At the same time, certain terms cause lexical contradictions since they combine concepts that are opposite in the classical sense ("urban" and "agriculture"), which can affect the perception of this phenomenon both in scientific circles and among practitioners.

A detailed analysis of foreign definitions of urban agricultural systems, in particular those proposed by FAO (n.d.), McEldowney (2017), Mougeot (2001), and Smit (1996), demonstrates their significant variability depending on conceptual approaches to the study of this phenomenon. In the international scientific environment, they are defined either as a branch of urban spatial planning and environmental regulation, as economic activities aimed at creating sustainable food systems within the cities, or as a multifunctional system that integrates food production, social cohesion and environmental sustainability of urban areas. Despite the wide range of approaches, most definitions emphasize

that urban agricultural systems should not be limited exclusively to food cultivation, as they also perform ecosystem, social and economic functions, which is a key difference from traditional agriculture.

An important aspect of the development of urban agricultural systems is their integration into the spatial planning of cities, which in world practice is implemented through the expansion of green space zones, the creation of special zones for urban agriculture, institutional support for agricultural initiatives and the introduction of legal mechanisms for their incorporation into urban development strategies. The absence of such mechanisms in Ukraine indicates the need to form a comprehensive policy in the field of urban agricultural systems, which will include modification of legislative norms, adaptation of spatial planning, introduction of financial incentives and support for socio-economic initiatives within cities.

Therefore, the presence of legal barriers, terminological inconsistencies and the lack of a strategic vision for the development of urban agricultural systems in Ukraine create significant challenges for their implementation in the urban space. To ensure their effective development, it is necessary to conceptually define this phenomenon, adapt legal regulation and introduce institutional mechanisms to support urban agricultural production. This will not only eliminate existing regulatory restrictions but also contribute to expanding opportunities for the implementation of urban agricultural initiatives, which play a key role in ensuring food security, ecological balance and socio-economic sustainability of urbanized areas.

The analysis indicates the need to form a unified definition that would reflect the specifics of urban agricultural systems in a broad socioeconomic and environmental context. The existing definitions proposed by foreign researchers have a significant level of detail and consider the economic, environmental and social aspects of urban agricultural production. However, they do not consider the specifics of the Ukrainian legal and spatial context, which necessitates the development of an adapted definition.

The analysis of the existing definitions of urban agricultural systems allows us to identify several important aspects that need to be clarified within the framework of this study. Firstly, most scientific approaches focus on the technological and environmental aspects of urban farming without fully considering its economic component and role in the structural development of urban areas. Second, the definitions of urban agricultural systems are often limited to traditional agricultural production methods, not considering innovative agricultural

technologies, including vertical farming, closed cultivation systems, and intelligent agricultural platforms. Thirdly, in many cases, the concept of urban agricultural systems is considered only in the context of small-scale production, although modern practice demonstrates the growth of large commercial agricultural enterprises integrating into urban infrastructure.

Based on the analysis, the author's definition of urban agricultural systems can be formulated as follows:

"Urban agricultural systems are systems located in urban communities that are engaged in the production, processing and distribution of various food and non-food products of crop and livestock production, using intensive and innovative methods based on the principles of circular economy and sustainable development, to meet the daily demand of urban consumers, contribute to the preservation of the environment and support the socio-economic development of local communities."

This definition allows integrating the environmental, economic and social functions of urban agricultural systems into a single conceptual framework, which contributes to a more comprehensive understanding of their role in the development of modern cities. In particular, urban agricultural systems can act not only as an alternative to traditional agriculture but also become a key element of urban ecosystems that ensure the circularity of resources, reduce the environmental burden and increase the self-sufficiency of urban areas.

Thus, the development of urban agricultural systems is a natural process due to global challenges related to sustainable food supply, spatial planning and environmental safety of cities. Their integration into the urban environment allows solving complex problems of optimizing land use, forming a circular urban economy and ensuring the sustainability of urban systems in the long term.

Urban agricultural systems play a significant role in the development of food systems of cities, ensuring ecological balance and the formation of social cohesion, but their diversity and multifunctionality complicate the process of their classification. The lack of a single typology creates conceptual uncertainty, which complicates the formation of effective policies for their support, assessment of economic and environmental effects, and integration into sustainable urban development strategies (Barulina, 2024).

At the international level, there are already typologies developed within the framework of European and global studies, such as COST Action Urban Agriculture Europe (Lohrberg et al., 2016, p. 38), the European Forum on Urban Agriculture (2022) and FAO, Rikolto and RUAF (2022, p. 156), which make it possible to consider urban agricultural systems in various aspects –

from social initiatives to high-tech agro-industrial production. However, the analysis of these typologies and their comparative characteristics (See Table 1.) demonstrates significant differences in approaches to the classification of urban agricultural systems, which is due to different research focuses and priorities.

In particular, COST Action Urban Agriculture Europe pays more attention to traditional forms of urban agriculture, such as community gardens and educational and therapeutic gardens, which focus on social inclusion and environmental sustainability. Instead, EFUA focuses on high-tech systems, including vertical farms and commercial urban agribusinesses, aimed at maximizing the use of urban resources. In turn, the FAO, Rikolto and RUAF typology systematizes urban agricultural systems according to the degree of commercial orientation, outlining the difference between food initiatives for self-consumption and market-oriented models.

The importance of developing a clear typology of urban agricultural systems is due to the need to unify approaches to their analysis, the development of support policies and the formation of regulation. A structured typology allows not only to systematize urban agricultural systems according to the main characteristics, such as production methods, forms of ownership, level of commercialization, location and environmental aspects, but also to determine the strategic directions of their development in the conditions of a specific urban environment.

Table 1. Comparative analysis of typologies of urban agricultural systems

Comparison aspects	COST Action Urban Agriculture Europe	EFUA (European Forum on Urban Agriculture)	FAO, Rikolto and RUAF
Social integration	Community gardens and garden associations promote social cohesion	Community parks and social farms integrate communities through agriculture	Community and collective gardens strengthen social bonds
Food security	Urban farms and garden associations contribute to food security	Urban farms provide products for both consumption and sale	Home gardens and commercial farms provide products for consumption and sale
Environmental sustainability	Permaculture gardens contribute to environmental sustainability	Vertical farms and innovative projects focused on reducing resources	Using organic methods and permaculture to minimize impact

Commercial Component	Urban farms are focused on commercial production	Some farms are sales-oriented, but many initiatives have social goals	Clear distinction between commercial and social agricultural systems
Technological Innovation	Less emphasis on technology, more traditional forms	Vertical trusses and hydroponics play a key role	Use of technology for commercial production and institutions
Scope of activity	Covers different scales – from gardens to farms	Covers a wider range from public to large farms	Households and commercial households of various sizes

Source: generated by the author

One of the key aspects of the problem is that most of the existing typologies are developed considering the socio-economic context of developed countries, where urban agricultural systems are already integrated into spatial planning, receive state support and are considered as part of the food strategy. At the same time, in Ukraine, urban agricultural systems do not yet have a clear regulatory definition, which complicates their development. The lack of formal legal status for many types of urban agricultural systems, such as community gardens, social farms or vertical farms, creates institutional barriers to their implementation, limiting the possibilities of obtaining financial support and assistance from municipalities.

In addition, the problem lies in the terminological ambiguity since different research and policy institutions use different concepts to refer to urban agricultural systems, which complicates their implementation in state programs. In the scientific literature, you can find such terms as "urban agriculture", "urban farming", "city farming", and "urban agriculture", which, despite their similarity, can have different contexts of application.

Thus, the lack of a generally accepted classification of urban agricultural systems hinders their integrated development and integration into the spatial, economic and social strategies of cities. To eliminate this problem, it is necessary to adapt the existing typologies to the specific features of the Ukrainian urban environment, which will allow:

- To create a clear classification system for urban agricultural systems by their functional characteristics and level of integration into the urban environment.

- To identify potential directions for the development of urban agricultural systems that best meet the challenges of urbanized territories of Ukraine.
- Develop effective support policies for certain types of agricultural systems, considering their socio-economic and environmental functions.
- To contribute to the formation of the legal status of urban agricultural systems and the definition of mechanisms for their regulation.

Thus, the systematization of urban agricultural systems according to clear criteria is an important step for their effective development and integration into the urban environment. Considering the specifics of urban space and the ecological, social and economic aspects of their functioning, it is advisable to form a coordinated typology that will reflect the key characteristics and differences between different forms of urban agricultural production.

With this in mind, this study proposes the author's typology of urban agricultural systems, which considers international experience and adapts to Ukrainian realities.

Typology of urban agricultural systems for Ukraine:

1. Urban farm – agricultural enterprises located within urban territorial communities and specializing in the cultivation of various types of agricultural products, such as vegetables, fruits, herbs, as well as animal husbandry, poultry farming and aquaculture. These farms operate within an urban or suburban area and play an important role in providing citizens with fresh, local products. In addition to the main activity of growing products for sale, urban farms offer a wide range of additional services that combine agricultural activities with recreational and educational activities. Such farms organize agritourism, public tastings, and master classes and can also provide space for cultural events, festivals and photo shoots. This helps to strengthen the ties between producers and consumers, as well as create a sustainable economic model.
2. A public garden is a shared urban space where locals collectively grow vegetables, fruits, and other plants for their consumption or sharing. These gardens are often located in adjoining areas, municipal lands, or areas specifically designated by local authorities. Public gardens not only have a food function but also fulfil a social and ecological role, contributing to community cohesion and greening the city.
3. Home gardens are private household plots where owners grow vegetables, fruits, berries, and other plants and also engage in animal husbandry for their consumption and sometimes to sell surpluses in local markets.

This system is the most common in Ukraine, especially in the suburbs. Home gardens play a key role in ensuring food security at the household level, enabling people to reduce food costs and get fresh produce throughout the year.

4. A social farm is an enterprise that combines the cultivation of agricultural products with a social mission aimed at supporting vulnerable segments of the population. These can be people with disabilities, war veterans, children, or other groups in need of rehabilitation and social integration. In the context of the war in Ukraine, the importance of such farms increases significantly, as many veterans who have been injured or become disabled need physical and psychological rehabilitation. Social farms offer them the opportunity to recover through work on the land, communication with nature and socialization in communities.
5. Educational farms are special agricultural initiatives created to teach children, youth and adults the basics of agriculture, sustainable development and environmental awareness. Such farms are often organized at schools, educational institutions or communities and provide the opportunity for interactive learning through direct participation in agricultural activities. In Ukraine, educational farms are of particular importance, as agricultural skills can be important for self-sufficiency and economic support of communities, especially in difficult times.
6. Vertical farms are high-tech agricultural systems that use vertical planes to grow plants in urban environments. Through the use of technologies such as hydroponics, aeroponics, and artificial lighting, these farms allow greens, vegetables, and even mushrooms to be grown in a limited area. The main advantage of vertical farms is the possibility of intensifying agricultural production in densely populated urban areas or even in rooms where conventional farming methods are not possible.

The development of a systematic typology of urban agricultural systems is an important element of ensuring the sustainable development of urbanized territories of Ukraine. It allows not only to structure approaches to urban agricultural production but also to create an effective basis for assessing their economic efficiency, environmental sustainability and social impact. In the context of growing food risks caused by hostilities, economic instability and climate change, urban agricultural systems act not just as an element of alternative production but as a strategic tool for the formation of an autonomous, adaptive and efficient food system of urban communities. In Ukraine, where a significant

part of agri-food chains has been disrupted due to the destruction of infrastructure and logistical constraints, the development of urban agricultural systems allows for minimizing dependence on imported products, reducing transportation costs, reducing transportation losses and providing citizens with affordable and high-quality food products.

The proposed typology considers various forms and models of functioning of urban agricultural systems, which makes it possible to distinguish them according to the main criteria: economic orientation, social functionality, level of technological support and scale of production. In particular, urban farms act as important actors in the formation of local food markets, as they provide a commercial component focused on profitable production and sale of products, which contributes to the development of small and medium-sized businesses. At the same time, public gardens and social farms form alternative models aimed at social integration, increasing food security among vulnerable segments of the population and activating civil society by involving citizens in joint work. Home gardens, which traditionally occupy an important niche in the Ukrainian economy of households, reduce the level of dependence on external sources of supply, ensure self-employment and contribute to the rational use of urban space.

The development of educational farms plays a significant role in the formation of human resources of the agro-industrial complex, as it contributes to the involvement of young people in agricultural production and the popularization of agribusiness as a promising field of activity. Vertical farms focused on high-tech production provide innovative solutions for intensifying agricultural processes within an urbanized environment. They allow optimizing the use of urban resources, reducing the cost of transportation, water and energy resources, which is critical for the formation of a circular economy in the face of a shortage of natural resources.

The interaction between different types of urban agricultural systems is a key aspect of their effective functioning. Urban farms can act not only as production units but also as educational and social hubs, providing training and rehabilitation for socially vulnerable groups, including war veterans and internally displaced persons. Public gardens can be integrated into municipal development programs aimed at improving the ecological quality of urban spaces, contributing to reducing the level of thermal pollution, the formation of natural recreational areas and the formation of an ecologically sustainable environment. Educational farms can expand their activities through cooperation with

urban farm enterprises, providing young people with practical skills in agricultural business, which will contribute to the creation of new jobs and the development of agricultural innovations in urban communities.

Particular attention should be paid to commercial models of interaction, in particular the formation of cooperative associations, which allow optimizing costs and ensuring joint sales of products. Collaboration between vertical farms and urban farmers can contribute to the creation of high-performance production clusters that apply economies of scale, ensuring the competitiveness of urban agribusiness at the national level. Institutional support from municipalities, including the provision of tax incentives, incentives for investment in high-tech agricultural systems and the development of strategic programs for the development of urban agriculture, can significantly improve the conditions for the functioning of these systems.

Thus, the typology of urban agricultural systems allows us to form a systematic vision of the role of urban agricultural production in the socioeconomic development of urbanized areas. It contributes to the identification of strategic priorities for the development of this area, allows you to identify potential risks and barriers to its spread, and also serves as a basis for the development of effective support mechanisms at the level of public policy. The integration of urban agricultural systems into the overall economic model of the city will contribute to increasing the level of food security, economic diversification, social cohesion and environmental sustainability, which is critically important in the current conditions of urbanization and global transformations.

7.4. Methodology for assessing the efficiency of urban agricultural systems: "Index of sustainability of urban agricultural systems"

Despite the significant potential of urban agricultural systems, their impact is still not clear and easily understood due to the lack of unified approaches to assessment. This makes it difficult for communities, city planners, and investors to determine their real value and effectiveness. To maximize the benefits of urban agricultural systems and promote sustainable development, it is necessary to develop a methodology that will allow assessing their economic, environmental and social impact in a complex.

Today, there are many generally accepted and authoritative methods for assessing certain aspects of the effectiveness of enterprises, projects and initia-

tives – economic, environmental and social – which foreign and domestic scientists successfully apply to study the effectiveness of urban agricultural systems. Among these tools, the following can be distinguished.

To assess economic efficiency, methods are used to determine how successfully the agricultural system functions from a financial point of view:

1. Cost-Benefit Analysis (CBA), which compares all costs associated with the implementation of a project (e.g. initial investment, operating and accompanying costs) with the potential benefits it can bring (revenues, cost reductions, positive externalities).

Thus, in a study (Hosseinpour et al., 2022). The authors used CBA to assess the feasibility of introducing urban agriculture in park design. The resulting cost index of 4.08 indicated the cost-effectiveness and low risks of such a solution, which confirmed the effectiveness of this method for assessing the effectiveness of urban agricultural systems. At the same time, CBA may not fully consider environmental and social aspects, so it is often combined with other methods for a more comprehensive assessment of sustainable projects, such as urban agricultural systems.

2. Net Present Value (NPV) is a financial instrument used to assess the long-term profitability of a project, considering the time value of money. Its essence is to compare the present (discounted) value of future cash receipts from the project with the present cost of its implementation. If the NPV is positive, it indicates the financial feasibility of the project (the benefits outweigh the costs), while the negative NPV value indicates the unprofitability of the investment.

As indicated in the study (Avgoustaki & Xydis, 2020). The method is widely used in the field of investment decision-making, as it allows you to consider key factors such as risk and inflation, which can have a significant impact on the sustainability of the project in the long term.

To assess environmental efficiency, the following methods are used to measure the impact of activities on the environment:

1. Life Cycle Assessment (LCA) is a technique that allows you to comprehensively assess the environmental impact of a product, service or process at all stages of its life cycle: from the extraction of raw materials and production to use and disposal. LCA makes it possible to estimate the number of resources used, energy consumed, and the amount of pollution generated at each stage. This allows you to determine the environmental sustainability of the project and ways to minimize the negative impact.

As indicated in the study (Langemeyer et al., 2021), this method is particularly useful for evaluating urban agricultural systems focused on increasing the sustainability of the urban environment and reducing the carbon footprint and energy load. LCA helps identify "hot spots" – the stages that consume the most resources or create the most pollution, which is critical to achieving environmental sustainability. However, this method is quite time-consuming and requires significant resources and detailed data, which can be an obstacle to its application by small businesses or communities.

2. The Ecological Footprint is an indicator that measures the number of natural resources needed to support a particular activity, consumption or lifestyle compared to the planet's ability to renew these resources. It is expressed in hectares and considers the area of land and water resources necessary for the production of consumed goods, the absorption of emissions (such as CO₂) and the disposal of waste.

As indicated in the study (Taylor & Lovell, 2021), The ecological footprint is an effective tool for assessing the environmental sustainability of urban agricultural systems and their compliance with the environmental standards of the urbanized environment. Cities and even countries. At the same time, its use has certain limitations, in particular, the underestimation of local environmental features and complex ecosystem relationships.

The following methods are used to assess social efficiency:

1. The Social Impact Assessment (SIA) is a methodology that analyses the potential impact of a project on the social aspects of the population's life, including employment, well-being, social inclusion, and quality of life. SIA investigates how the implementation of the project can affect different populations, with a particular focus on vulnerable categories, and determines whether these changes will contribute to improving social conditions and community cohesion.

The main goal of SIA is to identify both positive and negative social impacts, which allows project managers to prevent risks and adapt the project to the interests of the community. This contributes to the formation of a more sustainable foundation for the project, ensuring the integration of the needs and opinions of stakeholders. As noted by Bailkey and Nasr (2021) Urban agricultural systems can significantly influence social aspects, increasing food security, strengthening social cohesion and creating new economic opportunities for local communities. The use

of SIA in such projects allows not only the assessment of these benefits but also the consideration of all the factors that affect the sustainability of the project, providing an integrated approach to social assessment in the urban environment.

However, the SIA method has certain limitations: it is often based on qualitative data and respondents' opinions, which can lead to subjectivity, making it difficult to quantify and compare the results with other projects.

2. Stakeholder Analysis is a method that allows you to identify the interests, needs and influences of different groups or individuals involved in the implementation of a project for a deeper understanding of their expectations and possible reactions. It includes identifying key stakeholders (e.g. local communities, investors, government authorities, partners), analysing their impact on the project and assessing their level of interest or support.

The application of this method allows you to adapt communication and interaction strategies to different groups, contributing to increasing social cohesion and reducing the risks of conflicts. Considering the interests of all stakeholders ensures transparency, openness and building trust in the project. Urban agricultural systems can significantly contribute to the creation of sustainable cities, and the integration of the stakeholder analysis approach allows not only to meet the needs of communities but also to promote social inclusion. Such an integrated approach to considering the interests of different groups increases the efficiency of the implementation of urban agricultural system projects and contributes to their sustainable development.

However, the assessment of urban agricultural systems solely by individual components does not allow a complete and objective picture of their impact and potential. In modern conditions, there is a growing need to apply integrated approaches that combine economic, environmental and social aspects in a single assessment system. This approach allows you to conduct a comprehensive analysis of the effectiveness of agricultural systems and make informed decisions on their implementation and development.

To ensure a comprehensive approach to assessing the effectiveness of urban agricultural systems, it is important to apply integrated methods that consider all dimensions – economic, environmental and social. One such approach

is the Triple Bottom Line (TBL) concept, which focuses not only on financial performance but also on sustainability aspects.

The TBL concept evaluates the effectiveness of an organization or project through three main dimensions: economic, environmental and social. Its goal is to help organizations and communities make decisions aimed at sustainable development and not be limited by financial indicators.

TBL is an effective tool for assessing the sustainability of urban agricultural systems, as it considers all key aspects important for sustainable development in an urbanized environment. As the article by (Li et al. 2022) demonstrates, TBL has been successfully applied to assess urban agriculture in Shanghai, which confirms its ability to provide a comprehensive assessment of sustainability, highlighting the importance of each of the dimensions for the development of urban agricultural systems.

Based on the analysis, the author's methodology "Index of Sustainability of Urban Agricultural Systems" was developed, which considers the specifics of the economic, environmental and social impact of urban agricultural systems, adapted to the conditions of urban development of Ukraine (Barulina, 2024).

This index allows you to systematically assess the effectiveness of agricultural systems in three main areas – economic, environmental and social – and determine their impact on the community, the environment and the local economy.

The Urban Agricultural Systems Sustainability Index provides an integrated approach to assessing the efficiency of urban agricultural systems. It is focused on determining the level of sustainability, analysing the impact on social cohesion and environmental stability, and assessing the ability of agricultural systems to ensure long-term economic efficiency.

The methodology considers three main areas: economic, environmental and social. Within each direction, 10 indicators cover the key components of the sustainable development of urban agricultural systems, allowing for a comprehensive assessment of their effectiveness and potential.

The economic direction assesses financial efficiency and contribution to the local economy.

List of indicators:

1. Increase in tax revenues
2. Number of jobs created
3. Profitability of production
4. Investment return

5. External funds raised
6. Return on investment
7. Unit Area Maintenance Costs
8. Volume of products produced per unit area
9. Gross income per unit area
10. Diversification

The environmental direction assesses the impact of urban agricultural systems on the environment, in particular the efficiency of resource use, reduction of pollution and the promotion of environmental sustainability.

List of indicators:

1. Improving air quality
2. Organic waste management efficiency
3. Energy consumption per unit of production
4. Water consumption per unit of production
5. Energy efficiency and use of renewable energy
6. Environmental Efficiency of Transport Logistics
7. Maintaining the natural nutrient cycle
8. The level of environmental responsibility of the agricultural system
9. Water efficiency
10. Biodiversity

The social direction assesses the impact of urban agricultural systems on the community, in particular their contribution to improving the quality of life, social cohesion and support for vulnerable groups.

List of indicators:

1. Community Activity and Engagement
2. Educational activities of the agricultural system
3. Development of entrepreneurial initiatives in the field of urban agricultural systems
4. Involvement of young people in agricultural projects
5. Social cohesion and quality of life
6. Inclusion and support for vulnerable groups
7. Cooperation and partnership in the community
8. Number of social jobs created
9. Level of gender equality and women's involvement
10. Ensuring local food security

For each indicator, a 10-point assessment scale has been developed (see Appendix G), which allows you to consider the features of each direction and provides quantitative indicators for a comprehensive analysis. The scale is

structured in such a way that 1 point means the minimum level of influence or achievement, and 10 points means the maximum.

Data for each indicator is collected by surveying the owners of the agricultural system and monitoring their activity on social networks.

Questionnaires are one of the key methods of collecting information in the methodology for assessing the effectiveness of urban agricultural systems, as they provide accuracy, standardization and wide coverage of data necessary for in-depth analysis.

The questionnaires cover indicators of economic, environmental and social efficiency, which allows you to get a holistic view of the activities of the agricultural system. This is important for a comprehensive assessment of the impact that the agricultural system has on the community and the environment.

All questions in the questionnaires are formulated in such a way as to obtain information in a unified form. This provides convenience for further analysis, comparison between agricultural systems and identification of trends. Each question in the questionnaire provides not only the variability of answers but also the possibility of your expression. This helps to consider the uniqueness of each agricultural system and ensures accuracy in collecting data for indicators. Free answers allow respondents to provide detailed explanations that can expand the possibilities of evaluating and adapting the methodology, as urban agricultural systems are constantly evolving, and approaches to their activities are changing with them.

The questionnaire was chosen as the main method of data collection due to its flexibility, accessibility and the possibility of obtaining internal information. This method allows:

- Systematize the process of collecting data for a wide range of indicators.
- to ensure high accuracy of data collection through the direct participation of agricultural system owners.
- to increase the reliability of assessments, providing respondents with the opportunity to independently inform about the specifics of their activities.

Another method of obtaining information was the monitoring of activity in social networks, which is a flexible and effective tool that allows you to obtain additional data to assess both social, environmental, and economic indicators of the agricultural system. In addition to tracking community engagement, this method of gathering information allows you to gain important insights into products, services, active seasons, and customer feedback.

An economic assessment based on social media monitoring allows you to analyse in detail the activity of the agricultural system through the study of the content on its pages. Firstly, the analysis of publications makes it possible to trace the range of products, including both seasonal and permanent goods, as well as additional services such as workshops or excursions, which is important because the complete list of products and services reflects the ability of the agricultural system to adapt to the needs of the market. Secondly, monitoring marketing activity, frequency, and nature of promotional posts allows you to determine the level of economic activity, the popularity of products and consumer reviews, which are important indicators of demand and market stability of the agricultural system. Finally, permanent or seasonal collaborations with local businesses, as well as participation in market events covered on social networks, allow you to assess the level of partnership with local enterprises and the breadth of markets, which significantly affects the economic development of the agricultural system.

Social assessment based on social media monitoring allows you to assess the social impact of the agricultural system according to several important criteria. Feedback and comments from consumers and visitors reflect the general attitude towards the agricultural system and the level of satisfaction with its products and services, which serves as an indicator of social cohesion and reputation. Community engagement is expressed through likes, comments, reposts and participation in events reflected in social networks, which is a direct indicator of active interaction of the community with the agricultural system and an important element for evaluating indicators. The transparency and openness of the agricultural system are manifested in the constant informing of the public about environmental practices, measures and innovations, which indicates the desire for social responsibility and openness in communications (Ding & Shi, 2020).

The analysis of social networks provides an opportunity to assess the environmental performance of the agricultural system since most urban agricultural systems seek to demonstrate their environmental responsibility in the public space. This allows you to obtain information about the different environmental aspects of the activity. For example, environmental practices and initiatives of the agricultural system, such as waste sorting and disposal, the use of organic fertilizers, the rejection of pesticides and herbicides, and the conservation of biodiversity are often covered in publications. This approach allows you to assess how much the agricultural system adheres to the principles of envi-

ronmental sustainability. If an agricultural system uses innovative environmental technologies, such as drip irrigation or water recycling, it usually shares this information on social media, which helps to assess the effectiveness of resource management, in particular water and energy, and understand the level of innovation of the agricultural system. Social media also provides information on activities to raise environmental awareness of the community, such as environmental workshops, tree planting campaigns, creation of "green barriers", etc., which contributes to the assessment of environmental awareness indicators and community involvement in environmental conservation. The transparency of environmental activities is manifested in constant information about the implementation of environmental innovations and practices, which increases community confidence and indicates the desire of the agricultural system for environmental responsibility.

Thus, the analysis of social networks is an auxiliary method of collecting information that allows you to obtain relevant, versatile and reliable data on the activities of the agricultural system. Since most agricultural systems actively use social networks to communicate with the community and promote their products and services, these platforms become a valuable additional source of information for evaluating performance on economic, social, and environmental indicators.

The proposed methodology allows not only to objectively assess the efficiency of the functioning of urban agricultural systems, but also to form scientifically grounded recommendations for their integration into the urban environment. The use of the "Index of Sustainability of Urban Agricultural Systems" provides a comprehensive assessment of the impact of these initiatives on the local economy, environmental situation and social cohesion, which is critically important in the current conditions of urban development in Ukraine. The results of the study can serve as a basis for strategic decision-making to support urban agricultural systems at the municipal and state levels, which will contribute to increasing food security, expanding the socio-economic opportunities of communities and strengthening the environmental sustainability of urban areas.

The study of urban agricultural systems within the framework of the "Urban Agrosystems Sustainability Index" methodology provided a comprehensive assessment of their impact on local economic development, social inclusion and environmental sustainability. The use of an integrated approach made it possible to identify key patterns in the functioning of different types of agricultural systems, as well as to develop recommendations for improving their

efficiency. The analysis of six types of urban agricultural systems, including vertical farms, urban farms, community orchards, social farms, educational farms, and home orchards, made it possible to assess their contribution to the local economy, their impact on communities, and the environmental situation in cities.

The results of the study demonstrate significant differences like the economic, social and environmental impact of different types of urban agricultural systems. In particular, vertical farms have proven to be the most efficient in terms of economic indicators since they are characterized by high profitability, quick return on investment and efficient use of urban space. However, their social and environmental contributions are relatively limited, as they function indoors and do not contribute to direct interaction with the community or the greening of the city. At the same time, such agricultural systems demonstrate high results in the field of resource efficiency, in particular in terms of water and energy consumption, which emphasizes their important role in the development of sustainable urban food systems.

Urban farms demonstrated the most balanced distribution of impact across all assessment categories. They are economically sustainable, ensure stable production of products for local markets and create jobs, which has a positive impact on local economic development. In addition, such farms play an important social role by interacting with local consumers and participating in the development of urban food systems. With the introduction of modern technologies, urban farms can also contribute to increasing environmental sustainability by reducing the carbon footprint of agricultural production and optimizing the use of natural resources.

While vertical and urban farms focus on cost-effectiveness, community gardens place a primary emphasis on social and environmental impact. They perform a critical function in the field of social cohesion, contributing to the interaction of city residents, increasing the level of environmental awareness and creating recreational green areas. At the same time, such agricultural systems do not have a significant economic effect since their activities are mainly financed by membership fees, charitable support or grants. They are a tool to restore the lost ties between urban communities and food production, contributing to the promotion of sustainable consumption principles.

Social farms have an important impact in the context of integrating vulnerable populations and promoting their economic self-sufficiency. In Ukraine, where the number of war veterans and people with disabilities is growing, so-

cial farms can become an effective rehabilitation mechanism, providing physical and psychological support. They also contribute to the development of self-employment skills and the creation of inclusive labour opportunities, which can have a positive impact on the employment rate of socially sensitive groups. However, the economic sustainability of such agricultural systems largely depends on grant support and charitable funding, which limits the possibilities of their long-term development without additional state or municipal support programs.

Educational farms have significant social and environmental potential as they combine the educational process with direct agricultural activities. They create opportunities for the development of entrepreneurial thinking, provide practical training for young people and contribute to the promotion of sustainable agricultural production. In addition, such farms can integrate elements of social entrepreneurship, which allows them to partially ensure financial independence. The analysis demonstrated that their greatest potential is revealed in cooperation with local communities, which allows them not only to perform an educational function but also to promote social cohesion.

Home gardens, as the most common form of urban agricultural systems in Ukraine, play an important role in ensuring the food security of households. They reduce food costs, increase the level of food self-sufficiency of citizens and form a culture of responsible consumption. Although these agricultural systems do not have a significant direct impact on the local economy, their mass nature creates the potential for the development of local food markets and support economic activity through informal distribution channels.

The overall analysis proved that the effectiveness of urban agricultural systems cannot be evaluated solely from an economic point of view since they perform a significant social and environmental role in the urban environment. At the same time, to ensure their sustainability, a balanced approach is needed, combining economic feasibility, social utility and environmental responsibility.

The methodology "Index of Sustainability of Urban Agricultural Systems" used in the study allows you to obtain a comprehensive assessment of the effectiveness of these initiatives and is an effective tool for decision-making to support urban agricultural systems at the municipal level. In addition, the results can be useful for investors considering financing urban agricultural projects, as the methodology allows you to assess risks, development potential, and profitability.

Thus, the study confirms the need to integrate urban agricultural systems into the spatial planning of cities, in particular through state support mechanisms and their inclusion in sustainable urban development strategies. The use of the "Urban Agricultural Systems Sustainability Index" methodology allows not only the assessment of the effectiveness of existing agricultural systems but also the determination of ways to optimize them, which is a key factor in building sustainable, environmentally responsible and cost-effective urban food systems.

7.5. Challenges and opportunities for urban agricultural systems in Ukraine

Urban agricultural systems play an increasingly important role in ensuring food security, improving environmental sustainability, and promoting the socio-economic development of urban communities. However, their effective functioning faces several challenges that require a thorough analysis and development of strategic solutions to overcome them. The study showed that the main barriers to the development of urban agricultural systems in Ukraine are due to environmental, economic and social factors that significantly affect the level of productivity, competitiveness and overall sustainability of these systems.

One of the key environmental challenges is the degradation of urban soils, which is associated with pollution by heavy metals, industrial waste and pesticide residues. The high level of anthropogenic load on urbanized areas leads to the accumulation of toxic elements in the soil, which creates risks to public health and limits the potential for growing safe products (Lu et al., 2015). Restoring the fertility of urban soils requires significant financial investments in bioremediation technologies and the introduction of green manure and organic fertilizers, which significantly increase the cost of agricultural production. At the same time, the effective integration of ecological farming methods, including vermicomposting, the use of biological products and precision farming technologies can contribute to reducing pollution and increasing the economic sustainability of urban agricultural systems.

The second important factor limiting the development of urban agriculture is air pollution due to the high level of urban load. Emissions of particulate matter (PM_{2.5}, PM₁₀), nitrogen oxides, sulphur, volatile organic compounds and heavy metals negatively affect the quality of products, as pollutants settle

on the leaf surface of plants and can penetrate tissues (Medvedeva et al., 2021). This creates additional challenges for urban farmers, who are forced to implement protective measures, including placing production areas indoors or using special agricultural technologies such as hydroponics and aeroponics. In the future, active cooperation of urban agricultural systems with municipal authorities to improve the quality of the urban environment, in particular through the creation of green spaces, parks and phytofiltration barriers that reduce the level of air pollution, is a strategically important area of development.

Another significant limitation is the poor quality of water resources used for the irrigation of urban agricultural systems. Water coming from centralized water supply systems often contains traces of chlorine, heavy metals and organic pollutants, which reduces its suitability for use in high-tech plant growing systems. Alternative sources, such as rainwater or well water, may also contain impurities, which requires the introduction of additional filtration systems and treatment technologies (Teston et al., 2022). This creates additional financial costs for urban agricultural systems, which require the development of innovative approaches to water management, including water recycling systems, bio-filtration and the use of water-saving technologies.

In addition to environmental challenges, considerable attention should be paid to economic constraints, among which the high resource intensity of urban agricultural systems is key. Growing agricultural products in an urbanized environment requires significant investments in technological equipment, energy-efficient systems, packaging materials and logistics. In particular, vertical farms and hydroponic systems are completely dependent on artificial lighting and microclimate control, which significantly increases their operating costs. An analysis of the resource consumption of urban agricultural systems showed that one of the key strategies to increase their economic efficiency is the introduction of circular management models, in particular the use of renewable energy sources, the use of organic fertilizers from local sources, and the minimization of water and nutrient losses (Ghisellini et al., 2016).

Social constraints also play an important role in the development of urban agricultural systems. One of the key challenges is the low social acceptability of some types of agricultural systems, in particular, high-tech vertical farms, which often operate in isolation from urban communities. The lack of direct social ties between producers and consumers can reduce the level of trust in products, which, in turn, limits the potential for the development of local food markets. At the same time, socially oriented types of urban agricultural systems, such as community gardens and social farms, demonstrate a high level

of integration into local communities, contributing to the development of urban initiatives, increasing the level of social cohesion and promoting environmentally responsible consumption.

An important aspect is also the financial availability of urban agricultural products. The high cost of products grown in an urbanized environment can create barriers to their widespread distribution among the population, especially among socially vulnerable groups. This may threaten market segmentation when urban agricultural systems serve only a premium segment of consumers without significantly affecting the overall level of food security. Thus, a prerequisite for the development of urban agriculture is the development of mechanisms of financial support and state incentives, which may include grant programs, tax breaks and subsidies for small farms.

The analysis showed that urban agricultural systems, despite the presence of significant challenges, have a high potential for sustainable development if comprehensive strategic decisions are implemented. The integration of environmental, economic and social approaches to the development of urban agriculture will contribute to the creation of efficient production models that ensure high productivity, environmental responsibility and social inclusion. The key areas of further development are the introduction of precision farming technologies, the use of renewable resources, the creation of financial support mechanisms and the strengthening of interaction between urban agricultural producers and communities. This will allow urban agriculture to become a full-fledged element of urban food systems, contributing to the formation of sustainable urban food networks and increasing the overall food security of the country.

To maximize the potential of urban agricultural systems in Ukrainian cities, it is important to ensure their effective integration into all aspects of the urban environment. Below are the main recommendations and practical steps that will contribute to the comprehensive implementation of urban agricultural systems in the urban environment of Ukraine.

1. Amendments to the legislation

To ensure the sustainable development of urban agricultural systems in Ukraine, it is proposed to introduce comprehensive measures aimed at legitimizing and supporting agricultural activities in urban areas through legal and regulatory changes. One of the key steps is the official inclusion of the term "urban agricultural systems" and its definition in the legal system of Ukraine, as well as in the main regulatory legal documents, such as the Land Code of

Ukraine, the laws "On Farming", "On Personal Peasant Farming", and "On the Regulation of Urban Planning Activities". This will create the necessary legal framework for the development of agricultural activities in urban communities and legalize the use of urban spaces – undeveloped land plots, roofs of buildings, parks – for agricultural purposes.

It is also necessary to simplify the procedures for changing the purpose of land for urban farming. In this context, it is proposed to develop special mechanisms that will allow the temporary use of undeveloped urban areas for agricultural activities. This will allow for faster use of available land resources and reduce legal barriers that currently complicate the development of urban farming. For example, the introduction of simplified procedures for obtaining permits for the temporary use of roofs of buildings or undeveloped land plots can significantly contribute to the expansion of agricultural systems in cities.

The integration of the term "urban agricultural systems" into legislation should also include the definition of agricultural activities that can be considered as part of these systems. These can be various forms of plant cultivation, aquaculture, and raising animals for local consumption. The definition of specific activities will allow the standardization of urban farming practices and ensure that they comply with environmental and economic requirements.

The integration of the concept of "urban agricultural systems" into the legislative framework of Ukraine is aimed at creating a stable legal foundation for their development. This includes the regulation of land issues, the determination of the rights of agricultural entities, the establishment of environmental standards and the support of urban farming as a tool for ensuring food security, environmental sustainability and socio-economic development of local communities.

2. Integration of urban agricultural systems into comprehensive plans for the spatial development of the territory of territorial communities

The integration of urban agricultural systems into comprehensive spatial development plans of territorial communities and city master plans is a key step to ensure their stable functioning and optimal use of urban space. The introduction of zoning, which provides for the allocation of special plots for various types of agricultural systems – public gardens, urban and vertical farms, as well as other forms of agricultural activity – allows you to effectively organize urban space, making the most of the available territories. This approach contributes to the integration of agricultural systems into residential and public areas of the

city, providing them with access to the necessary infrastructure, including water resources, transport networks and power grids.

The integration of agricultural systems into urban planning allows them to be combined with green areas, recreational areas and other functional areas of the city, contributing to the development of integrated green infrastructure. This not only increases the ecological quality of the urban environment but also creates favorable conditions for social integration, involving residents in agricultural activities and increasing their environmental awareness. The designation of public plots for agricultural systems stimulates community participation in production processes, contributes to the strengthening of social ties and supports environmental responsibility among residents.

Clear zoning of agricultural systems in urban plans creates the necessary legal and economic prerequisites for attracting investment and state support. This opens up new opportunities for the development of both private and public initiatives in the field of urban farming. Thanks to such measures, urban farming can develop more efficiently, increasing the environmental, social and economic sustainability of urban communities.

In addition, the integration of urban agricultural systems into spatial planning contributes to the introduction of innovative technologies and ecological cultivation methods that meet modern standards of sustainable development. This allows cities to adapt to climate change, ensure food security and increase the resilience of communities to environmental and economic challenges. Thus, a systematic approach to the planning and development of urban agricultural systems not only optimizes the use of urban space but also contributes to the creation of more sustainable, healthy and prosperous urban environments that meet the needs of modern society.

3. Development of standards and instructions for environmentally friendly agricultural technologies. The development of environmental standards for urban agricultural systems should be aimed at optimal use of resources, preservation of the urban environment and minimization of negative impacts on the ecosystem. These standards should become the basis for ensuring the sustainable development of urban agricultural projects, regulating their activities by environmental priorities. In particular, such standards should cover several key aspects:

- Effective water resources management. Water is one of the most important resources for agricultural production, especially in urban environments. Environmental standards should regulate methods for the eco-

nomical use of water and promote the introduction of modern technologies such as rainwater harvesting, recirculation for reuse, as well as drip irrigation, hydroponic and aeroponic systems. For example, the use of automated irrigation systems will avoid overconsumption of water, reduce the load on the city water supply and ensure stable moisture of plants even during periods of drought. In addition, such approaches will contribute to the conservation of water resources for other urban needs while reducing the costs of agricultural systems for irrigation.

- Support for organic farming. Organic methods of growing products are an important component for maintaining the ecological balance of urban ecosystems. Environmental standards should recommend the abandonment of chemical fertilizers and synthetic pesticides, replacing them with organic alternatives such as compost, biological products and green manure. This approach not only improves soil quality and prevents soil depletion but also minimizes water and air pollution, providing a healthy environment for residents. Organic farming also contributes to the preservation of local biocenoses and allows you to maintain high-quality products, which is a key factor for consumers.
- Reducing carbon footprint and improving energy efficiency. Urban agricultural systems should strive to minimize greenhouse gas emissions and reduce energy consumption. This can be achieved through the introduction of energy-efficient equipment, the use of modern LED lighting, and renewable energy sources such as solar panels or windmills. Environmental standards should also provide for measures to optimize the energy infrastructure of agricultural systems. For example, the use of such technologies not only reduces energy costs but also helps to reduce the carbon footprint, which has a positive effect on the overall environmental condition of the city.
- Integration into existing urban ecosystems. The choice of crops for urban agricultural systems should consider local climatic conditions and ecological balance. The standards should regulate the cultivation of plant species adapted to local conditions, which reduces the need for additional resources such as water, fertilizers or protective equipment. For example, the introduction of local varieties will not only increase the sustainability of agricultural systems but also contribute to the preservation of local

biodiversity. This approach will allow the harmonious integration of agricultural systems into the urban environment, ensuring their environmental sustainability.

The introduction of environmental standards will create uniform rules for agricultural projects that will ensure their effective integration into urban spaces. This will contribute to the development of environmentally friendly technologies, raise awareness of urban communities about sustainable development, and help reduce the negative impact on the ecosystem. At the same time, such standards will ensure the rational use of urban resources, create conditions for improving the quality of life of residents and be an important step towards preserving the natural environment in the urban context.

4. Formation of effective financing and partnership mechanisms. Attracting funding from various sources, such as international grants, government support programs, private investors, as well as active cooperation with local communities, non-governmental organizations and businesses, creates a solid financial basis for the launch and development of urban agricultural projects. This approach allows you to ensure the stability of agricultural systems, minimize financial risks and effectively manage resources.

International grants and investments. International grants, in particular from environmental, social and innovation funds, are an important source of funding for agricultural systems seeking to implement projects that meet the Sustainable Development Goals. The funds direct financial support to the implementation of innovations such as vertical farms, social agricultural platforms, training programs and environmental initiatives. This not only helps to increase environmental awareness among citizens but also helps to modernize the infrastructure of agricultural systems.

International investments, in turn, can become a source of long-term financing for the expansion of agricultural systems and the modernization of equipment and technologies. For example, investments in automated irrigation systems, energy-efficient lighting or water recycling systems reduce operating costs and increase productivity and environmental sustainability.

Government support programs. The role of the state in stimulating the development of urban agricultural systems cannot be overestimated. Subsidies, tax breaks, and grant-funding programs focused on supporting small and medium-sized businesses will create favorable conditions for the launch and development of agricultural projects. In particular, state support may cover:

- Granting subsidies for the launch of social farms that promote the employment of vulnerable groups.
- Allocation of funds for the development of innovative agricultural projects.
- Preferential terms of land lease for socially significant initiatives.

Private Investors and Business Partnerships. The private sector plays an important role in supporting urban agricultural systems, especially in terms of implementing innovative and profitable solutions. Companies can invest in environmental initiatives through sponsorship, participation in joint projects, or funding for the development of community gardens, training programs, and social farms. For example, cooperation with corporate partners may include financing the installation of solar panels, supporting training courses for the community, or organizing educational activities.

For businesses, such participation is beneficial not only from the point of view of social responsibility, but also as a way to improve their image, expand the affiliate network and attract new customers.

Cooperation with local communities and NGOs. Interaction with local communities increases the level of social cohesion, responsibility, and citizen involvement in urban agricultural system projects. Citizens who participate in such initiatives become more interested in their development and preservation.

Non-governmental organizations can play the role of coordinators, providing support through the organization of educational events, the attraction of external financial resources and the implementation of social programs.

Local governments can also contribute to the development of agricultural systems by introducing municipal support programs, allocating land plots, or providing grants for the development of environmental projects. Preferential rental conditions or simplification of registration procedures are additional incentive tools.

These approaches create a sustainable basis for the development of urban agricultural systems, minimizing financial risks and providing the possibility of scaling. Thanks to the interaction of international, public and private sources of funding, agricultural systems will be able to implement large-scale projects aimed at achieving sustainable development goals.

Also, the involvement of local communities in cooperation will contribute to the formation of a positive social image, strengthening the social responsibility of business and creating conditions for the long-term integration of agricultural systems into the spatial planning of Ukrainian cities.

5. Monitoring and evaluation of the effectiveness of agricultural systems. The monitoring system is an important component of the management of urban agricultural systems, which allows for a comprehensive analysis of their impact on the economy, ecology and social processes. This approach not only contributes to the improvement of agricultural projects but also creates preconditions for attracting external funding, including investments, grants, and municipal support.

Key aspects of the monitoring system:

- Economic indicators. The system should include an analysis of such parameters as the number of jobs created, the volume of local products produced, the level of tax revenues and the economic efficiency of the agricultural system. Tracking these indicators allows you to assess the economic contribution of agricultural systems to the development of the community and demonstrate their financial stability to investors.
- Environmental indicators. The environmental component includes monitoring of air, water, and soil quality, as well as assessment of carbon footprint reduction and resource management efficiency. Such data will help assess the environmental sustainability of the agricultural system, its impact on the local environment and the effectiveness of the implemented eco-technologies.
- Social indicators. Social aspects include the analysis of the level of community involvement in the activities of agricultural systems, the availability of educational programs, the level of social cohesion and the impact on the quality of life of residents. Monitoring of social indicators will help determine the extent to which agricultural systems contribute to the formation of an integrated and cohesive society, as well as their role in solving social problems.

Regular data collection and analysis will allow timely adjustment of strategies for the development of agricultural systems, increasing their efficiency. This is especially important for identifying weaknesses and introducing innovations that meet modern challenges.

The monitoring data will be a convincing argument for attracting international grants, investments from private businesses and support from local authorities. A clear demonstration of economic, environmental and social results will strengthen the confidence of investors and sponsors, contributing to the further expansion of agricultural initiatives.

Public coverage of the monitoring results will help increase the level of trust on the part of the community and local authorities. This will provide support for residents, more active involvement in volunteer and educational programs, and increase loyalty to the project.

The monitoring system will become the basis for expanding the activities of agricultural systems, allowing successful practices to be adapted to other urban spaces. This will contribute to the creation of a national network of urban agricultural projects that are harmoniously integrated into the spatial planning of cities.

6. Conducting an information campaign as a key tool for popularizing urban agricultural systems in Ukraine. The popularization of urban agricultural systems requires a comprehensive information campaign that will contribute to their successful implementation and integration into urban spaces. Such a campaign should cover all stakeholders: urban communities, businesses, local governments, educational institutions and non-governmental organizations. The main goal is to raise awareness of the economic, environmental and social benefits of agricultural systems, as well as ways to overcome the challenges associated with their implementation. Thanks to this, it is possible to achieve public support, attract new participants and partners, and create a favourable environment for the development of urban agricultural systems.

The main directions of the information campaign:

- Educational and outreach activities for communities. The campaign should inform citizens about the benefits of urban agricultural systems, in particular their contribution to reducing food dependence, improving the environment and creating new opportunities for public interaction. Information seminars, workshops, excursions to existing agricultural systems, as well as the distribution of educational materials will allow residents to better understand the value of such projects. The involvement of citizens will contribute to the formation of a positive attitude towards urban agricultural systems and stimulate their participation in relevant initiatives.
- Information support for business. The business community is a key partner in the development of urban agricultural systems. The information campaign should highlight the economic opportunities created by agricultural systems, provide practical examples of business models and demonstrate the return on investment in this area. The organization of presentations, workshops and consultations on funding opportunities, in

particular through grants, government programs or private investments, will allow businesses to consider urban agricultural systems as a promising and profitable direction. In addition, the information campaign should contribute to the formation of partnerships between agricultural systems and businesses, for example, in the supply of fresh products to restaurants, cafes or supermarkets.

- Seminars and consultations for local authorities. The integration of urban agricultural systems into spatial planning requires the active participation of local authorities. They should organize seminars on the economic and environmental benefits of agricultural systems, as well as their role in the socio-economic development of communities. Providing recommendations for the development of support policies, the allocation of land plots, and the provision of subsidies and benefits for agricultural projects will help create a favourable environment for the development of this area. The participation of local authorities will contribute to the effective implementation of agricultural systems and their integration into local development strategies.
- Spreading success stories. Success stories are a powerful tool for forming a positive image of urban agricultural systems. The publication of real-world examples of projects that have already demonstrated successful economic, environmental and social impact will inspire other communities, businesses and authorities to implement similar initiatives. Such stories can be shared through social media, public events, or information platforms. They strengthen trust in urban agricultural systems and contribute to the formation of public consensus on their importance.

The information campaign will increase the level of public awareness of the benefits of urban agricultural systems and contribute to the formation of a positive attitude towards such projects. For business, this will be an opportunity to find new areas of development, and for local authorities, it will be a tool for implementing policies aimed at sustainable development. The campaign will help attract investments, expand partnerships and form active support from communities. In the long term, this will ensure the effective integration of urban agricultural systems into the spatial planning of cities, make them part of the urban environment and contribute to the sustainable development of Ukrainian communities.

7.6. Conclusions

Thus, urban agricultural systems are an important element of the spatial development of modern cities, capable of ensuring sustainable socio-economic development of territorial communities. In the course of the study, it was determined that the integration of urban agricultural production into the urbanized environment contributes not only to reducing food dependence on external supplies but also to creating additional economic opportunities for local entrepreneurs and households. The aspects of the development of urban agricultural systems considered in the monograph allow us to make several generalizations about their role in the sustainable development of territorial communities, economic efficiency and challenges facing their integration into the spatial planning of cities.

The prerequisites for the development of urban agricultural systems are formed under the influence of complex global transformation processes, in particular, anthropogenically caused climate change, rapid growth in the level of urbanization and the growing shortage of productive agricultural land. Changes in average annual temperatures, instability of the hydrothermal regime and extreme weather events pose threats to the agricultural sector and the ecological balance of urban areas, which necessitates the introduction of sustainable agricultural models, effective resource management and water-saving technologies. At the same time, urbanization causes spatial transformations, increasing competition for land resources and reducing the area of traditional agricultural land. The high capitalization of urban land complicates agricultural production, which requires the introduction of innovative approaches to food supply. It has been proven that the integration of urban agricultural systems into spatial planning contributes to increasing the food autonomy of cities, reducing transport costs, minimizing the carbon footprint and efficient use of urban land. In addition, the growing shortage of agricultural land, caused by the complex action of climatic, economic and social factors, actualizes the need to introduce alternative models of food production. In this context, urban agricultural systems act as a tool for ensuring food security, localization of production, implementation of circular models of resource management and adaptation of food strategies to the challenges of the modern urban environment.

The analysis of the conceptual apparatus, classification and role of urban agricultural systems made it possible to establish their multifunctionality and strategic importance for ensuring the sustainability of urban areas. It is deter-

mined that urban agricultural systems are complex socio-economic and environmental formations that integrate the processes of production, distribution and consumption of food within the urbanized space. Their development contributes to the formation of adaptive food systems, reducing the food vulnerability of the urban population and optimizing the use of natural resources according to the principles of a circular economy.

The author's definition and typology of urban agricultural systems proposed in the study are adapted to the national socio-economic, environmental and spatial conditions of Ukraine. It considers the variety of organizational and economic models and technological approaches used in urban agricultural production, which makes it possible to classify agricultural systems by functional purpose, level of technological development, organizational structure and spatial integration. It has been determined that different types of urban agricultural systems play a specific role in the socio-economic development of cities.

It has been proved that the integration of urban agricultural systems into the economic space of cities contributes to the formation of sustainable models of urban land use that combine industrial, social and environmental functions. It is determined that the development of such agricultural systems is an important tool for diversifying urban economies, as they create new opportunities for entrepreneurial activity, innovative development and attracting investments.

An important conclusion is that the functional efficiency of urban agricultural systems largely depends on the level of their integration into municipal spatial development policies. The introduction of appropriate regulatory and support mechanisms will contribute to the optimization of land use, increasing the economic profitability of urban agricultural production and the formation of an ecologically balanced environment. It has been determined that the promising directions for the development of urban agricultural systems are the institutionalization of their status in the urban planning system, the creation of specialized food clusters, the improvement of financial support mechanisms and the introduction of environmental standards of production.

The developed methodology "Index of Sustainability of Urban Agricultural Systems" is a tool for a comprehensive analysis of their economic, environmental and social impact. It contributes to the assessment of food security, land-use efficiency, investment attractiveness, social cohesion and environmental sustainability.

The methodology is based on 30 indicators distributed among three dimensions of sustainable development. The economic block assesses profitabil-

ity, profitability and investment attractiveness. The ecological dimension considers the efficiency of resource use, the impact on the microclimate, biodiversity and eco-technologies. The social component analyses employment, community engagement, social inclusion and food accessibility.

The use of the index as a management tool allows you to optimize decision-making at the municipal and state levels and contributes to the financing of urban agricultural production and the integration of agricultural systems into spatial development plans. The adaptability of the methodology ensures its application for monitoring the development of agricultural systems, which is critically important for the strategic management of urban agricultural production.

Further improvement involves expanding indicators, considering regional characteristics and introducing digital analytical technologies to predict the development of urban agricultural systems.

The study showed that urban agricultural systems, despite the challenges, have significant potential to ensure food security, social cohesion and environmental sustainability of urban areas. Their sustainable development is possible if economic, environmental and social aspects are integrated. The key factors in the development of urban agricultural systems in Ukraine are the introduction of innovative agricultural technologies, the use of renewable resources, the improvement of the regulatory framework and the strengthening of cooperation between communities, government and business.

The need for legislative changes to legitimize urban agricultural production and simplify the procedures for the use of urban land for agricultural systems is substantiated. The integration of urban agricultural systems into spatial planning will contribute to their effective functioning and optimal use of urban resources. The development of environmental standards to regulate the rational use of water resources, organic production and reduction of the carbon footprint is proposed.

The financial sustainability of urban agricultural systems requires the creation of effective support mechanisms, including the attraction of government programs, international grants, and private investment. A system for monitoring the efficiency of agricultural systems has been proposed, which will allow analysing economic, social and environmental indicators to optimize management decisions.

The importance of the information campaign, which will contribute to the popularization of urban agricultural systems, the involvement of citizens and investors, and the integration of urban agricultural production into sustainable urban development strategies, was emphasized.

Thus, urban agricultural systems are an important tool for adapting urban areas to global challenges, integrating the principles of sustainable development and increasing the economic self-sufficiency of urban communities. Further research should be aimed at improving the mechanisms of their implementation, adapting efficiency assessment methods to local conditions and developing strategic models for the development of urban agricultural production in Ukraine.

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LEGAL LIABILITY OF FARMERS IN THE CONTEXT OF ENVIRONMENTAL PROTECTION – COSTS OF ADAPTATION TO REGULATIONS

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8.1. Introduction

The concept of sustainable development, launched at the Earth Summit in Rio de Janeiro in 1992 (Dz.U. z 2002 r., nr 184, poz. 1532), has over the years become a global approach that is crucial for the future of our planet. It is a continuous process that aims to achieve balance in all aspects of human life, carried out in a way that does not harm ecosystems. Striving for this balance has become the main direction of development, shaping long-term goals and current activities, using a variety of methods, tools and instruments of influence (Jeżyńska 2022).

As part of this process, actions are taken to increase public awareness of threats, identify them and assess the degree of exposure. In addition, preventive and mitigating measures are being implemented to mitigate the effects of these risks, as well as corrective actions are being implemented. Innovative solutions are still being sought to balance development needs with the threats they generate.

Modern agriculture is the foundation of the economy of many countries, including Polish, but its development and intensification have an inseparable impact on the natural environment. With the increasingly visible consequences

of agricultural activity, such as soil, water pollution and greenhouse gas emissions, the need to comply with environmental standards is becoming a priority both nationally and internationally. In this context, farmers' legal responsibility is gaining importance as an instrument for shaping the sustainable development of the agricultural sector.

Compliance with legal regulations on environmental protection is associated with a number of obligations that farmers must fulfill, and failure to comply with them may result in sanctions. However, adaptation to the applicable standards often requires significant financial outlays, which can be a significant burden for farms, especially those with a smaller scale of production.

The aim of the article is to analyze the legal responsibility of farmers in the context of environmental protection, with particular emphasis on the costs associated with adaptation to applicable regulations. Legal mechanisms, challenges faced by farmers and an assessment of the impact of regulation on the sustainable development of agriculture will be analyzed. Globalization processes, especially integration with the European Union, have made Polish agriculture part of the international economic system.

An important role in its development is played by the Common Agricultural Policy, which, although it creates the possibility of free access to the European market, is also associated with competitive pressure. To meet these challenges, agriculture in Poland is undergoing constant transformation, both in terms of the structure of farms and related households. Among the key trends that show changes in Polish agriculture, the National Population and Housing Census 2021 in connection with data from the General Agricultural Census 2020 distinguishes: a decrease in the number of farms with a simultaneous increase in their average area and agricultural land area (increase from 11.26 ha to 12.65 ha and from 9.85 ha to 11.35 ha), changes in the structure of farms, where the share of the smallest farms decreased (up to 5 ha of agricultural land) and the percentage of commercial farms (less than 1 ha of agricultural land) increased, conducting intensive plant and animal production (e.g. greenhouses, pig and poultry farms) and farms with a larger area (15 ha and more), the continuing regional diversity of the structure of agricultural holdings, where the south-eastern provinces are characterized by a large number of small farms, while in the north-western voivodeships, farms with a larger area dominate (GUS Warszawa 2023).

8.2. National legislation governing agricultural activities from the point of view of environmental protection

The natural environment is a key subject of protection under legal regulations, which include both natural elements in their natural state and those transformed as a result of human activity. This concept is defined, m.in, in the Environmental Protection Law, Article 3(39) (LEX, Dz. U. z 2024 r. poz. 54), encompassing various components of the ecosystem, such as the surface of the earth, air, water, landscape or climate, as well as the interactions between them (Wierzbowski, Rakoczy 2018).

Agricultural activity has a significant impact on the environment, which results in the need to adapt farms to legal regulations aimed at minimizing the degradation of ecosystems. This includes, m.in, restrictions on the use of plant protection products, fertilization management, water management and biodiversity protection.

Pursuant to Article 3(20) of the Polish *Environmental Protection Law* (consolidated text: Journal of Laws 2025, item 647; hereinafter: EPL), the following are classified as entities using the environment: (1) entrepreneurs within the meaning of the *Law on Entrepreneurs*, (2) persons engaged in agricultural production—crop cultivation, animal rearing or breeding, horticulture, vegetable growing, forestry or inland fisheries, (3) organizational units that are not entrepreneurs, and (4) natural persons who are not entrepreneurs, provided their activity requires an environmental permit. Because agricultural producers are listed explicitly in item 2, every farmer—whether or not he meets the statutory definition of an entrepreneur—falls within the scope of the EPL. Hence doctrinal disputes over the entrepreneurial character of farming do not affect the farmer's core environmental obligations, which flow directly from his status as an entity using the environment. This status triggers the organizational duties set out in Article 140 EPL: every entity using the environment must ensure compliance with environmental requirements, inter alia by appointing qualified personnel, preparing emergency procedures (e.g. for slurry-tank leaks) and continually mitigating the adverse effects of its operations. In practice, even a small holding applying plant-protection products or natural fertilizers should keep records of treatments and train spray-equipment operators, as failure to meet these organizational duties may result in administrative sanctions and, where damage occurs, in additional rehabilitation costs.

The same status is decisive for potential environment-use fees. Under Article 284(2) EPL, natural persons who are not entrepreneurs are exempt, provided their activity does not require an emission or water-law permit. This exemption covers most small farms. Once the scale of production—for example, water abstraction for a herd exceeding 210 livestock units or discharge of whey effluent from a dairy unit—triggers the need for a permit, the farmer must calculate and pay the fee at the rates announced annually by the Minister for Climate and Environment. The legislature thus differentiates fiscal burdens according to the actual environmental impact of an agricultural installation.

Classification as an entity using the environment is equally crucial under the Act of 13 April 2007 on the Prevention and Remediation of Environmental Damage. Activities posing a risk of damage—such as storing and applying pesticides—place farmers under a strict administrative liability regime. If damage to protected species or habitats is recorded (e.g. in a Natura 2000 area), the competent Regional Director for Environmental Protection will order remedial measures and oblige the farmer to bear the full rehabilitation costs, irrespective of any insurance cover.

In sum, the notion of an “entity using the environment” constitutes the cornerstone of domestic environmental regulation in agriculture. It defines the addressees of public-law duties—from the principles of prevention, precaution and “polluter pays”, through the system of permits and fees, to liability for damage. Understanding this category is therefore essential for interpreting the other legal acts discussed in this chapter and for assessing the real cost of bringing farms into compliance with environmental requirements [Król 2013].

In the context of agriculture, the regulations resulting from the Act on Plant Protection Products, the Act on Fertilizers and Fertilization and the Water Law, which define the obligations of farmers related to the management of natural resources, are of key importance. Compliance with these regulations is associated with the need to incur adaptation costs, including the purchase of modern technologies, investments in water purification systems or the implementation of sustainable agriculture practices.

At the same time, these regulations reflect the broad context of environmental protection, which includes not only ecological aspects, but also human health and life. Contemporary environmental law is closely related to the concept of human rights, emphasizing that the state of the environment affects the quality of life of society. Therefore, farmers, as economic entities, bear both responsibility for compliance with environmental standards and the economic consequences resulting from the need to implement them.

In accordance with the applicable provisions of the Act on Fertilizers and Fertilization (Dz. U. z 2024 r. poz. 105), the conditions for placing fertilizers, plant cultivation aids and digestate on the market are specified in the Act. These regulations include: requirements for the composition and permissible impurities of fertilizers, procedures for registration and notification of new products, rules for the use of fertilizers in agriculture, restrictions resulting from the protection of human, animal and environmental health.

In addition, the marketing of fertilizers must comply with EU regulations, in particular Regulation (EU) 2019/1009 of the European Parliament and of the Council [Dz. U. UE. L. z 2019 r. Nr 170, str. 1], which lays down rules on EU fertilizing products. Compliance with these standards is supervised by the relevant administrative authorities.

Farmers are obliged to comply with legal standards regarding the use of fertilizers and plant cultivation aids. Legal liability in this respect may be administrative, civil, criminal. One of the key obligations of farmers is to keep records of the use of fertilizers and to comply with the rules for storing these substances in a way that minimizes the risk of environmental contamination. The implementation of legal regulations on the use of fertilizers is associated with the need to incur certain costs by farmers. These costs include, m.in, for example:

- purchase of certified fertilizers that meet the standards,
- modernization of fertilizer storage infrastructure,
- training on the correct use of fertilizers and minimizing their negative impact on the environment,
- additional documentation and administrative obligations.

These costs can be partially compensated by support programs for organic farming and EU funds intended for the development of sustainable agricultural production. Of key importance in this regard are the regulations on the use of plant protection products, which determine the conditions for their marketing, use and control. These regulations result from both national law and EU legal acts, in particular Regulation (EC) No. 1107/2009 of the European Parliament and of the Council (Dz. U. UE. L. z 2009 r. Nr 309, str. 1) on the authorization of plant protection products to the market and Regulation (EU) 2017/62 [Dz. U. UE. L. z 2017 r. Nr 95, str. 1], which lays down the rules for official control in the field of food safety and plant protection.

According to the applicable law, plant protection products must be used in a way that does not pose a threat to human health, animal health and the

environment. It is necessary to prevent the transfer of these substances to areas that are not the target of their application and to take into account the period during which people may be in the areas covered by the treatments. In addition, the regulations specify minimum distances from water bodies and requirements for the storage and disposal of plant protection products to limit their negative impact on aquatic ecosystems (Dz. U. z 2024 r. poz. 630).

Farmers, as professional users of plant protection products, are obliged to apply the principles of integrated pest management, which assumes minimizing the use of chemical protection products by giving preference to biological and agrotechnical methods. Each application of a plant protection product must be documented, and the documentation should include at least the reason for the treatment (Kuligowski 2014). These obligations also extend to landowners, who are required to keep records of the substances they use for at least three years. Compliance with legal requirements involves additional costs for farmers, including expenses for training, purchase of certified equipment, keeping documentation and implementation of the principles of integrated pest management. Restrictions on the use of certain products may also affect the yield of crops and force the search for alternative methods of plant protection. Nevertheless, compliance with the regulations is necessary not only to avoid administrative sanctions, but also to ensure the long-term sustainability of agriculture and environmental protection.

8.3. EU law – Common Agricultural Policy, Green Deal

The EU environmental policy and legal regulations on environmental protection determine the direction of development of European agriculture (Piekut, Pawluśkiewicz 2016). The development of agriculture in Europe plays a key role in solving environmental and climate problems. Despite the implementation of sustainable development strategies, there are still significant shortcomings in their effectiveness. The 2003 reform of the Common Agricultural Policy changed the model of financial support for farmers, shifting it to non-coupled payments, which reduced the incentive to intensify it. Instead, new obligations were imposed on farmers regarding sustainable land management. Appropriate production practices and technologies can help mitigate the effects of climate change in agriculture. In response to the deteriorating state of the environment and the effects of climate change in the European Union, the European

Commission presented a communication on the European Green Deal in December 2019. Its aim was to initiate international activities combining economic development with greater consideration of the principles of environmental and climate protection. This document confirmed the EC's commitment to prioritise environmental challenges as a key task of modern society. The European Green Deal is the European Commission's growth strategy that aims to create a modern, resource-efficient and competitive economy with net-zero greenhouse gas emissions by 2050. These actions are intended to steer the economy and society towards sustainable development, covering all sectors, including agriculture. This strategy is part of a broader plan to deliver on the UN 2030 Agenda and the Sustainable Development Goals. The implementation of the European Green Deal entails numerous challenges that need to be solved at the level of the European Commission, Member States and society as a whole. Four key areas of these challenges can be distinguished: substantive, administrative and legal, global, financial (Wrzaszcz, Prandecki 2020). The latter require significant financial outlays and the identification of entities responsible for their incurrence, especially since the environment and climate stability are common goods. The limited budgets of states and international institutions force the search for effective financing mechanisms and the involvement of the private sector. The European Commission stresses the need for large public investments and the mobilization of private capital to support climate action and environmental protection. The EU's role in coordinating global efforts to build a coherent financial system that supports sustainable development and in shaping inclusive growth strategies is also crucial.

8.4. Costs of adapting farms to environmental regulations

Adapting farms to environmental regulations resulting from the Common Agricultural Policy (CAP) is associated with the need to incur significant financial outlays. These costs include both infrastructure investments and ongoing expenses related to the implementation of practices in line with environmental and climate protection principles.

One of the key areas of farm adaptation is the modernization of infrastructure and agricultural technologies. This requires investments in modern storage systems for fertilizers and plant protection products, the implementation of precision farming and the construction of buffer zones to protect water reservoirs from pollution. Additional costs are associated with the implementation

of techniques to reduce greenhouse gas emissions, including nutrient management systems and the installation of renewable energy sources.

An important element of the CAP's environmental policy are eco-schemes, which are a support mechanism for farmers implementing additional pro-environmental practices. Poland allocates 25% of the direct payments budget for this purpose, which is a significant financial support (GOV.PL). Eco-schemes include measures such as increasing biodiversity, minimizing the use of fertilizers and pesticides, and improving soil quality. These funds partially compensate for the additional expenses incurred by farmers to adapt their farms to environmental requirements.

An equally important aspect of adapting farms to environmental regulations are administrative and transaction costs. Farmers are required to keep detailed documentation of the plant protection products and pro-environmental practices used, which generates additional organizational burdens. In the case of organic farming, it is also necessary to subject farms to regular certification checks, which entails additional operational costs (POLICJA.PL).

Financing of environmental activities in agriculture is based on EU and national funds. In the new CAP perspective, support for organic farming and environmental investments has been increased. The average annual expenditure for this purpose is about EUR 100 million, which means a significant increase compared to the previous period. At the same time, the principle of regressivity of payments was introduced, according to which larger farms receive lower support per unit area.

Restrictions on the use of chemicals in agriculture, including a ban on certain plant protection products and restrictions on fertilizers, entail a number of costs that affect the viability of farms. First of all, production costs are increasing, because it becomes necessary to use alternative methods of plant protection, which are often more expensive and less effective. The introduction of biological protection products also requires more work, for example mechanical weed removal instead of herbicides. Fertilizer restrictions can lead to the need to purchase specialized organic fertilizers or implement precise fertilization systems, which generates additional expenses.

Another significant cost is the potential decline in yields and quality of agricultural products. A lack of effective crop protection products can increase crop susceptibility to diseases and pests, leading to lower yields. This has a direct impact on farmers' incomes, as lower-quality products can fetch lower market prices and be less competitive. In addition, the need to adapt production

technology to the new regulations means investments in modern machinery and equipment that enable precise dosing of fertilizers and minimization of losses.

"Silent Spring" is a book by Rachel Carson, published in 1962, whose title symbolizes the drastic poverty of nature. This work provided a serious warning about the environmental effects of synthetic pesticides. The current model of plant protection, based on the extensive use of pesticides, has reached a critical point. Ecosystems, including those essential for human functioning, are seriously threatened. There is an urgent need to change this approach. The negative environmental impacts of intensive agriculture – including nitrate pollution of groundwater, loss of habitat for animals such as birds and insects, and loss of biodiversity, including fruit plants – are too serious and need to be changed immediately. The issue of pesticides should be treated as a key element of these systemic challenges. An inadequate system of authorization of pesticides and poorly developed monitoring of their impact on the environment lead to underestimating the risk and deteriorating the quality of the environment (Kujawa 2018).

It is necessary to develop crops and crop protection strategies that will ensure long-term productivity without damaging the environment. The current model, which prioritises crop yield growth and profits, must give way to sustainable agriculture. Widely accepted societal values, such as the provision of clean drinking water, food security and the protection of a diverse environment, should form the basis for negotiations between all parties involved in the process.

Responding to the pesticide problem with ad hoc, selective measures is insufficient. Pesticide use is closely linked to many other factors, so it should be treated as a systemic problem. Otherwise, environmental indicators such as the decline in insects, the disappearance of birds in the agricultural landscape, and the increase in groundwater and soil contamination by pesticide residues will deteriorate even further.

Table 1. Criteria of pesticides use by farmers

Criterion	Small farms (<10 ha)	Large farms (>50 ha)
Adaptable to environmental procedures	Limited due to lower financial and technical resources. Investments in green technologies are often difficult to finance without subsidies.	Greater adaptability through increased capital resources and better access to credit and EU funds.
Costs of implementing green practices	Relatively high in relation to the income of the household. It requires support from agri-environmental programs.	Lower unit cost of investment thanks to economies of scale. Better manage your budget and amortize costs.
Grants and programs	Often crucial for the profitability of implementing ecological practices. Schemes such as the RDP (Rural Development Programme) allow for partial compensation of costs.	Lower unit cost of investment thanks to economies of scale.
Application of precision farming technologies	Limited due to the high cost of purchasing equipment and digital technologies. Only basic tools can be used.	Common use of GPS systems, soil sensors, optimization
Compliance with standards	Complicated procedures and costs associated with certification can be a problem	Better preparation to meet standards (e.g. Nitrates Directive, Green Deal) due to access to advice and greater administrative experience.
Environmental impact	Relatively lower unit impact, but difficulties in applying modern methods of environmental protection can lead to soil degradation and water quality problems.	Greater potential environmental impact, but also greater opportunities to reduce it by investing in sustainable production methods.
Diversification of income sources	Often it is necessary to conduct additional activities (agritourism, direct sales) in order to maintain profitability.	Possibility of diversification of activities on a larger scale (biogas plants, large-scale crops, breeding).
Organic certification	More difficult to obtain due to complicated procedures and high certification costs.	Easier to implement with better administrative resources and greater scale of operations.
Alignment with the EU Green Deal	It can be problematic due to the need to incur the costs of changes without a guarantee of long-term return on investment.	Better preparation for the implementation of the Green Deal strategy through increased investment opportunities.

Source: Own elaboration based on interviews conducted with farmers.

OECD Typology of Adaptation Costs – An In-Depth Approach. The OECD Agricultural Policy Monitoring and Evaluation 2023 treats as investment costs all capital expenditures that shift a farm toward climate-friendly production: airtight fertilizer stores, precision-irrigation systems, photovoltaic panels, biogas units, or methane-reducing barn upgrades. Although annual public transfers to agriculture reach USD 851 billion, only USD 106 billion ($\approx 12\%$ of total support) is channeled to R&D, innovation and infrastructure—the spending categories most directly supporting adaptation .

The OECD stresses that such investments must be climate-resilient, i.e. designed and operated with future weather conditions in mind. It advocates combining “hard” solutions (e.g. drainage) with ecosystem-based measures (buffer strips, wetland restoration) to avoid mal-adaptation—for instance, over-abstracting groundwater in areas that will become too dry for current crops .

Public–private partnerships (PPPs) are singled out as a key vehicle for sharing the risk of long-term projects such as national water-retention schemes or green-energy grids for agriculture. The OECD estimates that 180 000 EU farms will benefit from climate-investment grants under the new CAP Strategic Plans 2023-27, financing, inter alia, agro-photovoltaics and upgraded slurry storage .

Operating costs cover dearer energy and water, the purchase of certified inputs, waste-disposal fees, and premiums for weather insurance. In 2022 the EU co-financed up to 64 % of drought-insurance premiums in the Netherlands, aiming to cover 4 400 farms by 2027 .

Yet the OECD warns of a moral-hazard effect: subsidized policies may disincentivize other adaptation measures and encourage riskier crop choices. U.S. studies show insured maize and soybean fields to be more heat-sensitive than uninsured ones, confirming a drop in incentives to diversify or invest in irrigation . The OECD therefore recommends shifting subsidies to index-based products (e.g. satellite drought indices) and limiting public support to catastrophic risk only.

On the price side, policy distortions remain significant: in 2020-22 just USD 1.6 billion out of USD 297 billion in budgetary support to producers was directly linked to environmental services; the rest took market-distorting forms that fail to curb energy or fertiliser use . The new CAP (2023-27) introduces enhanced conditionality plus voluntary eco-schemes, meaning that receipt of direct payments now depends on meeting numerous standards and keeping detailed environmental records . Typical cost items include:

- Staff time and IT resources for e-filing, geotagging field operations and reporting to the national paying agency;
- External audits (e.g. for organic or IPM farms) required every 12–18 months;
- Certification fees (EU Organic, Global G.A.P.) and software upgrades for precision-farming equipment.

The OECD notes that 61 % of all producer transfers in high-income economies are already paid conditionally on environmental compliance, while another 12 % flows through voluntary agri-environment schemes . Documentation errors—irrespective of any physical damage—can trigger payment reductions or claw-backs, turning administrative costs into a material financial and legal risk.

All three cost categories—investment, operating and administrative—shape a farmer’s legal liability. Failure to install infrastructure mandated by law can lead to administrative fines or civil suits (e.g. for slurry leakage). Ignoring higher operating costs without adopting recommended adaptation measures may be construed as negligence. Documentation gaps undermine the legality of CAP payments and expose the farmer to repayment with interest. Consequently, a full cost audit of adaptation is now an indispensable component of legal-risk management in modern farming.

8.5. Support mechanisms and financial compensation

The Common Agricultural Policy (CAP) introduces, in addition to the new, strengthened conditionality, also a program to support climate and environmental action, known as eco-schemes. This is a new type of direct payment, the implementation of which is mandatory for Member States, but its use by farmers remains voluntary. Eco-schemes are addressed to those agricultural producers who decide to implement additional pro-environmental practices, going beyond the mandatory requirements resulting from the principles of the new conditionality. Support under eco-schemes depends on the implementation of the annual commitment and the area covered by a given practice. It can take the form of an additional payment to basic income support or compensation for costs incurred and income lost [Wrzaszcz, Prandecki, 2020]. Eco-schemes contribute to the environmental and climate objectives of the CAP by supporting the protection of soil and water resources, combating climate change, improving animal welfare and preserving biodiversity in agriculture. They promote

practices that not only have an impact on environmental protection, but can also contribute to an increase in agricultural income by increasing soil fertility, increasing crop resistance to drought, optimizing fertilization and improving crop quality. The basic assumption of eco-schemes is their wide use among farmers, which would increase the effectiveness of the implementation of sustainable development goals in the agricultural sector [Wrzaszcz 2023].

The “polluter pays” principle, set out in Article 7 of the Environmental Protection Act, is one of the most enduring pillars of modern environmental law. Its origins can be traced to the OECD Council Recommendation of 14 November 1974, which for the first time required the internalization of the costs of preventing and removing pollution, stipulating that they must be borne by the actual polluter. In EU law, the principle was codified by Council Recommendation 75/436/EEC of 3 March 1975 on the allocation of environmental-protection costs, while its constitutional status was confirmed by Article 191(2) TFEU, which obliges the polluter to bear the burden of remedying environmental damage, in line with Principle 16 of the Rio Declaration. Implementation in the Polish legal order is unequivocal: the legislator charges both natural persons and legal entities, without distinction. Crucially, Article 7(1) EPA links the PPP with a duty of prevention—the polluter must finance not only the elimination of effects but also preventive measures that reduce environmental risk. In agricultural practice this translates, *inter alia*, into leak-proof slurry tanks, manure pads and storage facilities for liquid fertilizers. The costs of such investments fall, as a rule, outside public compensation schemes and are enforced through permits, fees and administrative fines. The economic face of the principle is seen in fees for using the environment (gas emissions, wastewater discharges, waste disposal) and monetary penalties for violating permit conditions. The Supreme Administrative Court has held that a lack of reliable emission measurements does not release the polluter from payment—authorities may estimate the fee to uphold Article 7 EPA (judgment of 6 February 2014, II OSK 2136/12). Conversely, the courts guard against excessive fiscalism: with water-service charges, the SAC ruled that merely being able to use water infrastructure does not trigger a fee if the devices for discharging stormwater do not in fact exist (judgment of 13 February 2020, II OSK 3686/18) [LEX Gruszecki 2025].

8.6. Precision Farming

In order for agriculture to be profitable, it must be based on appropriate knowledge and readiness to implement modern technologies. Innovative solutions improve the processes taking place on the farm, relieve owners of excess duties, and at the same time protect the environment and ensure food safety. Precision farming, defined as a set of technologies that make up a comprehensive agricultural system, adapts its elements to specific crops. Its use enables rational and economical use of plant protection products.

The process of implementing precision farming begins with obtaining data and saving it in spatial maps. The information collected includes variability in plant characteristics, environment and external conditions, as well as soil properties, projected yields and local variations. On this basis, soil and plant maps are created, followed by application models that enable precise adjustment of sowing, fertilization and plant protection. As a result, the doses of the agents used are precisely matched to each area of the field (Laskowska 2017).

Precision farming, also known as computer-aided farming, is a modern and comprehensive agricultural production management system that adapts all elements of agricultural technology to changing soil and plant parameters in different parts of the field. The introduction of such solutions becomes crucial to increase the quality of crops, reduce production costs and minimize the negative impact on the environment. The development of precision agriculture is possible thanks to the use of advanced technologies such as satellite navigation, multispectral imaging, electronics and automation. Similar solutions are also used in animal production, where modern technologies make it possible to adjust the breeding conditions to the individual needs of animals, which improves the efficiency and health of breeding.

One of the key aspects of precision farming is soil analysis, which allows for precise adjustment of fertilization and other agrotechnical treatments. Traditional sampling can be carried out manually with simple tools, but automated solutions such as the Egner's cane or the tractor-mounted Isaria Scout are increasingly being used, which allow for fast and accurate soil sampling up to a depth of 90 cm.

Precise fertilization management is possible thanks to the use of nitrogen sensors, such as Crop Circle, GreenSeeker or Yara N-Sensor, which analyze the needs of plants and allow for optimal fertilizer application. These sensors are mounted on tractors or sprayers and use the light reflected from the plants to assess their condition. As a result, farms can reduce the use of fertilizers,

which translates into lower production costs and less burden on the environment.

An important element of precision farming are also GNSS navigation systems (GPS, Glonass, Galileo, BeiDou), which increase the precision of field work. The use of RTK technology allows for the reduction of navigational errors, which allows the machines to be guided with an accuracy of a few centimeters. As a result, overlaps and bypasses during fertilization, spraying or sowing are minimized, which translates into savings in fuel, plant protection products and better use of resources. Modern tractors equipped with automatic guidance systems can operate for longer periods of time, reducing operator fatigue and increasing safety.

Modern optical systems such as EyeDrive enable additional optimization of field work by analyzing the condition of vegetation, weed infestation and possible nutrient deficiencies. Variable-Rate Application (VRA) machines, on the other hand, allow for the adjustment of fertilizer, plant protection and seed sowing doses to soil conditions, which increases production efficiency and reduces losses (DODR).

In the context of automation, universal CAN-BUS communication plays a key role, which enables the integration of various machine control systems and their remote monitoring. This allows for better control over the operating parameters of the machines, which increases their efficiency and reduces the failure rate.

The use of autonomous agricultural machinery, such as Yanmar YV01 spraying robots, Ztractor electric tractors or the unmanned AgXeed AgBot 5,1, allows for even greater automation of production. Autonomous vehicles can operate without the intervention of an operator, eliminating the problem of the lack of skilled labor and ensuring high precision of the procedures performed.

From an economic point of view, precision farming benefits both small and large farms, but the degree of their efficiency depends on the scale of production. For large farms, the return on investment is faster, as the savings resulting from the reduction in the costs of fuel, fertilisers and plant protection products are much greater. On smaller farms, the costs of implementing the technology can be relatively high and the payback period longer, but even there, modern solutions allow for increased production efficiency and reduced losses.

The blueberry farm “Victoria’s Sense” in the Kyiv region illustrates how low-budget precision tools can make climate-smart farming accessible even to smallholders operating under extreme conditions. After receiving a matching

grant under the World Bank-supported ARISE program (USD 132 million), the farm invested in:

- Smartphone-controlled drip-irrigation and fertigation: a cloud-based controller allows the manager to start, stop and dose nutrient solutions remotely. This cuts water use by $\approx 30\%$ and prevents over-fertilization—an issue that would otherwise trigger legal liabilities for nitrate leaching.
- IoT soil-moisture probes (LoRaWAN) spaced every 0.25 ha: they feed real-time data to an app that generates irrigation alerts. The system paid for itself within two seasons through water-energy savings.
- Drone scouting for UXO* detection and vegetation stress mapping. Multispectral imagery helps locate unexploded ordnance fragments left by shelling and pinpoints nutrient deficiencies before symptoms are visible to the eye.
- Digital grant workflow (Diya app): the entire subsidy application, progress reporting and geotagged photo documentation are handled via smartphone, slashing administrative costs and the risk of non-compliance penalties.

The case confirms OECD findings that administrative and investment costs are the main bottlenecks for smallholders entering precision farming; smartphone-centred solutions can cut both. Linking financial aid to verifiable digital data streams (water use, fertilizer doses, employment) creates a feedback loop that enforces environmental standards without heavy inspection overhead. For EU member states, a similar micro-grant window—capped at EUR 10 000 and tied to e-recording of inputs—could accelerate the Green Deal’s goal of digitalizing at least 75 % of farms by 2030.

8.7. Conclusions

The legal responsibility of farmers in the field of environmental protection includes national and EU regulations that impose obligations related to the reduction of pollutant emissions and the use of plant protection products. Adapting farms to these requirements is associated with high costs, including modernization of infrastructure and investments in modern technologies. Financial support, such as eco-schemes under the Common Agricultural Policy, partially compensates for these expenses, but for smaller farms it may not be enough.

Modern technologies, including precision farming, allow for efficient management of resources and minimization of the impact of agriculture on the environment. However, their implementation requires significant financial outlays, which is a challenge for many farmers. In addition, the European Green Deal strategy introduces new obligations that can improve the condition of ecosystems, but at the same time increase the costs of agricultural activities.

In conclusion, adapting agriculture to ecological regulations is crucial for sustainable development, but requires financial and technological support. The combination of legal regulations, subsidies and innovation will allow to achieve a balance between environmental protection and the profitability of agricultural production.

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PART III

PROBLEMS AND PROSPECTS OF AGRICULTURAL EXTENSION SERVICES DEVELOPMENT

CURRENT STATE, PROBLEMS AND PROSPECTS OF AGRICULTURAL EXTENSION SERVICES IN UKRAINE

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9.1. Introduction

In the context of global transformations that have engulfed the world and are striking in their scale and complexity, changes have affected not only technologies but also fundamental aspects of the human worldview. The modern understanding of progress is increasingly focused on ensuring a decent future for generations to come, which is the defining essence of the concept of sustainable development and sets the vectors of its strategic priorities. In implementing these strategic guidelines, the agricultural sector is assigned a key role, especially in sustainable rural development. Unfortunately, this area faces numerous problems in Ukraine and many other countries, including an insufficient innovation potential, which occupies a prominent place. This problem, in turn, is closely related to the quality of education and the lack of its targeted orientation to the needs of sustainable development. In these circumstances, the role of advisory services in the agricultural sector is gaining particular importance and relevance.

Today, the global scientific community and the public are actively discussing the prospects of transitioning to a new "Agriculture 5.0" paradigm. This discussion is a natural evolution from the previous concept of "Agriculture 4.0", which, focusing mainly on the digitalization of the agricultural economy and

technological innovations, insufficiently considered the potential negative consequences for achieving the Goals of sustainable rural development, especially in the environmental and social spheres. The evolutionary transition from "Agriculture 4.0" to "Agriculture 5.0" is an objectively conditioned process because the previous approach demonstrated its limitations, remaining primarily a technological paradigm that does not fully correspond to the philosophy of sustainable rural development. In modern conditions, it is fundamentally important to thoroughly study the problems of sustainable rural development in the context of rapid digitalization and develop appropriate organizational and methodological approaches for its effective provision, which is directly related to the development of the institute of advisory services.

Agriculture, by its nature, is not just a branch of production but a complex, multifaceted system that ensures humanity using biological resources. It covers a wide range of methods of growing plants and raising animals to obtain food, necessary raw materials for industrial needs, and the provision of related services, which makes it the basis of the existence of human civilization. In the context of modern challenges, small agricultural enterprises, in addition to their direct function of agrarian production, play a decisive socio-economic role in the development of rural territories of Ukraine. Their stable functioning is essential in sustainable rural development, encompassing economic, social and environmental aspects. Balanced development of rural areas and improving social standards of living in rural areas involves comprehensive support for rural employment, intensive infrastructure development, preservation of the unique identity of the traditional way of life and rural settlements, creation of decent working conditions, provision of social guarantees, and comprehensive promotion of the development of social infrastructure in rural areas. At the same time, strengthening financial stability and increasing the agricultural sector's competitiveness are based on ensuring high quality and competitive prices of Ukrainian agricultural products in world markets, which, in turn, contributes to the country's export potential growth. In this context, developing various forms of cooperation and effectively implementing the advantages of the circular economy becomes particularly relevant. The promotion and support of these areas should be the focus of advisory structures.

Analyzing scientific publications in specialized journals, such as profile scientific journals, it can be stated that they accumulate a significant amount of research results on the use of information and communication technologies (ICT) to promote development, presenting different scientific views on how ICT can be used to achieve the Sustainable Development Goals. A global trend

is the direct and active participation of advisory services (agricultural extension) in solving pressing problems of sustainable rural development and implementing the concept of multifunctional agriculture. In Ukraine, the issue of advisory services, despite the existence of a legislative framework and positive public perception of the idea itself, is still not adequately covered in the works of domestic scientists, especially in the context of ensuring sustainable rural development. Certain aspects of this issue have been partially reflected in the works of scientists such as Dovhan L., Kyrylova Yu., Korynets R., Khmil N., and several others. However, further research is needed to clarify the needs and identify promising directions for developing advisory services to ensure sustainable rural development. Thus, the issue of advisory services is undoubtedly relevant and timely and requires further scientific research. There is an urgent need to identify priority areas of advisory activities to create an effective model of sustainable rural development based on integrating modern digital technologies and social innovations. Agricultural advisory service (agricultural extension – literally "spreading agricultural knowledge") is critical in most countries. It catalyzes human capital development in rural areas, providing small agricultural enterprises (farmers) with the necessary information and knowledge to improve their well-being and increase farming efficiency. The functional load of advisory services covers many areas, including information provision, training, consulting, organizational support and promoting innovation.

In economically developed countries, state support for agricultural producers traditionally includes advisory services and various other forms, such as financial (direct and indirect), property and marketing support. In Ukraine, before the full-scale invasion, there was a program of partial compensation of costs for advisory services. Still, its operation has been suspended, which creates additional obstacles to the development of agricultural business and, accordingly, negatively affects sustainable rural development. In the context of a full-scale military Russian invasion, a positive factor for the activation of advisory activities was the inclusion, along with taxes paid, of funds used by agricultural producers (at the first stage, small ones) to receive services from advisory services, in the mechanism of minimum tax liability. In the context of European integration processes, advisory services are of particular importance, given their direct impact on sustainable rural development and adaptation to European standards. A promising form of advisory services organization is the establishment of effective partnerships between local communities, agrarian higher education institutions, and existing advisory structures. Advisory activ-

ities should be primarily aimed at consulting support for small agricultural enterprises, which requires developing an effective information and consulting development system. This, in turn, necessitates active advisory activities in the context of forming digital competencies among both employees of small agricultural enterprises and the rural population as a whole, directly related to achieving Sustainable Development Goals. At the same time, when determining promising areas of activity, it is necessary to consider the multifaceted nature of advisory services, which act simultaneously as a scientific and applied sphere, a social institution and a business sector.

The purpose of the research is to clarify the problems of the functioning of advisory services in Ukraine, to determine the prospects for its development and appropriate areas of consulting, scientific substantiation of recommendations for improving information support for the functioning of small agricultural enterprises in the context of digitalization, in the context of effective cooperation with regional advisory services.

To achieve this goal, the work envisages solving the following tasks:

- to investigate the theoretical and methodological foundations of the functioning of advisory services in the context of ensuring sustainable rural development, considering current trends in the digitalization of the agricultural sector;
- to determine the key factors of the impact of digitalization on the functional load of advisory services in the context of promoting the development of small agricultural businesses;
- to analyze existing models and practices of information support for small agricultural enterprises and assess the role of regional advisory services in this process;
- to develop practical recommendations for improving information support for small agricultural enterprises by optimizing cooperation with regional advisory services in the context of digitalization;
- to substantiate promising directions for developing advisory services in the context of forming digital competencies of employees of small agricultural enterprises and rural populations to promote sustainable rural development.

The novelty of the research lies in the development of conceptual approaches to improving the functioning of advisory services in Ukraine, focused on ensuring sustainable rural development in the context of rapid digitalization of the agricultural sector. In particular, for the first time:

- the theoretical foundations of the study of the role of advisory services in ensuring sustainable rural development in the context of "Agriculture 5.0" are systematized and supplemented;
- the impact of digitalization on the expansion of the functional load of advisory services is substantiated and new directions of its activity related to the digital transformation of the agricultural sector are identified;
- a model of information support for small agricultural enterprises based on the integration of the capabilities of regional advisory services and modern digital technologies has been developed;
- methodological recommendations for forming digital competencies of employees of small agricultural enterprises and rural populations within the framework of advisory activities to overcome the digital divide and promote inclusive development of rural territories are proposed.

The relevance of the research is driven by the urgent need to ensure the sustainable rural development of Ukraine in the context of global challenges, digital transformation, and prospects for European integration. Developing an effective advisory service system is a key factor for increasing the competitiveness of small agricultural enterprises, ensuring the country's food security, and improving socio-economic living conditions in rural areas. The research is especially relevant in the context of overcoming the consequences of military aggression and the restoration of Ukraine's agricultural sector on the principles of sustainable development.

The significance of the research topic is determined by its focus on solving a significant socio-economic problem – ensuring sustainable development of rural territories of Ukraine. The research results have practical significance for state authorities, local self-government, advisory services, small agricultural enterprises, and scientific and educational institutions. They will contribute to developing effective strategies and mechanisms to support the agricultural sector, increase its innovation and competitiveness, and improve the quality of life of the rural population. The obtained results can be used to improve the regulatory framework in agricultural advisory services and sustainable development and develop training programs and methodical materials for the training and professional development of advisors and agricultural sector workers.

9.2. Functioning of Advisory Services in the Context of Ensuring Sustainable Rural Development

In the context of global changes that are taking place today and are striking in their scale and complexity, not only technologies are changing, but also the very worldview of humanity. The desire to ensure a decent future for generations to come is the essence of the concept of sustainable development and defines its strategic guidelines. A key role in implementing these guidelines belongs to the agricultural sector, particularly sustainable rural development. Both in Ukraine and abroad, there are currently problems in this area, caused, in particular, by a low level of innovation potential, which, among other things, is related to the insufficient quality of education and the lack of its targeted focus on the needs of sustainable development. Accordingly, the role of advisory services is increasing.

The study of the functional load of advisory services in the context of ensuring sustainable rural development is based on the use of the following methods:

- Bibliographic method (a review was conducted, and the results of the analysis of works by domestic and foreign scientists devoted to the issues of sustainable rural development, digital transformation of the agricultural sector, the role of advisory services and the use of information and communication technologies in agriculture were provided);
- Analysis and synthesis (analysis and generalization of various scientific views on the problems of sustainable rural development and the role of advisory services, analysis of models of sustainable rural development, functions of advisory services, and promising areas of advisory activity were conducted);
- System approach (agriculture is considered as a complex system, and advisory service as an element of ensuring the sustainable development of this system);
- Elements of empirical research method (surveying clients of the advisory service of the Kirovohrad region to confirm the relevance of the issue and the needs of advisory service clients);
- Graphical method (visualization of key concepts and models).

Today, the scientific community and society are actively discussing the transition to the "Agriculture 5.0" model. This discussion is because the previous concept of "Agriculture 4.0" focused mainly on digitalizing the agricultural

economy and technological innovations, insufficiently considering the potential negative consequences that may hinder achieving the Goals of sustainable rural development, especially in the environmental and social spheres. The evolution from "Agriculture 4.0" to "Agriculture 5.0" is an objectively conditioned process since the previous approach was mainly a technological paradigm that does not correspond to the philosophy of sustainable rural development (Manifesto on Ukraine's transition to Industry 5.0. <https://www.clusters.org.ua/blog-single/manifest-perhid-ua-industry5-0/>).

In modern conditions, it is important to study the issues of sustainable rural development in the context of digitalization and the development of appropriate organizational and methodological approaches to ensure it.

Agriculture is not just a branch of production but a complex system that ensures human livelihood through the use of biological resources. It covers various methods of growing plants and raising animals to obtain food and raw materials for industry, as well as the provision of related services.

In modern conditions, small agricultural enterprises, in addition to the direct production of farm products, play an essential role in the development of rural areas. Their functioning has an impact on sustainable rural development (Fig. 1).

Balanced development of rural territories and improvement of social conditions include support for rural employment, infrastructure development, preservation of the traditional way of life and rural settlements, creation of decent working conditions, provision of social guarantees, and promotion of social infrastructure development in rural areas. Strengthening the financial condition and increasing competitiveness are based on ensuring high quality and competitive prices of Ukrainian agricultural products in the world market, increasing the country's export potential. At the same time, developing cooperation and realizing the benefits of a circular economy for society are advisable.

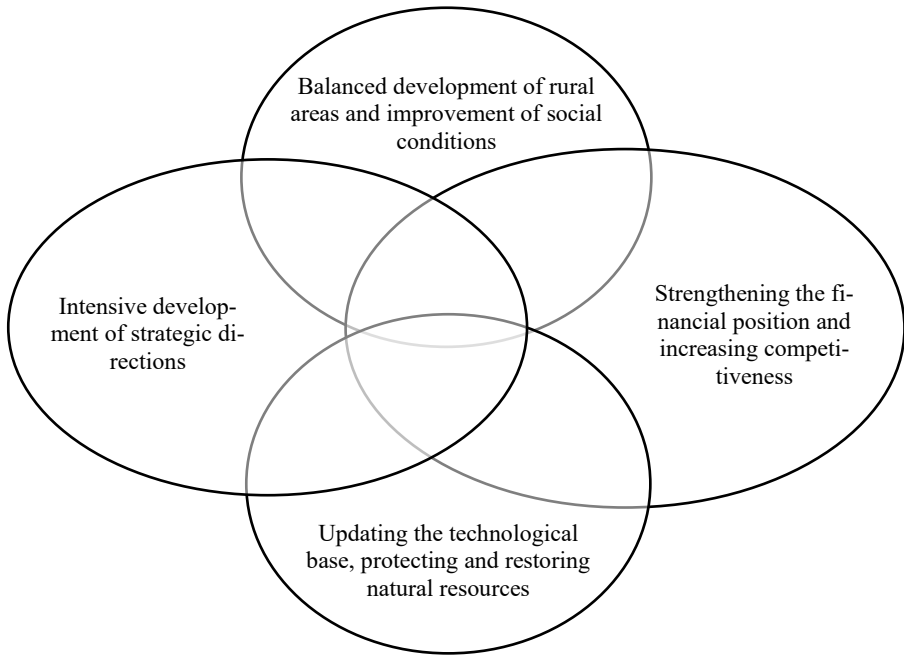


Figure 1. The main components of ensuring sustainable rural development

Source: developed by the authors

Scientists actively research the problems of sustainable rural development. Of the significance of the issue, especially for developing regions, foreign scientists focus on social aspects and the need for an adaptive approach and argue for the objectivity of directing efforts to choose an effective way to achieve inclusive rural development in the future (Castro-Arce, Vanclay, 2020). Thus, the ADEZN University non-profit organization implemented projects to develop rural areas, including educational programs, public-private partnerships, agricultural by-products, land use and infrastructure planning, and natural resource management. ADEZN coordinated the activities of local communities through discussion platforms. Implementing such practices in modern conditions is effective precisely due to information and communication technologies (ICT). This emphasizes the need to develop digital competencies among residents of rural regions. In Ukraine, these tasks should be solved with the help of advisory services. In this regard, it is advisable to refer to the results of scientific research presented in a specialized journal. This journal accumulates the results of scientific research on using information and communication

technologies (ICT) to promote development, presenting different scientific views on how ICTs can help achieve the Sustainable Development Goals (Andersson, Hatakka, 2023).

Research by Heeks, R. is devoted to the study of the impact of digitalization on modern society. The scientist analyzes the changing role of digital ICTs in international development and characterizes these changes as paradigmatic – a new paradigm – "digital technologies for development" causes transformations in the economy and politics (Heeks, 2020).

A global trend is the direct active participation of advisory services (agricultural extension) in solving the problems of sustainable rural development.

It is necessary to determine promising areas of advisory activity in creating an effective model of sustainable rural development based on modern digital technologies and social innovations.

Agricultural advisory service (agricultural extension – literally "spreading agricultural knowledge") plays an important role in most countries. It contributes to developing human capital in rural areas, providing small agricultural enterprises (farmers) with the necessary information to improve their well-being and increase farming efficiency.

The functional load of advisory services is illustrated in Figure 2. In the civilized world, state support for agricultural producers includes advisory services and various other forms, such as financial (direct and indirect), property and marketing. Before the full-scale invasion, a program of compensation of expenses (partial) for advisory services was in place in Ukraine. Still, it has now been suspended, which hinders agricultural business development and, accordingly, negatively affects sustainable rural development.

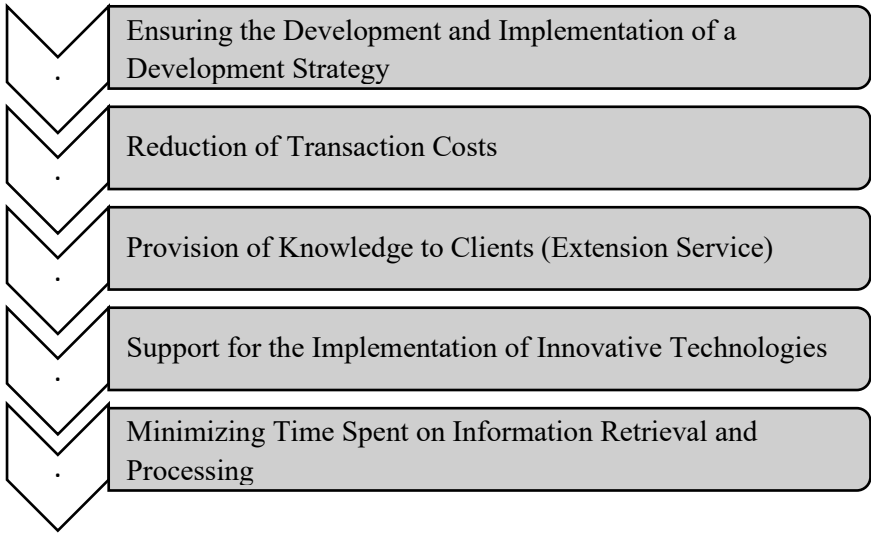


Figure 2. Basic functions of advisory services

Source: grouped by the authors

In the context of a full-scale military Russian invasion, a positive impact on the activation of advisory activity was made by the inclusion, along with taxes paid, of funds used by agricultural producers (at the first stage, small ones) to receive services from advisory services. An agricultural producer can only choose the optimal tax policy based on complex calculations. The development of the innovative component, which is connected with the formation and development of human resources, and the digitalization of business directly determine the development of agrarian business in modern conditions. The importance of these directions should be considered when making taxation decisions. Therefore, in our opinion, it is appropriate to include documented expenses in these areas (consulting of advisory services on the development and implementation of innovative technologies, introduction of digital technologies, and development of personnel potential) along with taxes when calculating tax payments in accordance with the minimum tax liability (Savchenko, Kononenko, Gai 2023).

In the context of European integration processes, advisory services are necessary precisely in view of their impact on sustainable rural development. One of the promising forms of organization of advisory services is the establishment of partnerships between local communities, agrarian higher education institutions and advisory structures. Advisory activities are primarily aimed at

consulting support for small agricultural enterprises. This requires developing a system of information and consulting development, which necessitates advisory activities in the context of forming digital competencies among both employees of small agricultural enterprises and the rural population (directly related to the implementation of Sustainable Development Goals). At the same time, when determining promising areas of activity, it is necessary to take into account the multifaceted nature of advisory services (as a scientific and applied field, a social institution, and a business sector).

In order to improve the quality and efficiency of management decision-making, optimize costs for information support, expand management opportunities, use modern information technologies and attract highly qualified consultants-experts, it is advisable to form an outsourcing system within the framework of providing advisory services. The experts-advisors involved have extensive experience and use their methods for business valuation, identifying the potential to improve its efficiency, developing accounting policies, etc. The problem of competitiveness management is inextricably linked with the problems of an economic entity's production efficiency and sustainable development.

A strategic direction for developing small agribusiness (a condition for sustainable rural development) is ensuring its innovativeness. At the same time, the digital divide and the rural population's low level of digital competencies are problematic in modern conditions. Accordingly, a promising direction for consulting in advisory activities is overcoming these problems associated with social innovations and strategic partnerships.

Research aimed at forming an optimal rural development model by many foreign scientists is associated with local and extra-local networks. Local networks consider the cooperation of local communities with such entities as representatives of local businesses, public organizations and educational institutions. At the same time, cooperation is organized precisely to ensure sustainable rural development. Extra-local networks are associated with the need for communication between city and village and the establishment of social and public ties between different rural areas, which in the future should lead to social innovations beyond territorial boundaries.

Traditional for researchers is the argumentation regarding the need to implement an innovation development model of cooperation between business, science and public administration (called the "triple helix"). However, now, when substantiating the optimal model of sustainable rural development, they

also consider the "quadruple helix", which is based on cooperation between business, government, education and the local territorial community (Fig. 3).

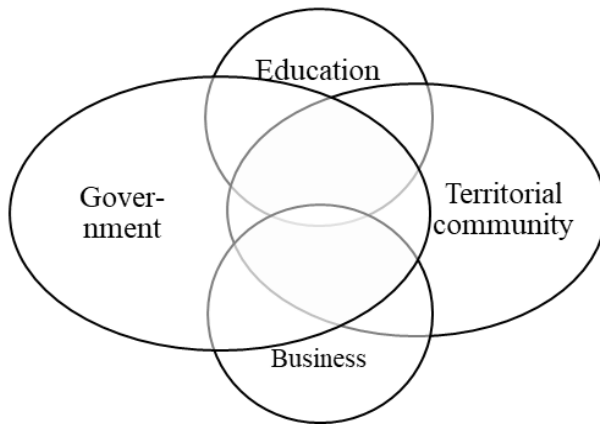


Figure 3. Model of sustainable rural development – quadruple helix

Source: developed by the authors based on research Kyrilov, et al. (2024)., Malik, et al. (2021)., Zhou, C., & Etzkowitz, H. (2021).

We believe that advisory services should unite various participants in this process, play a coordinating role, and provide consulting services to ensure sustainable rural development (Fig. 4).

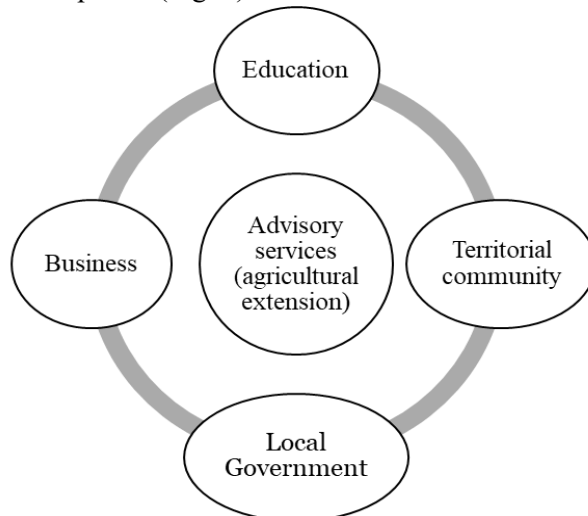


Figure 4. Advisory services in the organizational model of sustainable rural development

Source: developed by the authors

In the context of promoting sustainable rural development in the context of the formation of "Agriculture 5.0", the prospect for the development of advisory activities is the development of new areas of consulting, in particular, the promotion and methodological support of the implementation of the principles of circular economy; promoting the organization of new forms of partnership, cooperation and competition at the level of territorial communities; targeted consulting for small agribusiness entities on information management; participation in activities aimed at forming a sufficient level of digital competencies of agricultural enterprises employees and the rural population.

Among the models of sustainable rural development, the most effective are those aimed at forming social innovations based on local resources and interaction between local territories and the external environment. Advisory services should become the central link in forming such a model. At the same time, it is necessary to ensure the development of consulting activities and coordinate its directions with the needs of sustainable rural development.

In the context of sustainable rural development and the formation of "Agriculture 5.0", it is important to improve advisory activities, which include the development and implementation of new areas of consulting, providing individual consultations to small agricultural enterprises, activities that ensure the formation of necessary digital skills among agricultural sector workers and rural residents.

Thus:

- advisory service is a key tool for ensuring sustainable rural development in the context of modern global challenges and the transition to the "Agriculture 5.0" paradigm;
- digitalization is an important factor that significantly affects the functioning of the agricultural sector and opens up new opportunities for advisory activities, but requires appropriate adaptation and development of digital competencies;
- the "quadruple helix" model is a promising organizational model of sustainable rural development in which advisory services play a central, coordinating role;
- promising directions for the development of advisory activities should be aimed at expanding the range of services, actively using digital technologies and forming digital competencies among the rural population and agricultural sector workers;

- state support for advisory services is necessary for their effective functioning and realization of potential in ensuring sustainable rural development.

The research clarified the importance of advisory services for ensuring sustainable rural development in Ukraine and the need for further development and adaptation to modern challenges and opportunities of the digital age.

9.3. Impact of Digitalization on the Functional Load of Extension Services in the Context of Supporting the Development of Small-Scale Agricultural Business

The research is based on a comprehensive approach using theoretical and empirical methods to analyze the impact of digitalization on the functional load of extension services in the context of promoting the development of small-scale agricultural businesses. The main methods include:

- analysis of scientific literature and regulatory legal acts;
- sociological survey (questionnaire) (questioning of clients of the Kirovograd Regional Extension Service to identify their information needs and assess the quality and accessibility of information support; the survey results are used to confirm the relevance of the problem and justify the need for digitalization of extension services);
- statistical analysis (statistical data are provided, and a statistical method is used to analyze quantitative indicators);
- system approach and modelling (extension activity is considered as an element of the support system for small-scale agricultural businesses, and a model of the regional agricultural extension service using digital tools is developed; modelling is used to visualize the proposed system and its key components);
- graphical method (for a visual representation of the model of the regional extension service using digital tools).

As in most EU countries, agricultural sector enterprises in Ukraine are represented by large, medium, and small-scale management forms. Large enterprises are usually the driving force behind scientific and technological progress in the agricultural sector. However, according to domestic realities, small agricultural enterprises guarantee the country's food security, ensure the self-employment of the population, and preserve rural territories. Today, successful

business is impossible without science-based production, planning, control, information support systems, etc. However, the specifics of small agricultural enterprises functioning in the context of constant external environment changes, territorial location, and insufficient staffing level necessitate appropriate support. The peculiarities of small businesses determine the feasibility of outsourcing, particularly regarding technological agro-consulting, planning, accounting, tax management, and more. An effective area of state support for agribusiness is extension services, whose activities aim to promote the development of small agricultural enterprises. The rapid development of society's digitalization significantly expands opportunities and necessitates substantiating organizational directions for transforming advisory services.

Extension service employees advise on issues that arise during the establishment and operation of agricultural enterprises. A significant difference between extension services and other consulting organizations is that they provide advice on a fairly wide range of issues. Secondly, most of these consultations are free of charge for clients. The staff of these services is composed of highly qualified specialists from various fields. Therefore, cooperation with regional extension services is an important prerequisite for successful operation for small agricultural enterprises.

The importance of information support for small-scale agricultural businesses is that its management and personnel live in rural areas and, therefore, have limited access to information support. This problem is exacerbated by the energy crisis caused by Russian aggression. When providing advisory services, it is necessary to consider the possibilities of digital technologies considering modern realities. Overall, the world and Ukraine are experiencing an increase in Internet users. In Ukraine, as of the beginning of 2024, over 60-70% of households in rural areas have Internet access, and the country's total number of Internet users exceeds 29-30 million (Ministry of Digital Transformation of Ukraine (Mintsifra): <https://thedigital.gov.ua/>).

Mobile internet is the dominant form of access in villages, and a smartphone is the primary internet device for most rural users. Despite the positive trend, the digital divide between urban and rural areas remains significant, especially regarding the quality and speed of connection, as well as the digital literacy of the rural population. However, in rural areas, a smartphone has become the first and only device for accessing the Internet for a significant part of new users. The accessibility and widespread use of smartphones allow them to be used in cooperation with extension services. Based on a survey of clients of the extension service (Kirovograd region), it was found that 97% of

respondents note significant problems in finding the necessary information and negatively assess its quality. In addition, the time spent searching for information is essential when consuming information services. In small agricultural enterprises, information retrieval is usually carried out by an employee (or directly by the business owner) who performs many other duties. For them, searching for information directly on the network is problematic. This issue can be resolved by using the services of advisors.

Before the full-scale military invasion, information on staffing of advisors and extension services in an up-to-date state was available on the information and analytical portal of the Agro-Industrial Complex of Ukraine (section "Rural Development"), where Registers of Extension Services, Agricultural Advisors, and Expert Advisors were posted in the relevant section. Today, the registers are closed. In the future, after the registers are opened, we consider it appropriate to create a regional regulatory and reference base for clients of the extension service, in which to systematize information by area. For example, economic and legal support for establishing and operating small agricultural enterprises, production technologies (zoned technological maps, fuel consumption rates, seeds, etc.), taxation of farming business, land resources and land relations, and others.

Under the requirements of the Law of Ukraine "On Agricultural Advisory Activity" (On Agricultural Advisory Activity: Law of Ukraine dated 17.06.2017 No. 1807-IV (as amended). <https://zakon.rada.gov.ua/laws/show/1807-15#Text>), the central executive body that implements state policy in agriculture must create and maintain registers of advisory services and advisors on the official website of the Ministry of Development of Economy, Trade and Agriculture of Ukraine, the Register of Agricultural Advisory Services for 2022 listed 45 organizations (Sayapin 2021). The Register of Agricultural Advisory Services also provides a personalized quantitative composition of advisory services, indicating the expiration date of certificates.

A negative point is that not all regions of Ukraine yet have regional extension services. Kirovograd region has a positive experience in cooperation between small agribusiness and the regional extension service (public organization "Kirovograd Regional Agricultural Advisory Service"), which has been operating since 1999. The extension service constantly cooperates with regional specialists in the field of agriculture, in particular, employees of the State Financial Service, regional and district administrations, scientific experts on theoretical and practical issues.

The areas of consulting of extension services are quite diverse, but the proportion of certified advisors who support a particular area differs significantly. According to a survey of clients of the public organization "Kirovograd Regional Agricultural Advisory Service", it was found that requests regarding technological issues are not fully satisfied, and there is a need to develop the direction of using IT technologies, both directly in business processes and in cooperation with advisors.

The production of agricultural products by small enterprises in the agricultural sector of the economy, their lower efficiency compared to large enterprises, and their readiness to use modern communication channels (the Internet) emphasize the feasibility of using agricultural extension services using modern digital technologies.

The first attempts to use information and communication technologies and the Internet to provide users with high-quality online information services began in the 90s. Today, Ukraine is implementing the "State in a Smartphone" concept, which involves service-oriented implementation of electronic educational platforms, web resources of executive authorities, etc. The basis for introducing an electronic agricultural extension system was the international experience developing information and reference systems (Savchenko, Kononenko 2021). In the countries of the Global North, the use of electronic platforms for extension activities has proven its effectiveness. Today, the process of creating and developing regional extension services is underway. Registers of agricultural advisors, expert advisors, and agricultural extension services deserve special attention from users. However, a significant disadvantage of their functioning (after opening) is that these information resources are limited only to certified advisory services and advisors with qualification certificates.

Digitalization of the economy (including agriculture) opens up many new opportunities, but their implementation requires significant transformations of almost all business processes. Thus, digital platforms optimize the process of information exchange between participants. In addition, digital transformation helps to improve the quality of production of goods and services while reducing costs. However, its implementation requires new approaches to educational processes, such as forming digital competence, which is possible through a digital advisory and educational platform. Using digital technologies opens up new opportunities for more profound structural changes in the economy and agriculture in particular.

Today, there is an urgent need for advisory services for small enterprises in the agricultural sector of the economy. However, most of these enterprises

are not informed about the possibilities and procedures for contacting them. The easiest way to disseminate information that an advisory service can use is to use mass methods. Mass methods of information dissemination usually include publications in the press, interviews on television and other media, placement of information exhibits at exhibitions, information on billboards along busy highways, and information on the Internet. Mass methods make it possible to inform many people quickly and relatively inexpensively.

In modern conditions, for a representative of an agricultural enterprise to have the opportunity and desire to contact an employee of the extension service, it is necessary to have not only contact details and a list of service advisors but also web resource addresses. Today, such means of communication as web resources are mandatory. Thus, to contact an extension service specialist directly if necessary, a potential client must be able to find him/her in the register of advisors, determine the area of competence, contact information, etc.

Today, Ukraine is experiencing a general trend of decentralization of power, which leads to the transfer of ever more extraordinary powers to local government structures. Partnerships between local communities and business structures significantly expand the competence of local authorities. In addition, the effectiveness of state regulation primarily depends on considering all the regions' opportunities. This necessitates the functioning of regional extension services and the development of areas of their cooperation with small enterprises in the agricultural sector of the economy and local government structures. It should be noted the expediency of involving employees of extension services to optimize cooperation between small enterprises in the agricultural sector of the economy and fiscal authorities. Implementation of this in practice is quite possible, especially given that extension services in Ukraine are regional. In addition to the above, the regionality of extension services is also important since, to ensure the efficiency of each small enterprise in the agricultural sector, it is necessary to consider the agro-climatic zones of each region. Increasing the efficiency of each small enterprise in the agricultural sector involves a scientifically sound choice of the most effective areas of activity, considering agro-zonal specifics.

The provision of advisory services should contribute to developing agricultural sector enterprises and improving socio-economic living conditions in rural areas. Attracting an agricultural advisor from small agricultural enterprises is possible by forming a system of information and consulting and educational support for economic entities in the agricultural sector, the rural population, dissemination of knowledge, provision of technical assistance, etc.

Given that small agricultural enterprises often do not have the financial capacity to pay for extension services, it is advisable to provide their support at the expense of budgetary funds.

Professional consulting for small enterprises in the agricultural sector of the economy should be accessible to all. In cases where face-to-face consultation is impossible (due to the territorial remoteness of a farming enterprise, etc.), modern digital technologies allow it to be carried out remotely.

In the countries of the Global North, significant financial resources are allocated for consulting small enterprises in the agricultural sector of the economy. This is because it is impossible to create an efficiently operating agricultural sector without ensuring the process of technology transfer and the latest scientific achievements.

Today, extension services are a key element in ensuring the efficient operation of enterprises in the agricultural sector of Ukraine. The extension service employees are conductors to agrarian producers of important information necessary for production diversification, opening new business areas, gaining new knowledge, etc. In addition, as already mentioned, agricultural activity is risky and prone to specific long-term crises. In these conditions, the extension service can ensure the effective functioning of agricultural producers.

Digitalization has a significant impact on agribusiness. The viability of small enterprises in the agricultural sector of Ukraine largely depends on their ability to dynamically and constantly master innovative digital technologies, adapt to market conditions, actively respond to changes in the external environment, etc.

It should be noted that the environment in which the subjects of the agricultural sector of Ukraine operate is characterized by instability, stagnation, and insufficient efficiency of management mechanisms.

Small enterprises in the agricultural sector of Ukraine have problems with access to digital technologies and attracting specialists in information and communication technologies. In addition, a small Ukrainian agricultural producer, in the course of his/her activity, faces significant problems with materials and technical issues, staffing, lack of sales markets, etc. Thus, even with official agricultural web resources, most small enterprises in the agricultural sector cannot meet their information demand. This applies even to regulatory legal acts since most of them require clarification by specialists. A wide range of highly specialized, experienced specialists is needed to address technological, organizational, environmental, and other issues.

A promising direction for cooperation between regional educational institutions of agricultural orientation and the regional agricultural extension service is creating a distance learning network for employees of agricultural sector enterprises. At the same time, it is advisable to create a system involving all regional agricultural extension services. This will make it possible to get acquainted with the specifics of the work of regional agricultural extension services of different agro-climatic zones, and, accordingly, different specializations, etc.

The development of regional agricultural extension services is primarily associated with their integration into a higher-order innovation infrastructure that combines the potential of science, education, and extension services.

The issue of developing communication links today can be solved through digital technologies. Combining classic and electronic forms of extension services should ensure quality, timeliness, and accessibility. To increase the effectiveness of extension services, we consider it appropriate to implement and operate an electronic extension system in the agricultural sector of Ukraine based on higher regional educational institutions of agricultural orientation with the involvement of their scientific and pedagogical staff.

A positive example is the experience of Kherson State Agrarian and Economic University in выделении a structural unit "Educational and Scientific Center "Institute of Postgraduate Education and Extension", whose activities are aimed at training certified advisors and expert advisors, and improving their level of qualification.

As a rule, extension services provide advice on a fairly wide range of issues; a large part of these services are free of charge for the client – an agricultural enterprise. Extension services are traditional for most developed countries in the world. Clients of agricultural extension services ("agricultural extension") in foreign countries are mostly small farming enterprises that need advice on analysis, innovation implementation, etc. When providing "agricultural extension" services in developed countries, significant emphasis is placed on ensuring long-term well-being.

Agricultural advisors and expert advisors have the right to provide services not only as representatives of extension services but also as individuals with the status of advisors and expert advisors. In this case, they also act based on a certificate, the validity of which is extended after passing advanced training for agricultural advisors and expert advisors. Advanced training is carried out by leading educational and scientific institutions. Thus, the National Uni-

versity of Life and Environmental Sciences of Ukraine has developed and implemented a training program for certified advisors, expert advisors, and advanced training. This program involves classes conducted by leading scientists and practitioners in Ukraine. The list of issues covered by the program is characterized by both relative generality and specificity. Thus, following the training program for advanced training of agricultural advisors and expert advisors of the event held by the National University of Life and Environmental Sciences of Ukraine, the consideration of the following issues is envisaged:

- agricultural policy in the current conditions of military, financial, and economic challenges;
- world history and current trends in the development of agricultural extension in the world;
- extension systems;
- extension and AKIS;
- history and current state of extension in Ukraine;
- legal regulation of agricultural advisory activity in Ukraine;
- approaches and tools of extension;
- demonstration methods of extension;
- demonstration farms;
- agricultural entrepreneurship and agricultural extension;
- ethics of advisory activity; – information technologies in advisory activity;
- electronic extension system;
- fundraising basics for advisors;
- current problems of land relations in Ukraine and ways to solve them;
- technologies of cultivation of field crops: methodological and applied aspects in extension;
- forestry of Ukraine and its role in the development of rural areas;
- innovative technologies in crop production;
- EU Common Agricultural Policy and European integration of Ukraine;
- fundamentals of rural development.

After listening to the program course and studying, solving, and analyzing practical situations, students pass a final test based on the results of which they are credited (or not credited) with advanced training.

In the consulting services market in agribusiness, in addition to extension services, agricultural advisors, and expert advisors, there are also marketing and

consulting units of companies selling machinery and equipment, agrochemicals, and other products of farming enterprises, consulting firms that offer services for building agribusiness "turnkey", etc. However, the target orientation of their services is to promote a specific (own) product on the market or is oriented towards cooperation with large enterprises in certain product sectors (Kononenko, Savchenko, Karnaushenko, 2023). At the same time, most agricultural enterprises need consulting services related to innovative changes due to digital technologies that consider the multifunctionality of agriculture.

Permanent transformations that take place in almost all sectors of the economy lead to serious problems in the labour market. Competencies necessary for successful competition in the labour market are constantly changing, requiring employees to constantly update their skills and knowledge. In such conditions of permanent accelerated obsolescence of competencies, personnel of enterprises and institutions, consulting structures are able to contribute to maintaining and strengthening the competitiveness of economic entities.

Despite a sufficiently large number and types of consulting firms on the market, Extension Services are the most optimal for economic entities of the agricultural sector. This is because extension services specialize in consultations on a wide range of issues, and a large part of these services are free of charge for the client – an agricultural enterprise.

By the state policy of ensuring modern conditions for agribusiness development, the possibility of covering the costs of consulting services at the expense of state funding is positive. However, in practice, agricultural enterprises mostly do not use this. Therefore, we consider it appropriate to develop and implement measures to promote advisory services among agribusiness and rural residents. The prospect for further research is the issue of organizing and methodological support for consulting for the development of small agribusiness in an innovative economy.

The regional agricultural extension service system uses digital tools to consult agricultural sector enterprises promptly. For this purpose, it is advisable to provide a user information search scheme, especially given that the user registration and identification system is mandatory when using the web interface. In the case of electronic mail consultations, it is possible to provide the user with system access details automatically. Digital technologies allow users to find the necessary information in the system databases independently.

Using the Moodle platform when creating databases of electronic training courses and regulatory and reference databases allows the user to inde-

pendently choose a direction (and a consultant) and proceed to distance learning. In addition, the Moodle platform allows scientific and pedagogical staff and advisors to constantly work with information resources, update them as needed, and communicate with clients.

A systematic approach and specialized information aggregation tools allow for more functional use of resources. A large amount of information and its diversity in the regional agricultural extension service system requires systematization, for which the simplest solution today is to create a catalogue (Fig. 5).

The efficient operation of extension services in Ukraine is ensured by the availability of highly qualified personnel and effective communications for prompt consultation and by reliable, high-quality, and timely information support. Today, the most appropriate is the use of information and reference materials from the Agroportal "Agrarian Sector of Ukraine" web portal (Agroportal "Agrarian Sector of Ukraine" <https://propozitsiya.com/ua/agroportal-agrarniy-sektor-ukrayini-odin-iz-naypovnishih-informaciynih-resursiv-v-ukrayinskomu>). Using the existing platform of the information and reference system "Agrarian Sector of Ukraine" and its content, it is advisable to form an encyclopedic database of agricultural knowledge "by deeply modernizing the structure, content, content and user management system, including territorial binding of encyclopedic and technological data (geographical interpretation of the distribution or application of information units)" (Sayapin 2021).

Using a regional agricultural extension service system using digital tools should integrate and optimize the processes of developing and adapting innovations of scientific institutions. Direct contact of representatives of agricultural sector enterprises is carried out through advisors. They adjust the knowledge accumulated on the digital platform to specific recommendations that consider the specifics of clients' activities (availability of financial, labour, and land resources; agro-climatic conditions; farming specifics). Combining classical and electronic extension services on a digital platform is a tool for combining monetized and socially oriented extension services.

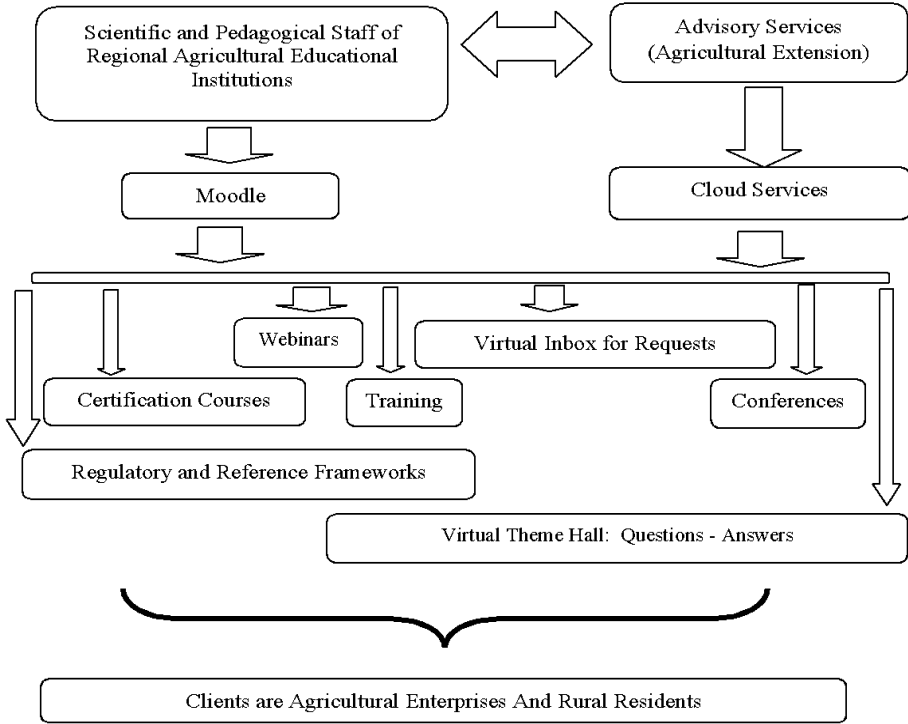


Figure 5. System of regional agricultural advisory service using digital tools

Source: developed by the authors

The current state of economic development requires expanding the list of consulting questions the extension service provides. Today, it is advisable to provide advisory support for issues related to modern agro- and information technologies, renewable energy, property rights (purchase, sale) of land plots, etc.

Digitalization of the economy necessitates the transformation of the institution of extension services. One of the ways to adapt the extension service to the requirements of the digital society is to create a digital platform for electronic extension, the use of which should be combined with the potential of highly qualified advisors. It is advisable to implement this by combining the existing infrastructure of classical regional agricultural extension and the electronic extension system using modern digital tools.

As a result of the research, the following conclusions are drawn:

- digitalization significantly affects the functional load of extension services, expanding its capabilities and creating new tools to support small agricultural businesses;
- for effective promotion of small agricultural business development, transformation of extension services by actively introducing digital technologies and creating regional digital extension platforms is necessary;
- the combination of classical and electronic forms of extension is the optimal approach to ensure high-quality, accessible, and timely extension services for small agricultural enterprises;
- the activity of extension services should be aimed at overcoming the digital divide and improving the digital literacy of the rural population and employees of small agricultural businesses, ensuring their access to modern information resources and tools;
- popularization of extension services and strengthening cooperation with local communities and authorities are essential conditions for ensuring the effective functioning of extension services and their impact on the development of small agricultural businesses and sustainable rural development.

The proposed model of the regional agricultural extension service using digital tools is a promising direction for the development of extension services in Ukraine, which corresponds to modern challenges and opportunities of the digital age and can contribute to increasing the competitiveness of small agricultural businesses and improving socio-economic living conditions in rural areas.

9.4. Prospective Areas of Consulting in the Provision of Advisory Services in the Context of Multifunctionality of Small Agricultural Enterprises

Agriculture is much more than just the production of food and raw materials. It plays a comprehensive role in society, performing several vital functions beyond purely economic activity. This multifaceted nature is determined not so much by the desire to maximize profits (profitability in many other sectors of the economy is much higher) but by the wide territorial coverage of agricultural production and its significant impact on the life of rural communities and the environment.

The following methods were used in the research:

- bibliographic;
- conceptual analysis and synthesis;
- deductive approach;
- sociological survey (questionnaire);
- graphical.

The specificity of agriculture lies in the fact that a significant part of its activity, although economically costly and in many cases does not bring direct profit, is of invaluable importance to society. That is why there is a tendency to increase funding for this sector in the countries of the Global North, which indicates an awareness of its multifunctional role and the need for support in this direction.

The specifics of the functioning of agricultural enterprises are determined by several factors that distinguish them from enterprises in other sectors of the economy. Unlike industry or the service sector, where the main goal is profit-making, agriculture performs a much wider range of functions that directly affect the social, economic, and environmental spheres. Multifunctionality contributes to increased production efficiency, cost optimization, and investment attraction.

Updating the technological base and protecting and restoring natural resources involve introducing modern technologies and innovations in agricultural production, allowing for increased productivity and reducing negative environmental impact, rationalising land, water and other natural resources, introducing environmentally sustainable farming methods, and preserving biodiversity.

Intensive development of strategic guidelines is realized through the support and development of priority areas of agriculture, such as organic production, products with high added value, and the development of green tourism.

The multifunctionality of small agricultural enterprises is an essential factor in the sustainable development of rural areas, ensuring the country's food security and preserving its natural potential. Thus, the concept of multifunctionality of agriculture is closely linked to implementing sustainable rural development. This link emphasizes the ability of small agricultural enterprises to play a key role in ensuring economic growth, social cohesion, and environmental sustainability in rural areas. However, to realize this potential, multifunctional agriculture must use:

- science-based farming methods;
- take into account environmental and social aspects;
- ensure continuous training and professional development of owners, management, and employees;
- introduce innovative technologies in production, processing, and sales;
- rational use of land, water, energy, and other natural resources;
- minimize waste;
- ensure the preservation of biodiversity (Ristić, Despotović, Dimitrijević, 2020).

The concept of multifunctionality transforms the traditional view of agriculture into a dynamic system. Integrating various activities creates a new kind of agricultural sector, making it possible to meet modern societal needs and promote sustainable rural development. Multifunctional agriculture is a prerequisite for sustainable development and positively affects the distribution and use of resources.

The formation, evolution, and implementation of the concept of multifunctionality in agriculture is a complex process that requires the involvement of a wide range of institutions and social groups that are not limited exclusively to the agricultural sector. To successfully implement the principles of multifunctionality of agriculture, it is necessary to apply a comprehensive approach that covers political, economic, technical, and social components. Currently, in most countries of the world, the multifunctionality of agriculture plays a key role in ensuring the implementation of the Goals of Sustainable Rural Development (Fig. 6).

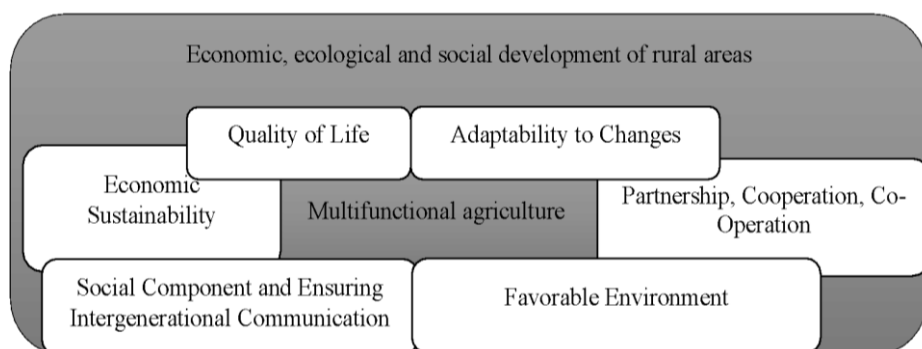


Figure 6. Multifunctional agriculture in ensuring the implementation of the Goals of Sustainable Rural Development

Source: developed by the authors

Forming sustainable agriculture based on the principles of circular economy, intergenerational responsibility, and social support is a global trend. The concept of sustainable rural development, aimed at harmonizing the economic, environmental, and social interests of present and future generations, has become highly relevant worldwide, including in Ukraine. However, despite the desirability of implementing the concept of multifunctionality of agriculture, recognised by scientists and society, in practice, disseminating its principles is insufficient. Thus, based on a survey of owners and management of extension service clients in the Kirovograd region, it was found that 9% of respondents are aware of the essence of "multifunctionality of agriculture" and share their position on the feasibility of its implementation. However, 98% of respondents representing small enterprises answered that their farms are engaged exclusively in producing grain and technical crops and do not adhere to the basic principles of circular economy and frugal land use. This situation is typical for Ukraine as a whole, which negatively characterizes the current state of implementation of the concept of multifunctionality of agriculture by small agricultural enterprises.

The creation and effective operation of a system of multifunctional agriculture is objectively associated with the emergence of internal contradictions that require comprehensive solutions. These contradictions, inherent in any complex system, manifest themselves at different levels: between the functions of the system and its organizational structure, between individual functional components, between different structural levels, and also in the form of conflicts between functions and structure at various hierarchical levels. The fundamental basis of these contradictions is the conflict between the system's multiple goals, an essential characteristic of multifunctionality.

A systematic approach to studying multifunctional agriculture makes it possible to identify features that should be considered when implementing the concept (Fig. 7).

Given the above, implementing the concept of multifunctionality in agriculture is characterized by specific features. At the same time, it is advisable to emphasize that despite the multivariate nature of potential functions of agriculture (environmental, social, recreational, etc.), agricultural production remains the essential foundation for the development of all others (Hrosul, Kruhlova, Mkrtchyan, Zubkov, Timchenko, 2021).

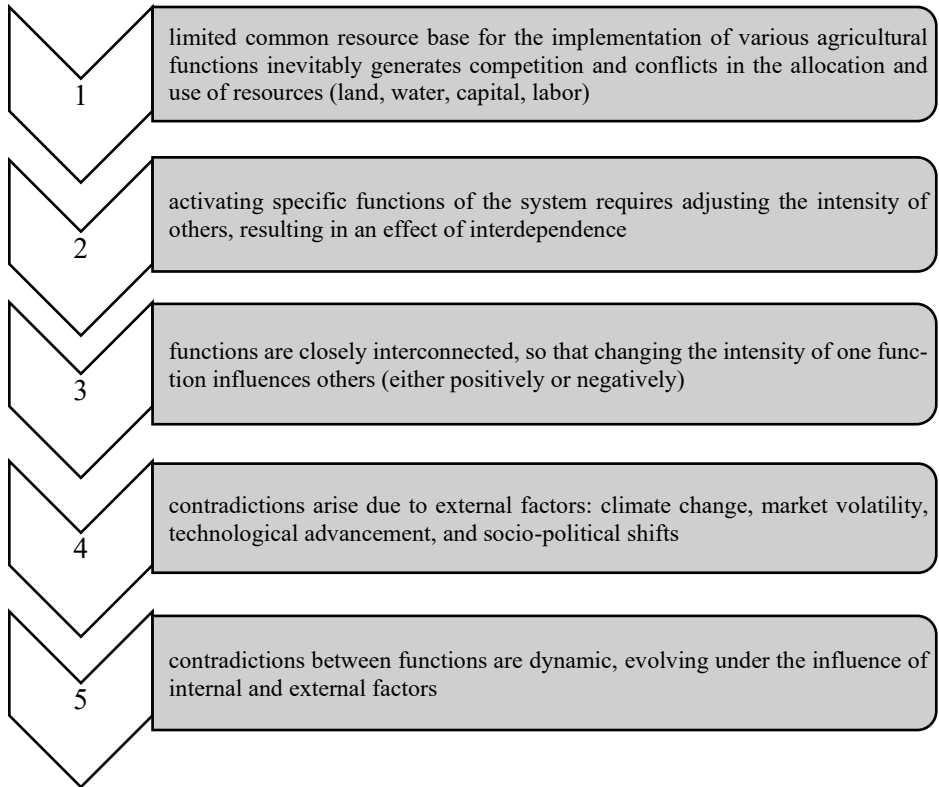


Figure 7. Types and nature of contradictions arising from the implementation of the concept of multifunctionality of agriculture

Source: developed by the authors

The implementation of the concept of multifunctionality of agriculture by small enterprises is complicated by such problems as limited financial resources, difficulty in attracting investment, the digital divide, restricted access to sales markets, insufficient technical equipment, management and production personnel qualifications, etc. Extension services play a significant role in overcoming these problems.

The modern functioning of agricultural enterprises is characterized by complexity and multi-aspect nature, which necessitates the implementation of the concept of multifunctionality. Problems and contradictions, especially characteristic of small farm enterprises, necessitate a comprehensive approach to implementing the concept of multifunctionality in agriculture. Thus, it is nec-

essary to develop measures related to access to financial resources, technologies, skilled labour, infrastructure development, partnership and cooperation, implementation of circular economy principles, etc. Implementing these directions should ensure the realization of the Goals of Sustainable Rural Development. For most small agricultural enterprises, overcoming contradictions and problems in this path is associated with advisory services.

Despite the considerable time spent on the functioning of extension structures in Ukraine, their impact on agribusiness development is insufficient. The results of a survey and analysis of the problems of small businesses in agribusiness made it possible to identify promising areas of agro-consulting. Thus, tax issues are among the preferences of clients of the Kirovograd Regional Extension Service. In the context of the transformation of the tax system of Ukraine, the National Revenue Strategy until 2030 (National Revenue Strategy until 2030) has been adopted. Among other things, the strategy provides for the abolition of the right to a simplified taxation system for legal entities. Thus, most agribusiness entities currently payers of group 4 will be forced to switch to paying taxes under the general taxation system and, in particular, become corporate income taxpayers. Corporate income taxpayers must ensure the reflection of income and expenses in accounting under the requirements of the standards. Accordingly, such enterprises should revise their accounting policies and record these changes in internal regulations (Tax Code of Ukraine: Code of Ukraine; Law, Code dated December 2, 2010 No. 2755-VI). As a rule, enterprises that are payers of Group 4 have significant errors in the formation of financial results due to the lack of control by fiscal authorities and are not entities that are required to conduct a mandatory audit of financial statements. This leads to a decrease in the quality of financial statements. We positively assess the prospects for changes in tax legislation and consider one of the appropriate areas of consulting by extension services for small enterprises: forming accounting policies and information management support.

The issues of agro-consulting (extension, agricultural extension) have been studied by many Ukrainian and foreign scientists. Maulu S., Hasimuna O. J., Mutale B., Mphande J., and Siankwilimba E. investigated the degree of influence of agricultural extension programs in rural areas on poverty reduction. Norton G. W. and Alwang J. studied the evolution of agricultural extension and its impact on farmers' adoption of new methods. Kacharo D. K. discovered the effects of information and communication technologies on modern agricultural extension. Koval N. V. considered the essence of advisory activity, clarified obstacles to its development in Ukraine, and the peculiarities of organizing the

agricultural extension system in Poland. Yevchu S. A., in his research, carried out a theoretical substantiation of the essence of modern agricultural extension as a socio-economic institution.

However, in today's volatile environment, the issue of identifying promising areas for developing agro consulting information management support for agricultural enterprises requires further research.

When developing accounting policies, it is necessary first of all to consider the farm's size and fix the reporting format (full or abbreviated) in the accounting policy regulation. The methodological component of accounting policy is more influenced by industry specifics, namely that land and biological assets are the primary resources of agricultural production.

At the regulatory level, the peculiarities of reflecting biological assets in accounting and reporting are regulated by the National Accounting Standard 30 "Biological Assets" (National Regulation (Standard) of Accounting 30 "Biological Assets": Order of the Ministry of Finance of Ukraine dated November 18, 2005 No. 790), which was adopted in 2007 under the requirements of International Accounting Standard (IAS) 41 "Agriculture" (International Accounting Standard 41. Agriculture). This standard defines an approach to valuing biological assets at fair value with fewer selling costs. IAS 41 "Agriculture" was published in December 2000 and first applied to annual reporting periods beginning on or after January 1, 2003. Despite the considerable application period of this standard in international practice, foreign scientists note that there are problems with its compliance (Gonçalves, Lopes, 2014). In Ukraine, too, despite the introduction of NAS 30 "Biological Assets" since 2007, most agricultural enterprises, especially small ones, do not comply with the requirements of this standard.

In this regard, the results of scientific research by Rute Gonçalvesa and Patrícia Lopesa are interesting. These scientists analyzed the level of compliance of agricultural companies listed on the stock exchange with the requirements of IAS 41 "Agriculture" regarding the disclosure of information on biological assets. They found out the factors that influence the presence of different levels of compliance with the requirements of this IAS (Fig. 8).

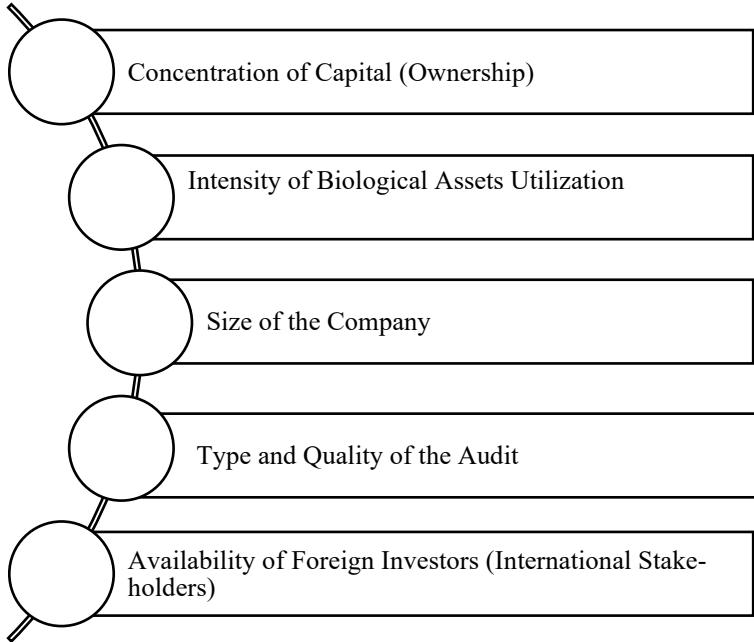


Figure 8. Factors influencing compliance with biological assets standards

Source: Developed based on (Gonçalves, Lopes 2014).

Thus, these scientists found that the concentration of capital (ownership) is an essential factor. This situation is also characteristic of domestic enterprises by the significant share of small enterprises (more than 90%) functioning in agribusiness in Ukraine, managers and owners' lack of understanding of the feasibility of applying the norms of NAS 30 "Biological Assets" regarding valuation at fair value with deferred sales with the formation of financial results and, accordingly, a positive impact on indicators of financial condition assessment.

Accordingly, extension service employees, with the involvement of expert advisors who are specialists in accounting and accounting support for tax reporting, can provide qualified assistance in the valuation of biological assets.

Farmers and scientists believe that introducing a simplified taxation system in the agricultural sector requires a more detailed analysis and individual approach to each enterprise. In particular, applying uniform taxation rules for extensive agricultural holdings and small farms may be unjustified.

The formation of accounting policies for agricultural enterprises is the subject of scientific research and methodological support. However, most agrarian enterprises neglect both the development of scientists and methodological industry recommendations.

The use of modern methods of information management support can help reduce costs and increase productivity in agriculture. In this regard, it is crucial to substantiate the organizational aspects and methodological components of accounting policies in the information management support system for costs and soft costs, which requires the formation of internal management reporting for business entities specializing in the cultivation of crops. There is a need to develop methodological support for using elements of the normative cost management method based on technological maps calculated for a crop rotation field. Also, with the participation of advisory structures, it is possible to draw up environmental passports of the field and develop and implement cumulative personal accounts for production units and cost formation locations (cost centers and responsibility centers). Accordingly, this direction is also vital in agroconsulting activities.

Peculiarities of agribusiness entities and their impact on the choice of accounting policy elements are presented in Figure 9.

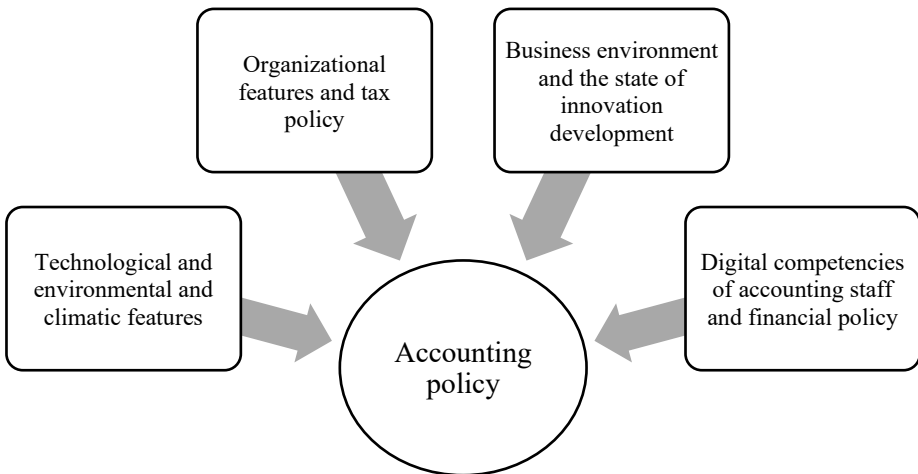


Figure 9. Factors Influencing Accounting Policy

Source: Developed by the authors

In the professional literature, more attention is paid to the impact of technological features on the formation of accounting policies of agricultural enterprises, which is related to using land as the leading resource and transforming biological assets. Accordingly, a promising area of consulting is methodological support for the reflection of land resources and land relations in accounting, which is associated with the formation and development of the land market as an essential segment of the financial market of Ukraine.

In foreign literature, attention is focused on the fact that investors direct their investments based on the financial condition of economic entities and their expectations, profits and losses, cash flow, and forecast of capital changes, respectively; accounting policy is critical regarding its impact on reporting indicators.

In developed countries, businesses constantly monitor the impact of their financial information on profits, considering it an essential factor in achieving high results. Therefore, the need to improve the organizational and methodological support of accounting policies in agricultural enterprises based on international standards increases the relevance of this problem in the context of the modern globalization process.

In modern conditions, it is necessary for extension structures to develop new areas of consulting: promotion and mechanism for implementing the principles of circular economy (Savchenko, Kononenko, Karnaushenko 2023). promoting the organization of new forms of partnership, cooperation, and cooperation at the level of territorial communities (Kyrylov, Hranovska, Savchenko, Kononenko, Gai, Kononenko (2024) targeted consulting for small agribusiness entities on information management support, in particular on the formation of internal management reporting; consulting on taxation issues and the creation of outsourcing structures for accounting and reporting with the participation of extension services; participation in activities aimed at formation of sufficient level of digital competencies of owners, management, and employees of small agricultural enterprises; consulting on the formation of reporting and tax consequences for land tax, which is associated with solving problematic issues that arise for individuals – different tax consequences for owners of land shares and plots, depending on who is granted the right to use the land (when leased and the fact of registration of the agreement to group 4 taxpayers, the owner is exempt from land tax) and the terms of transfer (the emphyteusis agreement does not entitle to non-payment of land tax).

Promising areas of consulting, according to the requests of potential clients of extension services, are considering permanent changes in the current

legislation on taxation and tax reporting, as well as strategic ones related to the directions of reforming the simplified taxation system under the National Revenue Strategy until 2030. When providing consultations, it is advisable to involve expert advisors specializing in accounting, taxation, and reporting, provided there are different taxation systems – choosing the optimal one for the client is a vital consulting area. Also promising areas of consulting are the issues of forming accounting policies, information management support for costs and production costs, land relations, and reflection of their consequences in accounting and reporting.

As a result of the research, it was found out:

- multifunctionality is a key concept for understanding the modern role of agriculture and ensuring sustainable rural development;
- it is necessary to implement the concept of multifunctionality in Ukraine, which faces numerous challenges, especially for small agricultural enterprises (due to limited resources, low awareness, and the presence of internal contradictions);
- extension services play an essential role in supporting small agricultural enterprises on the path to implementing the principles of multifunctionality, providing the necessary knowledge, advice, and practical assistance in overcoming existing problems;
- prospective areas of agro-consulting should be aimed at providing practical assistance to farmers in solving specific problems related to accounting, taxation, cost management, land relations, implementation of circular economy, and development of digital competencies;
- popularization of the concept of multifunctionality and activation of extension activities are necessary conditions for ensuring sustainable development of agriculture in Ukraine and realizing its multifaceted potential.

Extension service is an essential tool for implementing the concept of multifunctionality, especially for small agricultural enterprises.

9.5. Conclusions

The conducted research has allowed for a comprehensive analysis of Ukraine's current state of advisory activities to identify key problems of its functioning and outline prospects for further development. Despite the existing legislative framework and recognition of its importance for the agricultural sector, it has been established that advisory services still do not fully realize their potential in Ukraine. The research confirmed that although the idea of advisory services is positively perceived by society and farmers, there are significant problems in the organization, financing and methodological support of advisory services.

The analysis revealed that the digitalization of the agricultural sector creates new opportunities and additional challenges for advisory activities in Ukraine. On the one hand, digital technologies open up new tools for providing advisory services, expanding their reach and increasing efficiency. On the other hand, the digital divide in rural areas, insufficient digital competencies of advisors and farmers, and the limited use of digital tools in advisory practice hinder the development of digital advisory services in Ukraine.

The paper substantiates that a comprehensive modernization of the advisory system is needed to ensure the effective development of advisory activities in Ukraine, which would consider current challenges and opportunities. This involves improving the regulatory framework, increasing funding, improving advisors' skills, actively introducing digital technologies, and strengthening the role of advisory services in ensuring the sustainable development of the agricultural sector of Ukraine.

Based on the research, the following recommendations are proposed to promote the development of advisory activities in Ukraine:

- improve the regulatory framework for advisory activities, in particular, expand the list of types of advisory services, standardize issues of financing advisory activities;
- increase the volume of state funding for advisory services, considering the possibility of restoring full-fledged state support programs for advisory services, including compensation of costs for advisory services for small agricultural enterprises and ensuring stable budget funding for regional advisory services;
- improve the qualifications and professional level of advisors by developing a comprehensive system of training, retraining and advanced training

of advisors, focusing on mastering modern consulting methods, using digital technologies and knowledge in the field of sustainable rural development;

- promote the active introduction of digital technologies in advisory activities by creating digital advisory platforms, developing electronic educational resources and providing advisors and farmers with access to modern information and communication tools; it is essential to provide digital literacy training programs for advisors and the rural population;
- strengthen the role of advisory services in ensuring the sustainable development of the agricultural sector of Ukraine, orienting advisory services towards the dissemination of knowledge about sustainable technologies, environmentally safe production, circular economy and social innovations in agriculture;
- intensify cooperation between advisory services and other stakeholders in the agricultural sector, ensuring effective interaction with public authorities, local governments, scientific and educational institutions, farmers' associations and business representatives;
- increase the awareness of agricultural producers and the rural population about the capabilities of advisory services by conducting information campaigns, measures to popularize advisory services and ensuring the availability of information about advisory services through various communication channels, including digital platforms and social networks.
- Further research may be aimed at an in-depth study of the following aspects of the development of advisory activities in Ukraine:
 - analysis of the effectiveness of various models of organization of advisory services in Ukraine and development of recommendations for optimizing their organizational structure and management;
 - research of financial mechanisms for supporting advisory activities and searching for optimal sources of funding, including state, private and international funds; development of indicators and methodologies for assessing the quality and effectiveness of advisory services in Ukraine and their impact on the development of the agricultural sector and rural areas;
 - study of the needs and expectations of agricultural producers regarding advisory services and development of personalized approaches to providing advisory assistance to various categories of farmers; analysis of the impact of European integration processes on the development of

advisory activities in Ukraine and adaptation of the Ukrainian advisory system to European standards;

- research the possibilities of using artificial intelligence and big data analysis to improve advisory activities, automate routine processes and increase the personalization of advisory services;
- study of socio-economic consequences of the development of advisory activities for rural areas of Ukraine, including the impact on employment, rural incomes, small business development and improvement of the quality of life in rural areas.

The research and proposed recommendations can contribute to the development of advisory activities in Ukraine, increasing its efficiency, expanding the coverage of agricultural producers, and ensuring the sustainable development of the country's agricultural sector.

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AGRICULTURAL EXTENSION SERVICES IN THE CONTEXT OF ECONOMIC SECURITY

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10.1. Introduction

Given the turbulence of the global economy, growing geopolitical tensions, digital transformation and the formation of the Society 5.0 concept, economic security issues are paramount. This issue is especially relevant for the agricultural sector, which is strategically vital for food security and socio-economic stability. While playing a key role in employing the rural population, preserving rural areas, and producing a significant share of agricultural products, small agribusinesses are also the most vulnerable to external and internal economic, social, technological, and environmental challenges. Under these conditions, the adequate economic security of small agricultural enterprises requires the search for innovative approaches and tools, among which agricultural extension services play a unique role.

As intermediaries between science, the state and agricultural producers, extension services can provide the necessary information and agricultural extension service support, contributing to small agricultural enterprises' competitiveness, adaptability and economic sustainability.

The study's relevance is due to the need for theoretical substantiation and practical development of mechanisms for intensifying agricultural extension services as an essential factor in ensuring the economic security of small farm enterprises in modern conditions.

The study aims to clarify the current state and problematic issues of agricultural extension services and determine the prospects for its development in the context of ensuring economic security.

To achieve this goal, the following tasks have been set:

- to reveal the evolution and essence of the concept of economic security, to define its multilevel structure and key factors of influence at different levels of the economic system;
- to define the role and place of small agribusiness in the system of ensuring the economic security of the country, to analyze its specific characteristics, advantages, problems and risks;
- to substantiate the theoretical foundations of agricultural extension services in agriculture, to reveal its essence, forms, principles and significance in the context of ensuring sustainable development and increasing the competitiveness of agricultural enterprises;
- to study the relationship between agricultural extension services and accounting and analytical support for the management of small agrarian enterprises as a component of their economic security;
- to develop practical recommendations for intensifying agricultural extension services to improve the economic security of small farm enterprises, in particular with the use of digital technologies and in the context of the development of multifunctional agriculture;
- to determine the prospects for the development of agricultural extension services in the context of digital transformation and the formation of the concept of Society 5.0, aimed at ensuring economic security

The scientific novelty of the obtained results lies in a comprehensive study of the theoretical, methodological and applied aspects of agricultural extension services to ensure the economic security of small farm enterprises in the context of modern transformations. The elements of scientific novelty include:

- the conceptual foundations of economic security are improved by deepening the understanding of its multilevel structure, identifying key factors of influence and systematizing evolutionary approaches to its interpretation, which allows expanding the scientific knowledge of modern dimensions of economic security;
- the methodological tools for assessing the role of small agribusiness in the economic security system have been developed by developing an integrated approach that considers the economic, social and environmental

aspects of its functioning and allows for a more informed determination of the directions of support and development of small agricultural enterprises;

- The strategic role of agricultural extension services as an effective mechanism for ensuring the economic security of small farm enterprises is substantiated by disclosing its information, consulting, educational and organizational functions, which allows for increasing the validity of management decisions and the adaptability of small agricultural enterprises to changes in the external environment;
- practical recommendations for intensifying agricultural extension services to improve the economic security of small farm enterprises, in particular, the introduction of digital technologies, expanding the range of agricultural extension services and optimizing cooperation with agricultural extension services, which is of practical importance for improving the efficiency of small farm enterprises and agricultural extension services in the agricultural sector.
- The obtained theoretical generalizations and conclusions deepen scientific knowledge about economic security and the role of small agribusiness and agricultural extension services in modern economic transformations. The practical significance of the study lies in the possibility of using the developed recommendations by public authorities in the formation of agricultural policy and agricultural extension services to improve the methods and tools for supporting small farming enterprises, as well as by small agricultural enterprises themselves to improve their economic security and competitiveness in the market.

10.2 Economic security: emergence, current state and prospects for further development

Economic security issues have always been the focus of both scholars and practitioners. However, these issues are gaining new relevance today.

The following methods were used during the study: **bibliographic analysis, content analysis, chronological analysis, comparative historical analysis, systematic approach, structural and logical analysis, induction and deduction, generalization and systematization.**

The global trend of free market dominance has weakened the national security of most countries (Farrell, Newman 2023). In addition, the last decade has been characterized by a trade war between the world's two largest economies, a pandemic (during which access to critical medical resources was used as a tool of diplomatic pressure); politicisation of access to semiconductors (one of the most vital technologies in use today) (Chimits, Mccaffrey, Lopez, Poitiers, Vicard, Wibaux, P. 2024); a full-scale Russian military invasion of Ukraine; and the formation of Society 5.0 (Mishchuk, Riabykina, Ushenko, Hamova, Tkachenko, Yastremska, 2022). Accordingly, risks have arisen that did not exist before. All this and much more has increased attention to the "economic security" issue. Thus, on 20 June 2023, the European Commission adopted the European Economic Security Strategy (European Commission (2023).

Although economic security is a fundamental need and has been widely and long used, there is no consensus on "economic security". This category remains somewhat blurred and vague (Chimits, Mccaffrey, Lopez, Poitiers, Vicard, Wibaux 2024). This uncertainty is due to the multidimensional nature of economic security. Ensuring it primarily involves considering economic and political goals. The purpose of formulating and implementing an economic security strategy is to "protect" the economic efficiency of economic entities from various risks. Business entities differ from each other in terms of size, organizational and legal form, and type of activity. Accordingly, this should be considered when developing and implementing the economic security mechanism.

The definition of "economic security" consists of two components: "economic" and "security". The initial category is "security". Security issues were of concern to scholars of the ancient world. For example, Plato, in his work "The Republic" (Plato. The State / translated from the ancient Greek by D. Koval. K.: Osnovy, 2000) and Thomas More, in his work "Utopia" (Mohr, Campanella, 1988) studied the issues of ensuring the security of the state. Aristotle, in his work Politics, when studying the category of "security", considered it in the context of ensuring the security of citizens of the state through the fair distribution of benefits and the establishment of justice in rights (Aristotle (2023).

The modern era is characterized by a new wave of interest in the "security" category. The most famous works of this period belong to John Locke and Thomas Hobbes. Thus, J. Locke considered security in the context of ensuring the safety of citizens, which is achieved by protecting the property and

freedoms of citizens (Locke, John (2020) T. Hobbes also studied the problem of ensuring the security of citizens, but he focused on establishing a strong state power to ensure citizens' security (Hobbes 1904) . Nevertheless, both J. Locke and T. Hobbes believed that the primary role in ensuring the security of an individual belongs to the state.

In the twentieth century, there was a renewed interest in the " security " category. In 1943, the prominent American psychologist Abraham Maslow published **The Theory of Human Motivation (Maslov 1943)**. **This work describes for the first time the hierarchy of human needs, where the need for security is considered as fundamental.** A. Maslow describes the hierarchy of needs **in more detail** in his work "Motivation and Personality" (Maslov 2023). The first two levels in this hierarchy are fundamental (Fig. 1). Only after satisfying physiological and safety needs can an individual move on to satisfying higher-level needs. Even though the second level of the figure specifies "economic security" when detailing security, such a category did not exist at the time. Nevertheless, it is pretty logical to interpret it this way based on the features described by Maslow.

The conditional separation of the economic component began with US President T's introduction of the concept of national security—Roosevelt in 1904. However, the idea of economic security was formed only in the 1960s. (Accounting and Analytical Support in the System of Risks and Threats to Economic Security of Agricultural Enterprises of Ukraine: Monograph. Kharkiv National Agrarian University named after V.V. Dokuchaev. Kharkiv: Druk. Madrid, 2020). The second half of the twentieth century saw the peak of interest in studying the essence and specifics of economic security. In 1985, at the 40th session of the UN, a resolution was adopted that provided an international definition of economic security – economic security is a state in which a people can sovereignly, without interference and pressure from outside, determine the ways and forms of their economic development (Agenda of the 40th regular General Assembly session / adopted by the General Assembly at its 3rd plenary meeting on 20 September 1985).

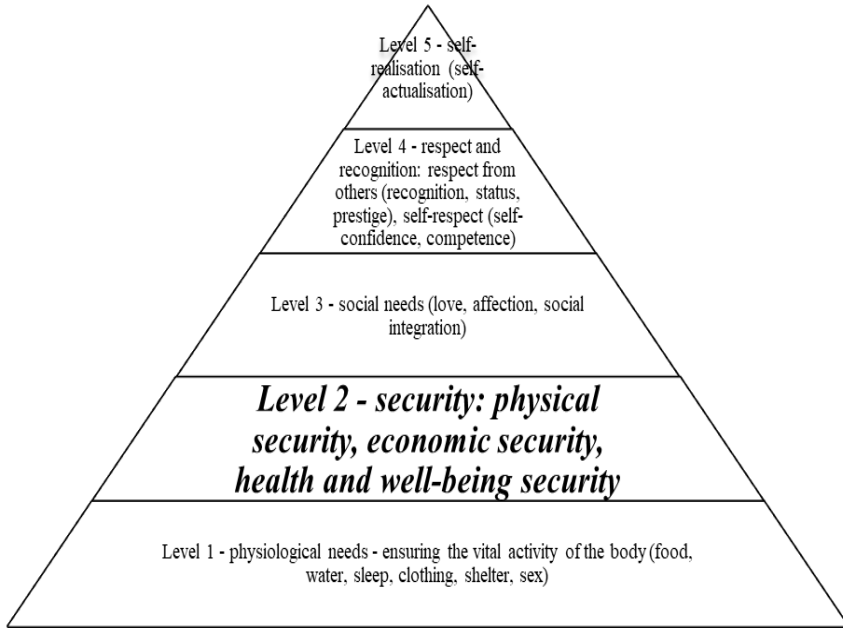


Figure 1. Security in Maslow's hierarchy of needs

Source: Built by the authors based on (Maslov 2023)

In Ukraine, the concept of economic security began to emerge in the early 1990s based on **the approaches of Western economists**. The Encyclopedia of Modern Ukraine defines economic security as a complex multifactorial category that characterizes the ability of the national economy to expand reproduction to meet the needs of the population and the state at a certain level to resist destabilizing factors that pose a threat to the sustainable, balanced development of the country; to ensure the competitiveness of the national economy in the global economic system (Encyclopaedia of Modern Ukraine. Kyiv: NAS of Ukraine, 2009) . The Law of Ukraine "On National Security of Ukraine" does not directly define economic security (On the national security of Ukraine: Law of Ukraine No. 2469-VIII of 21.06.2018). However, the economic component is seen as a component of national security in ensuring the implementation of the Strategy for the Development of the Defense Industry of Ukraine (On the Decision of the National Security and Defense Council of Ukraine of 18 June 2021), the National Security Strategy of Ukraine (On the Decision of the National Security and Defense Council of Ukraine of 14 September 2020), the Military Security Strategy of Ukraine (On the Decision of the

National Security and Defense Council of Ukraine of 25 March 2021), and the Cyber Security Strategy of Ukraine (On the Decision of the National Security and Defense Council of Ukraine of 14 May 2021). Accordingly, economic security is a mandatory component of all components of national security. However, considering international practice, we believe it expedient to prescribe the terminology "economic security" at the legislative level and, considering European approaches (namely, the development and adoption of the European Economic Security Strategy (European Commission (2023) Joint Communication To The European Parliament, The European Council And The Council On "European Economic Security Strategy". JOIN(2023), to supplement the Law of Ukraine "On National Security of Ukraine" with the following with the Strategy for Ensuring Economic Security.

The European Economic Security Strategy states that the starting point for its development was an awareness of the existing risks and recognition of the objective contradictions between strengthening European economic security and ensuring that the European Union can continue to benefit from an open economy. The European Commission has identified three main areas (Table 1).

Table 1. Key priorities for ensuring European economic security*

№	Priority.	Implementation mechanism
1	increasing its competitiveness by improving the economy's and supply chains' resilience, stimulating innovation and industrial potential while maintaining a social market economy.	This can be achieved by deepening the Single Market, investing in the economy of the future through innovative macroeconomic and cohesive policies, NextGenerationEU, and investing in human capital, in particular by upskilling the European workforce. This will require diversifying sources of supply and export markets or strengthening the research and industrial base in strategic areas such as advanced semiconductors, quantum computing, biotechnology, zero-emission industries, clean energy or critical raw materials.
2	protecting against economic security risks through more effective use of existing instruments (trade protection, foreign subsidies, 5G/6G security, foreign direct investment verification and export controls) and developing and implementing new tools to counter economic coercion.	In parallel, the effectiveness of the EU toolkit should be assessed and expanded as necessary to address some emerging risks, for example, related to exports or foreign investment in a narrow set of keys enabling technologies with military applications (e.g., quantum technologies, advanced semiconductors, artificial intelligence).

3	<p>partnerships with the broadest possible range of countries that share European concerns about economic security, as well as with countries that have common interests and are willing to cooperate to achieve a transition to a more sustainable and secure economy.</p>	<p>This means working with the broadest possible range of partners to strengthen economic security, promote sustainable value chains, and strengthen the international rules-based economic order and multilateral institutions. It also means partnering with countries on similar paths to reduce risk, encourage and complete free trade agreements, invest in sustainable development and secure global connections through the Global Gateway.</p>
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Source: Created by authors based on European Commission (2023) Joint Communication To The European Parliament, The European Council And The Council On "European Economic Security Strategy". JOIN(2023) 20 final.

The European Economic Security Strategy states that no country can act alone to ensure its economic security in today's interconnected world. The economic and national security interests of states are closely linked.

Adequate economic security requires a comprehensive approach that considers its manifestations at different levels of the economic system (Figure 2).

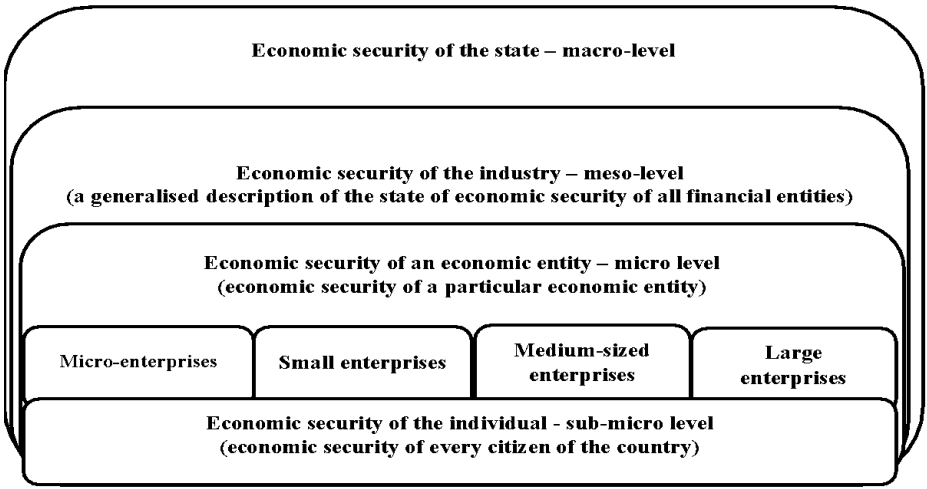


Fig. 2 - Hierarchy of economic security levels

Figure 2. Hierarchy of economic security levels

Source: own elaborations based on European Commission (2023) Joint Communication To The European Parliament, The European Council And The Council On "European Economic Security Strategy". JOIN(2023) 20 final

At the level of an economic entity, economic security is mainly seen as a set of measures to manage risks and ensure sustainable development (Kuzmenko, Chyzhevska, 2024). This systemic approach considers economic security as an integral part of strategic planning, where resource provision, financial stability and risk management synergistically interact to ensure long-term stability, which requires the availability of appropriate accounting and analytical support.

The classical components of economic security of an economic entity are shown in Fig. 3.

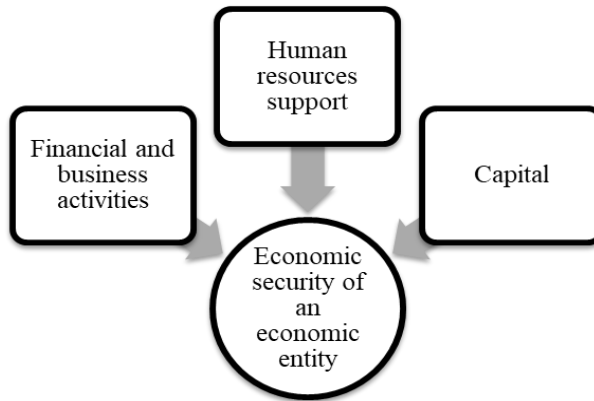


Figure 3. Components of economic security of an economic entity

Economic entities differ in their activity, size and organizational and legal form. Ensuring the economic security of each economic entity requires it to accumulate significant potential (including human resources), use market positions and gain advantages in competition. For most small businesses, these conditions cannot be met independently, so they unite in integration or cooperative structures or cooperate with consulting and agricultural extension services structures. In addition, economic actors are now facing the issue of ensuring economic security in forming Societies 5.0 (Society 5.0....2020). The Society 5.0 paradigm is human-centered and involves the integration of cyber and physical spaces, which **necessitates** balanced economic development and economic security in combination with addressing social and environmental issues. In the context of Society 5.0, opportunities are created to strengthen not only individuals' economic security but also society's social and economic security as

a whole. **The formation of Society 5.0** places new demands on economic actors to ensure their economic security in the context of global digitalization and the Sustainable Development Goals.

The latest digital technologies are being introduced into the practice of economic entities daily, along with the introduction of sustainable business models (SBMs) (Broccardo 2023). In such circumstances, an economic entity can ensure its economic security only if it has a strong and diverse human resource potential with relevant professional competencies. Accordingly, today, providing economic security as never before requires considering such components as "human resources", "competencies", and "experience and knowledge" (Desyatnyuk, 2024). At the same time, the effectiveness of economic security is determined not only by the presence of these components but also by the ability of an economic entity to strategically develop, effectively use and continuously improve human capital to withstand external challenges and achieve strategic goals. However, for many economic entities, especially small ones, achieving this staffing level is complicated by objective resource constraints. In such circumstances, turning to consulting and agricultural extension services structures is not just a forced step but a rational and justified strategy to ensure economic security. This approach helps to overcome staff shortages, gain access to multidisciplinary, highly qualified specialists, increase flexibility and responsiveness to challenges, optimize costs and boost innovation potential. The strategic and prudent use of external consulting and agricultural extension services resources is becoming an integral part of an effective strategy to ensure the economic security of small businesses in today's dynamic and competitive business environment.

Security issues, including economic components, have been of interest to humanity since ancient times. Nevertheless, the concept of economic security as a separate category began to emerge only in the twentieth century, evolving from an understanding of the security of the state and citizens to an awareness of the importance of economic sustainability at the international level. The concept was formalized in the second half of the twentieth century against the backdrop of increasing economic interdependence of countries and the realization of the need for international cooperation in this area.

Today, economic security issues have become particularly relevant under global challenges, such as military actions, trade wars, pandemics, geopolitical instability and digitalization. These challenges increase the vulnerability of national economies and highlight the need for active measures to ensure their economic security. At the same time, there is no universal definition of "economic

security" due to its multidimensional nature and contextual dependence. The current understanding of economic security is complex and covers different levels.

Further development of the concept of economic security requires a comprehensive approach. Today, human capital is becoming a key element of economic security. At the level of economic entities, especially small businesses, it is becoming strategically important to use external consulting and agricultural extension services to strengthen human resources and ensure flexibility in the face of limited opportunities. The prospects for economic security are also closely linked to the digital transformation of the economy and the need to adapt to the latest technologies while ensuring the sustainability and stability of economic development in the face of global uncertainty. In formulating and implementing economic security strategies for enterprises, it is necessary to consider the balance of economic efficiency, social justice and environmental sustainability in the context of global mass digitalization and geopolitical turbulence.

Thus, the issue of economic security has been an object of scientific interest since ancient times. However, the conceptualization of economic security as an independent category is relatively recent, developed only in the twentieth century. The evolution of the understanding of security has gone from focusing on the security of the state and citizens to realizing the importance of economic sustainability at the international level.

The concept of economic security was formalized in the second half of the 20th century due to the growing economic interdependence of countries and the realization of the need for international cooperation in this area. The global definition of economic security was provided by the UN in 1985. The emphasis was placed on the sovereign right of nations to determine the path of economic development without external pressure.

Current global challenges, such as military conflicts, trade wars, pandemics, geopolitical instability, the emergence of Society 5.0 and digitalization, have led to increased attention to economic security. These factors increase the vulnerability of national economies and necessitate the intensification of measures to ensure economic security.

Today, no single, generally accepted definition of "economic security" exists due to its multidimensional nature and contextual dependence. The current understanding of economic security is complex and covers different levels of the economic system: international, state, sectoral, economic entity and individual.

Further development of the concept of economic security requires a comprehensive approach that considers the hierarchy of levels and the interconnection between them. Human capital is recognized as a key element of economic security in digital transformation and the formation of Society 5.0.

At the level of economic entities, especially small enterprises, it is strategically vital to engage agricultural extension services to ensure flexibility and adaptation of economic entities to the latest technologies. The strategic use of agricultural extension resources is becoming an integral part of an effective strategy for ensuring the economic security of small businesses in the face of global uncertainty.

The prospects for economic security are closely linked to the digital transformation of the economy and the need to balance economic efficiency, social justice and environmental sustainability in the context of global mass digitalization and geopolitical turbulence.

10.3 Small agribusiness in the system of economic security

Small businesses play a crucial role in the economic security of any country. It is in the small business system that most jobs are created. Small businesses help to support competition and innovation, diversify the economy, make the economy more resilient to crises, ensure social stability, etc.

The study is based on a set of theoretical and empirical research methods, namely:

- theoretical methods: bibliographic analysis; content analysis; systematic approach; structural and functional analysis; comparative analysis; generalization and synthesis; induction and deduction; generalization and systematization,
- empirical methods: statistical analysis; tabular and graphical methods.

Ensuring economic security for small businesses, including protection from internal and external risks, guaranteeing financial stability and solvency, creating conditions for sustainable and stable development, increasing competitiveness, maintaining a positive business reputation, ensuring financial independence, and compliance with legal regulations, is essential in the context of strengthening the economic security of the country as a whole.

The importance of small business in the European Union is evidenced by the focus of all EU policies on the concept of "Think Small First". This concept aims to create the necessary environment for small businesses' successful operation and development, ensuring predictability for small businesses and providing them with a transition period to implement any changes. In addition, the average number of employees in European companies is four. Therefore, the "Think Small First" principle should be the basis of all EU policy (Renew Europe at Business Days: "Think small first" principle basis for EU policy).

Agriculture is a specific industry which fundamentally distinguishes it from other types of economic activity. For example, agricultural production depends on natural conditions, is characterized by seasonality, is linked to biological processes, etc. In addition, climate change currently affects agrarian production; it faces regulatory pressures, namely, environmental regulation on the use of pesticides, reduction of nitrogen emissions, the need to ensure food safety, etc. The importance of agriculture for Ukraine is primarily because the agricultural sector is not only an essential component of food production, but also rural areas occupy 87% of the country's territory (Zinchuk, Kutsmus, Prokopchuk, Lagodiienko, Nych, Naumko 2021), which require appropriate conservation and development, which is ensured primarily by small agribusinesses, which perform several functions that go far beyond economic activity. **Ukraine's agricultural sector is the basis of its national security and a vital element of its socio-economic landscape.** It performs critical functions that include rural development, environmental protection, and ensuring the implementation of the Sustainable Development Goals. Despite the unprecedented destruction of agricultural infrastructure, horrific minefields and a significant decline in production capacity as a result of full-scale military operations, leading experts unanimously confirm the strong position of the agricultural sector as a **leading industry in the Ukrainian economy**. A characteristic feature of the agricultural sector is that a significant part of its activities, although potentially economically costly, is of value to society.

Small agribusinesses play a unique role in the system of economic security of agricultural enterprises since, unlike large agrarian enterprises, they are focused on the domestic market and thus ensure the country's food security, contribute to sustainable rural development, improve living standards in rural areas; preserve traditional rural lifestyles; provide employment in rural areas; supply consumers with high-quality, often unique products, etc. However, these enterprises face **several significant and interrelated problems: insufficient logistical support** (mostly outdated equipment and manual labour); **shortage**

and low level of qualified personnel; high production costs due to lack of economies of scale and significant expenses; **problems with sales** due to limited access to markets and dependence on intermediaries; geographical remoteness from centres of economic activity, etc.

Agricultural enterprises in Ukraine vary in size. According to the Law of Ukraine, "On Accounting and Financial Reporting in Ukraine (Law of Ukraine "On Accounting and Financial Reporting in Ukraine), enterprises (including agricultural enterprises) are divided into micro, small, medium and large enterprises. As a rule, large enterprises drive scientific and technological progress. However, **small and micro-enterprises (hereinafter called small) agricultural enterprises are crucial in ensuring sustainable rural development.** A high-quality agricultural structure is possible only based on a **sympiosis of** business entities of different sizes and organizational and legal forms with **socially equal access** to production resources, finance, market infrastructure, and technical, technological and managerial innovations. Equally important is the creation of appropriate conditions for rural residents.

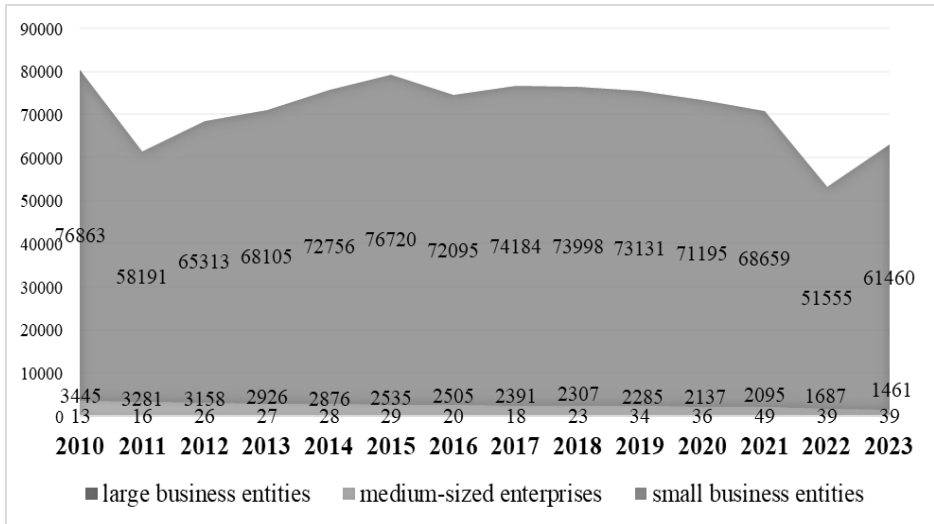


Figure 4. Structure and dynamics of operating large, medium and small enterprises in agriculture, forestry and fisheries in 2010-2023

Source: Compiled by the authors based on (Website of the State Statistics Service of Ukraine).

Even though small agricultural enterprises in Ukraine produce less than 10% of most agricultural products, their number has consistently exceeded 94% over the past thirteen years (Website of the State Statistics Service of Ukraine). Figure 4 and Table 2 illustrate the number of operating large, medium and small businesses in agriculture, forestry and fisheries in 2010-2023

Table 2. Number of operating large, medium and small businesses in agriculture, forestry and fisheries in 2010-2023

Years	Business entities								
	total, units	large entrepreneurial entities		medium-sized enterprises		small business entities		of which micro-entrepreneurial entities	
		units	in % to the total of business entities of the corresponding type of economic activity	units	in % to the total of business entities of the corresponding type of economic activity	units	in % to the total of business entities of the corresponding type of economic activity	units	in % to the total of business entities of the corresponding type of economic activity
2010	80321	13	0,0	3445	4,3	76863	95,7	72421	90,2
2011	61488	16	0,0	3281	5,3	58191	94,7	52654	85,6
2012	68497	26	0,0	3158	4,6	65313	95,4	59671	87,1
2013	71058	27	0,0	2926	4,1	68105	95,9	62419	87,8
2014	75660	28	0,0	2876	3,8	72756	96,2	66258	87,6
2015	79284	29	0,0	2535	3,2	76720	96,8	71649	90,4
2016	74620	20	0,0	2505	3,4	72095	96,6	66905	89,7
2017	76593	18	0,0	2391	3,1	74184	96,9	68819	89,9
2018	76328	23	0,0	2307	3,0	73998	97,0	68492	89,7
2019	75450	34	0,1	2285	3,0	73131	96,9	67627	89,6
2020	73368	36	0,1	2137	2,9	71195	97,0	65753	89,6
2021	70803	49	0,1	2095	2,9	68659	97,0	63051	89,1
2022	53281	39	0,1	1687	3,2	51555	96,7	46622	87,5
2023	62960	39	0,1	1461	2,3	61460	97,6	56851	90,3

Source: Compiled by the authors based on (Website of the State Statistics Service of Ukraine).

Figure 5 shows the distribution of operating business entities in agriculture, forestry, and fisheries by the number of employees in 2016-2023.

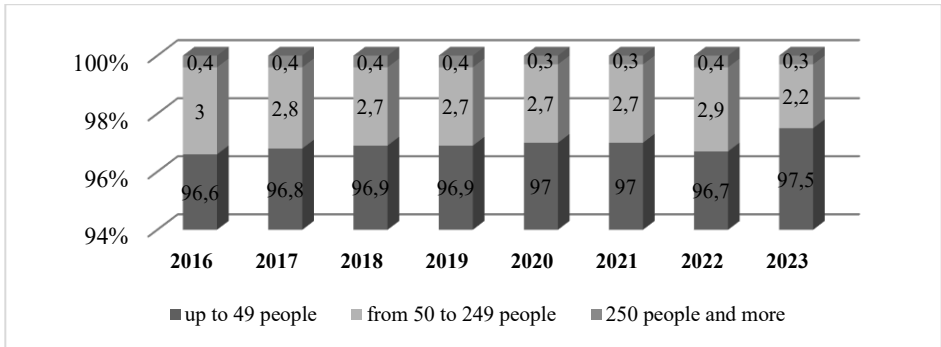


Figure 5. Distribution of operating business entities in agriculture, forestry, and fisheries by number of employees in 2016-2023.

Source: Compiled by the authors based on Website of the State Statistics Service of Ukraine

The figure shows that over the past eight years, the share of enterprises with up to 49 employees (50 employees is one of the criteria for grading enterprises by size (Law of Ukraine "On Accounting and Financial Reporting in Ukraine" of 16.07.99 No. 996-XIV) has consistently exceeded 96.6%.

Today's general trend is transitioning from the traditional agriculture paradigm to the multifunctionality paradigm, which is now recognized as an economically advantageous alternative primarily for small agricultural producers (Cardillo, Cimino, De Rosa, Francescone, 2023; OECD 2001). The OECD report defines multifunctional agriculture as one that can generate other non-commodity products besides food and raw materials production (positive environmental externalities, social services, landscape management, etc. At the same time, in some cases, this may lead to losses for multifunctional agricultural producers. This necessitates the application of measures to ensure their economic security.

The multifunctionality of the new European agricultural model reflects the innovative idea of agricultural competitiveness and sustainable rural development. However, competitiveness does not exist in isolation. It is primarily dependent on other, more crucial characteristics such as quality, sustainability, animal welfare, contribution to quality of life and trust (i.e. acceptance by society at large) (Cardillo, Cimino, De Rosa, Francescone, (2023).

The EU document "EU Rural Long-Term Vision – Towards Stronger, More Connected, resilient and Prosperous Rural Areas by 2040" proposes four main dimensions for the renewal of rural development through a diversified set

of initiatives, one of the most important of which is the diversified rural economy (EU Commission 2021). Thus, developing and implementing a strategic portfolio that provides for the deepening and expansion of activities is the basis of a new paradigm of competitiveness in rural areas based on multifunctional agriculture.

For the most part, agribusiness's multifunctionality is seen as agriculture's ability to perform functions beyond food production. It involves the combination of three functions: economic, social and environmental (Figure 6).

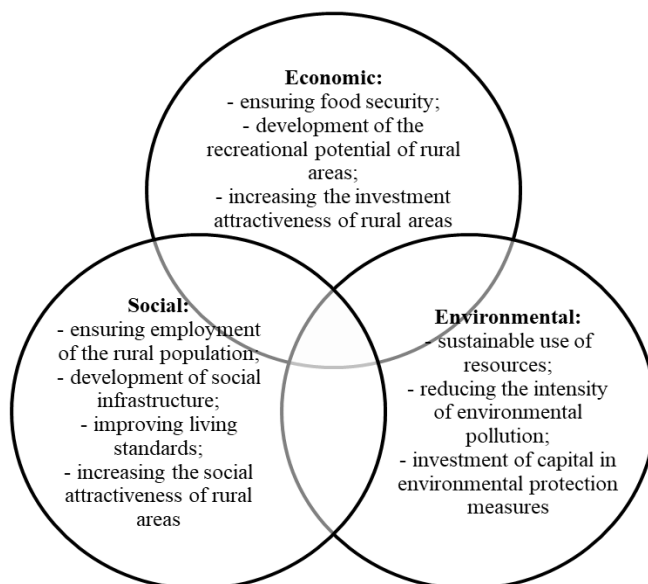


Figure 6. Multifunctionality of small agricultural enterprises as a basis for sustainable rural development (synthesis of economic, social and environmental aspects).

Source: Developed by the authors based on (Zinchuk, Kutsmus, Prokopchuk, Lagodiienko, Nych, Naumko, 2021).

The transition to multifunctional agriculture is a permanent socially constructed process that requires constant revision (Barnaud, Couix, (2020). The multifunctional paradigm of agriculture is usually implemented at the level of an economic entity. To implement it, it is advisable to develop and implement a set (portfolio) of strategies to retain more added value at the level of small agricultural enterprises and diversify activities. In any case, the transition to

multifunctionality is based on developing and implementing a strategy involving new business models that contribute to social impact and ensure sustainable rural development (Sivini, Vitale, 2023). That is, small agribusiness is at the centre of modern transformational processes in agriculture, where not only economic but also environmental and social aspects should be considered in the decision-making process (Tohidyan Far, Rezaei-Moghaddam, 2019). The expansion of small agribusiness activities is focused on diversifying agricultural activities by expanding the types of activities directly related to agricultural production (processing of farm products, provision of agricultural services to other agricultural producers, bioenergy, rural tourism, landscape conservation, etc.)

Multifunctionality implies a whole range of positive effects and benefits. However, multifunctionality does not automatically guarantee additional profits for small agricultural producers. For small farming enterprises that want to use the potential of multifunctionality to increase their economic security, active efforts are needed to monetize these additional functions. This requires a strategic approach and stakeholder cooperation to ensure sustainable rural development and the financial security of small agribusinesses. This requires support from appropriate resources (including human resources and information). In the context of multifunctionality, agritourism is gaining particular relevance today. Integrating agritourism and agricultural production creates synergy, where multifunctionality manifests as a positive result of the technical combination of these two activities. Agritourism is a harmonious and integral part of agriculture itself (Petelca, Pătrăuceanu, Beșliu, I. (2021).

The multifunctionality of agriculture results from entrepreneurial behavior that arises from the functional reorientation of agricultural activities. Accordingly, multifunctionality is a new type of locally embedded agricultural model that aims to produce both marketable and non-marketable products. To compensate for non-tradable output, rural development policies should provide small agribusinesses with appropriate incentives and compensation mechanisms to generate positive externalities and public goods. In addition, in the context of economic security, the functioning of a community creates the necessary environment for the survival and development of its members. This social capital becomes the foundation for developing rural community agritourism, which, in turn, is an essential element of multifunctionality. In other words, the multifunctionality of small agribusinesses not only diversifies the activities of enterprises (to make a profit from different types of activities) but also creates conditions for the preservation and development of rural areas, promotes

the creation of new jobs, infrastructure development and the conservation of cultural heritage. Small agribusinesses' multifunctionality provides rural residents access to various services and educational and recreational opportunities, which contributes to improving their living standards and quality of life. In addition, the multifunctionality of small agribusinesses contributes to their competitiveness, which is ensured by their ability to adapt to changes, which in turn makes multifunctional agribusinesses more attractive to investors. However, small agribusinesses are primarily unable to take advantage of multifunctionality on their own, which makes it advisable for them to cooperate with agricultural extension services.

The specificity of small agricultural enterprises is that their main goal is not only to make a profit but primarily to implement a much wider range of functions that directly affect the social and environmental components, thereby contributing to the achievement of sustainable rural development goals.

Small agricultural enterprises often specialize in growing a variety of crops, including traditional and local crops, which contributes to biodiversity conservation; these enterprises are usually focused on meeting the needs of local communities, which reduces dependence on imports and contributes to the stability of the region's food supply, creates jobs in rural areas and improves the living standards of the rural population. The total share of small agricultural enterprises is more than 80% worldwide (Mizik 2021) and more than 90% in Ukraine (Website of the State Statistics Service of Ukraine). However, these enterprises face significant problems with logistics, human resources, high production costs, lack of markets, etc. The global practice of addressing this issue is to cooperate with extension services. However, the current agricultural extension services structure does not consider small farm enterprises' multifunctionality and does not meet their needs.

Despite the economic nature of the creation and operation of small agribusiness, the strategic goal of its functioning is to create conditions for the implementation of the goals of rural sustainable development, ensuring the livelihoods of the rural population, implementing environmental protection measures, preserving biodiversity, etc. The criterion for the general purpose or effectiveness of the social function of multifunctional agribusiness is to maintain and increase the potential of rural areas. Accordingly, it is necessary to expand the areas of agricultural extension services in the context of the multifunctionality of small agricultural enterprises. Today, it is essential for agricultural extension services to cover not only agricultural production but also other

areas such as rural tourism, excursions, tastings, organization of master classes, etc. This can be achieved by involving academic staff of higher education institutions in providing agricultural extension services. This approach will allow for the involvement of experts from various fields and ensure a comprehensive approach.

Ensuring economic security at the micro level is primarily based on high-quality, relevant and timely accounting and analytical support. However, small agricultural enterprises cannot achieve adequate support, which justifies the expediency of their cooperation with agricultural extension services.

Small agribusiness plays a key role in ensuring the economic security of any country. It is the basis for creating jobs, supporting competition, diversifying the economy, ensuring food security, social stability and sustainable rural development.

Ukraine's agricultural sector is characterized by the dominance of small farm enterprises, which account for over 94% of the total number of agricultural enterprises despite their lower production volumes than significant agrarian holdings. This underscores their importance for sustainable rural development and the need for state support.

Small agricultural enterprises face several specific problems that threaten their economic security: limited resources, outdated technologies, lack of qualified personnel, high production costs, problems with sales, dependence on natural conditions and geographical remoteness. These challenges make it difficult for them to ensure economic security and competitiveness on their own and make it advisable to cooperate with agricultural extension services.

The concept of multifunctionality is a promising paradigm for small agribusiness development that combines economic efficiency with social and environmental goals. Multifunctional agriculture goes beyond traditional food production to include various activities, such as agritourism, processing, service provision, and ecological and cultural heritage preservation.

The transition to multifunctionality opens up new opportunities for small agricultural enterprises to diversify their incomes, increase their competitiveness, ensure sustainable rural development and strengthen economic security. However, successfully implementing this paradigm requires a strategic approach, active efforts to monetise additional functions, and stakeholder cooperation.

Cooperation with extension services is an essential and appropriate strategy for small agricultural enterprises seeking to become multifunctional and increase their economic security. Extension services can provide expert support

in diversifying activities, developing business plans, finding markets, applying the latest technologies, accounting and analysis, ensuring sustainable development and implementing social and environmental initiatives.

The current structure of agricultural extension services needs to be adapted to the needs of multifunctional small agribusinesses. Expanding the range of agricultural extension services to include issues related to rural tourism, processing, ecological production, marketing, cooperation, and other activities beyond agrarian traditional output is necessary. The involvement of university research and teaching staff in agricultural extension services can provide a comprehensive and interdisciplinary approach to solving the problems of small agribusiness in the context of multifunctionality and economic security.

10.4. Agricultural extension in the context of accounting and analytical support of small agricultural enterprise management as a component of economic security

It is difficult to overestimate the importance of accounting and analytical support in the economic security system of an economic entity. The formation of **Society 5.0** leads to the transformation of accounting and analytical support.

The study is based on theoretical research methods: bibliographic analysis, content analysis, structural and functional analysis, induction and deduction, comparison, generalization and systematization.

Global and large-scale digitalization processes characterize the current stage of society's development. This determines the peculiarities of economic processes, functioning of economic entities, etc., including the dominance of digital technologies in all economic processes; goods and services in kind are increasingly inferior to electronic analogues; the sale of economic benefits is carried out using electronic means; digital (virtual) assets are emerging. In addition, introducing the concept of sustainable economic development leads to the formation of new requests from information users and the integration of financial and non-financial components. The modern world economy is characterized by transitioning to a sustainable development model considering economic, social, and environmental elements. This necessitates consideration of the economic security of an economic entity in connection with ensuring the environmental and social components of national security, which involves obtaining information on the impact of business entities' activities on the economy, environment and social sphere. All of the above entails a corresponding

transformation of the accounting and analytical support system as a component of the economic security of an enterprise.

The essence of accounting and analytical support is seen by most scholars as the integration of accounting and analytical operations into a standard process, into a single system based on a single methodology of accounting and analysis. However, scholars today have no unambiguous approach to the "accounting and analytical support" category. Scholars have different approaches to defining the essence of "accounting and analytical support". Thus, some scholars consider it as a system, others – as a set of specific tools and methods; others – as a set of processes (process); some – as a model, etc. (Kononenko, Nikolaeva, 2022). This lack of a unified point of view among scientists and practitioners on the conceptual and categorical apparatus slows down the solution of the problem of complete satisfaction of management needs in the formation of accounting and analytical information to ensure the enterprise's economic security.

Accounting and analytical information is formed based on a functional approach in the accounting and analytical support subsystem, which is the main component of the management information support system. It is complex and has an integral hierarchical structure with multifaceted connections and complex management functions. As a synthesis of various types of accounting and analysis, this subsystem is created to provide information for making management decisions and controlling their implementation, which is a prerequisite for optimizing management decisions. Therefore, the accounting and analytical support subsystem is a component of the enterprise management information support system, and its purpose is to provide users with high-quality and timely economic information to make information-based management decisions. In the context of ensuring the financial security of an enterprise, the category of "accounting and analytical support should be considered as a resource created in a cybernetic system, which ensures the generation of high-quality and timely information for users to make information-based management decisions to ensure the economic security of an enterprise. The use of the definition of "cybernetic system" is justified by the fact that it is the systematic approach that is most effective. It contributes to improving the accounting and analytical system of an economic entity. The modern enterprise management system is characterized by a complex information system in which external and internal information flows are constantly exchanged.

The system of accounting and analytical support of enterprise management, especially in the context of ensuring economic security, is characterized by considerable complexity, which is due to both the hierarchical structure and the branching of interrelations between its elements and the dynamic complication of these relations under the influence of the permanent introduction of the latest digital technologies. This determines the expediency of using such a concept as a "black box", i.e., in general, the accounting and analytical support system for enterprise management (Fig. 7) is considered as a converter of inputs to outputs: $Y = RX$, where R is a symbolic designation of a set of transformations of a set of inputs into a set of outputs (Farion 2014).

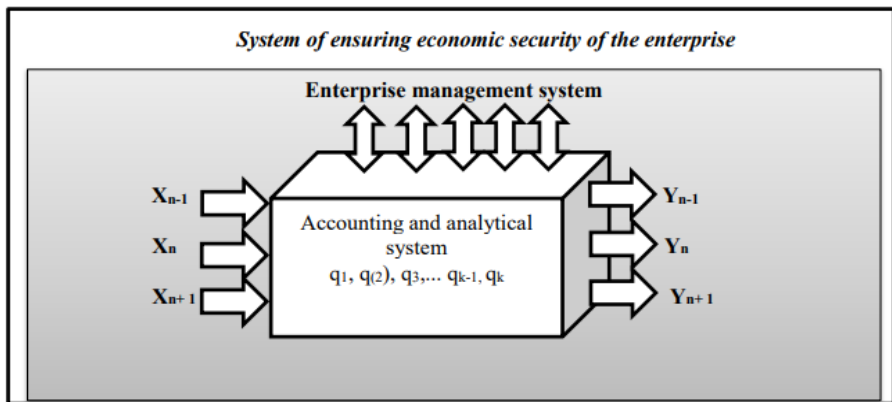


Figure 7. Model of the system of accounting and analytical support of enterprise management as a component of ensuring economic security as an open cybernetic system

Source: compiled by the authors

The traditional approach is to classify the following components (which interact with each other to create a single whole) as components of the accounting and analytical support system as part of enterprise management:

- accounting subsystems;
- analysis subsystems.

In modern scientific works, one can find proposals for developing the accounting and analytical system by adding individual elements or their combination (audit, controlling, budgeting, risk-oriented component, etc.). We agree with those scholars who consider the accounting and analytical support system to be complemented by audit. According to this approach, enterprise management's accounting and analytical support system to ensure economic

security integrates three subsystems: accounting support, analytical support and audit (Fig. 8).

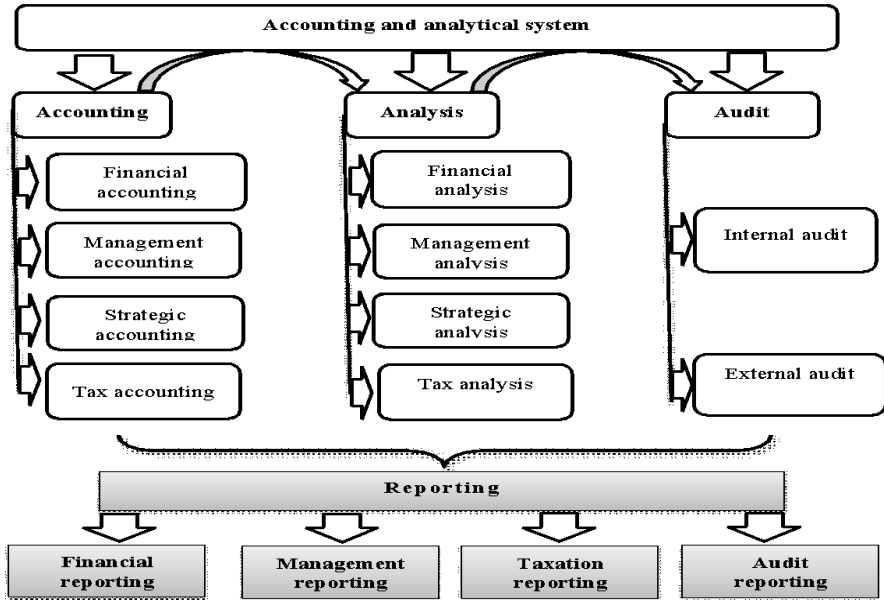


Fig. 8. Accounting and analytical support system as a component of information support for economic security of an enterprise

Figure 8. Accounting and analytical support system as a component of information support for economic security of an enterprise

Source: compiled by the author

Complementing the structure of the accounting and analytical support system with such a component as "audit" makes it possible to improve the quality of information generated within this system. The accounting component remains the basis of the accounting and analytical support system since it generates information for both financial analysis and audit. A single information system serves as the basis for accounting and analytical procedures. Automatic receipt of data on individual accounting objects, for which digital technologies can be used to measure the volume of expenditure (receipt), eliminates the need for an auditor to check the primary document flow or conduct an inventory to establish their actual availability since the accounting system built using digital technologies provides reliable data on such objects (in some cases in real-time).

Thus, to confirm the legitimacy of business transactions and establish the reliability of accounting information, the auditor has new controls, which generally help to minimize the auditor's risks and speed up the audit process.

The accounting subsystem of the accounting and analytical system ensures the collection, formation, accumulation, classification and generalization of the necessary information. However, it is the analytical component that allows for the development of forecast indicators, determining strategic directions of the enterprise's growth, thereby contributing to the economic security of the enterprise. The analysis subsystem allows, through the use of financial, mathematical and analytical methods, to study the dynamics of economic indicators, analyze the efficiency of their use, and determine the impact of various factors on the financial condition of a business entity.

When forming a system of accounting and analytical management support, it is necessary to consider that any enterprise is not isolated but forms a unique unity with the external environment, which significantly affects the results of both its activities and the quality of management decision-making and economic security. Adaptation of the system and its individual elements to changes in the external environment is one of the conditions for ensuring the financial security of an economic entity.

By implementing and using digital technologies in the accounting and analytical system, accountants can access real-time business transaction data and specific business transaction controls; there is no need to maintain primary documentation. This significantly improves the reliability and relevance of accounting information. Using digital technologies leads to a change in the audit procedure, as it ensures higher data quality, transparency, durability and reliability. Digital technologies play a significant role not only in terms of collecting and processing accounting data but also in terms of auditing. Since the use of digital technologies changes the sources of data on business transactions summarised in accounting registers, this changes how such transactions are audited. Digital technologies ensure transparency of transactions, controls and exposures in real-time processing systems, which increases the need for ongoing audits. In addition, it significantly reduces the time required to conduct an audit, improves its quality and accuracy, and makes it possible to automatically check large amounts of information, allowing focus on more complex work areas. In general, the introduction and use of digital technologies lead to a significant convergence of accounting and audit procedures, which indicates the expediency of supplementing the accounting and analytical support system with such a component as audit. However, it should be noted that despite the total use of

digital technologies in the work of accountants and auditors, it is mostly not about introducing and using the latest digital technologies but about optimizing traditional approaches through digital technologies. In accounting, it is more appropriate to talk about digitization rather than digitalization. As for audit procedures, although digital technologies have been used in auditing for quite some time, most auditors around the world use the traditional time-tested MS Excel spreadsheet processor when conducting audits. Despite the fact that various products represent modern digital technologies and, accordingly, given the diversity of the audit, it is possible to use multiple digital technologies to perform various audit tasks, today, most audit firms (including Big4 audit firms) continue to use traditional tools, among which the leader is the MS Excel spreadsheet processor when conducting audit procedures. This is an excellent product that allows auditors to automate various tasks: ^{Still, the} use of modern digital technologies creates opportunities to increase the relevance of the audit, create conditions for expanding the range of audit services, improve the quality of the audit, etc.

Thus, in the context of the formation of **Society 5.0**, the accounting and analytical support system is transforming as a component of ensuring the economic security of the enterprise. For example, the use of digital technologies leads to an increase in the role of audit, which is associated with the convergence of accounting and audit procedures. The accounting procedure is also transforming: contactless identification of assets is emerging, paper records are being replaced by electronic ones, etc. Achieving sustainable development goals requires the development of the analytical component of accounting and analytical support to form a forecasting component.

At the present stage, there are significant problems with the quality of accounting and analytical support at the micro level, primarily with the quality and reliability of financial statements. Business entities' falsification of financial statements has reached catastrophic proportions – even large and financially stable enterprises (according to published reports) have gone bankrupt. Based on the information in these financial statements, financial analysts made the most favorable forecasts for companies that would go bankrupt shortly thereafter. It should be noted that auditors' reports often confirm the data in these financial statements. This has led to a global decline in trust in the information provided in financial statements. Since financial statements are based on accounting data, there is a need to develop measures to improve the quality and reliability of information disclosed in companies' financial statements.

Financial analysis is based on the information provided in the financial statements and confirmed by the relevant auditor's report. However, economic analysts are not the only ones who use audit opinions. Auditors use financial statement data and financial analysts' opinions when conducting audit procedures and forming reports.

Financial analysis results are the basis for making management decisions and ensuring an economic entity's economic security level. The dominant indicators (indicators that enable the process of assessing the state or changes in the economic condition or situation) of the economic security of an enterprise are indicators of its financial condition, the analysis of which is an essential element of the mechanism for ensuring the economic security of an enterprise. All indicators of the financial condition are interrelated, which makes it necessary to use a set of indicators when assessing the actual financial condition, considering the impact of various factors on them (Zhuk 2022) . Figure 9 shows the main groups of indicators characterising small agricultural enterprises' financial condition.

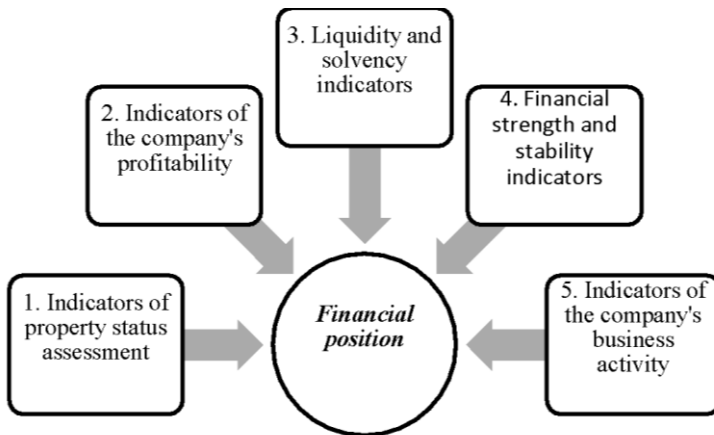


Figure 9. Main groups of indicators characterizing the financial position of an economic entity

Source: Developed by the authors based on (Zhuk 2022)

Calculating the indicators shown in Fig. 1 requires thorough professional competence from the employees who make these calculations. In addition, when determining the financial condition of an enterprise, it is necessary not only to know the methodology for calculating and interpreting the results obtained but also to consider the type of activity of the enterprise. In other words,

the criterion values of financial and economic indicators calculated for a particular enterprise differ significantly depending on the kind of activity. For example, the normative values of the inventory turnover ratio for agriculture are 3-6 turns per year, while for wholesale and retail trade – 8-18 turns per year (Kobyletskiy). All this necessitates the involvement of highly qualified specialists in accounting and analytical work to ensure the economic security of enterprises. However, most small agricultural enterprises do not have the opportunity to employ such specialists. Today, in most countries, small and medium-sized agricultural enterprises use agricultural extension services, whose employees provide a wide range of services, including advice on analysis, economic security, etc. There are also agricultural extension services in Ukraine, so we believe that to ensure the financial security of small farm enterprises, it is advisable to cooperate with agricultural extension services regularly. For this purpose, it is advisable to implement and use an active-adaptive model (Figure 10).

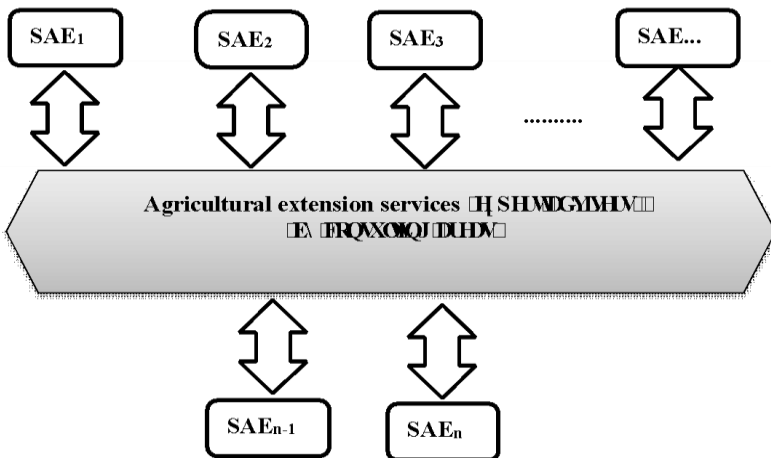


Figure 10. The structure of the relationship between small agricultural enterprises and the extension service
SAE – small agricultural enterprise

Source: Developed by the authors

Delegating complex and variable tasks by small agricultural enterprises to advisers will increase the enterprise's economic security level.

The peculiarities of the economic security mechanism at the enterprise level primarily depend on the activity, size and organizational and legal form.

Since more than 90% of domestic agricultural enterprises are small and micro enterprises, building and using an effective economic security mechanism requires cooperation with regional agricultural extension services. The feasibility and prospects of cooperation between small agricultural enterprises and agricultural extension services structures are also linked to global digitalization processes, which require appropriate staffing and digital competencies for both employees of small farm enterprises and agricultural extension services structures.

Economic security is defined as a system of risk management measures for sustainable development, where the availability of reliable financial information plays a key role. However, at the current stage, there is a crisis of confidence in financial statements due to their falsification. This underscores the urgent need to improve the quality of accounting data, as it is the basis for financial analysis, management decisions and, ultimately, the economic security of the enterprise.

To ensure the economic security of small agricultural enterprises with limited resources, it is advisable to cooperate actively with agricultural extension services. These services can provide qualified assistance in analysing the financial situation, considering small agricultural enterprises' industry specifics and characteristics. Cooperation of small agrarian enterprises with agricultural extension services is an effective strategy for improving their economic security in the current economic environment.

Accounting and analytical support are critical elements of any economic entity's economic security system, especially in the formation of Society 5.0 and the total digitalization of the economy. It forms the information base for making informed management decisions to minimize risks and ensure sustainable development.

Digitalization is transforming the accounting and analytical support system, bringing accounting and audit procedures closer together, and improving information quality, transparency and efficiency. However, despite the development of digital technologies, their implementation in accounting and auditing practices is mainly through digitising traditional approaches rather than introducing and using the latest digital technologies.

Currently, the credibility of financial statements is low due to the significant scale of fraud. This leads to an urgent need to improve the quality and reliability of accounting information, which is the basis for financial analysis, audit and management decision-making in economic security.

Financial analysis is the dominant indicator of an enterprise's economic security. A comprehensive analysis of financial indicators allows one to assess the current state of the enterprise, identify potential threats and develop measures to minimize them. However, high-quality financial analysis requires a high level of professional competence and consideration of the industry specifics of economic entities.

Due to limited resources, small agricultural enterprises often cannot independently provide adequate accounting and analytical support. In such circumstances, cooperation with agricultural extension services is a rational and effective strategy for improving the quality of accounting and analytical information and strengthening economic security.

The active-adaptive cooperation model between small agricultural enterprises and agricultural extension services allows complex accounting and analytical tasks to be delegated to qualified specialists, providing constant expert support and adaptation to changes in the external environment. Such cooperation contributes to the economic security of small agribusinesses in the context of digitalization and global uncertainty.

Practical cooperation between small agricultural enterprises and agricultural extension services requires the development of digital competencies among both agricultural employees and agricultural extension services consultants. Digital technologies open new opportunities for information exchange, accounting and analytical process automation, and quality agricultural extension services.

10.5 Prospects for the development of agricultural extension services in the context of economic security

In the context of globalisation, the emergence of Society 5.0, rapid technological change, growing geopolitical instability, and economic security issues are paramount. In this context, agricultural extension services play an increasingly important role as a tool for disseminating knowledge and providing support.

The study was based on **the analysis of literature and trends, logical analysis and deduction**, and the results of the **empirical research**.

Today's economic landscape is characterized by several factors that create new threats and require a rethinking of approaches to financial security. Thus, the current stage of society's development is characterized by a change

from relatively uniform economic dynamics to vortex, pulsating, chaotic and turbulent ones. This leads to destroying the traditional logic and sequence of many economic processes. The future is becoming fundamentally uncertain, and the role of the "ignorance" factor is growing. Consequently, there are situations when it is necessary to "look for unknown answers to questions that no one can formulate..." (Beck 2009). This necessitates transforming management systems and their information support, which can be solved in small agricultural enterprises through cooperation with agricultural extension services.

The next megatrend of our time is digital transformation. The rapid development of digital technologies, such as artificial intelligence, blockchain, and the Internet of Things, opens up new economic growth opportunities and creates new risks, including cybersecurity, data protection, and intellectual property. The latest digital technologies are widely used in agriculture to control pests, monitor soil and growing conditions for crops and animals, optimize food supply chain management, etc. (Javaid, Haleem, Khan, Suman, 2023). However, the formation of information support for the management system of agricultural enterprises is mainly carried out using standard accounting software that does not fully meet the information needs of a modern agricultural enterprise. Thus, most accounting software is aimed only at automating accounting work (Spivak, Didyk, Skurskiy, Zhytko, 2021). However, using the latest digital technologies creates the precondition for forming information support for an effective enterprise management system and ensures economic security.

Managers and owners of large companies (including Big4 firms) understand that implementing and using the latest digital technologies in enterprises' accounting and analytical activities is only a matter of time. The future of an enterprise depends on who will be the first to take advantage of the latest digital technologies. Therefore, managers of large companies are already investing heavily in implementing the latest digital technologies. Extensive agricultural holdings also actively invest in and implement the latest digital technologies (Lazebnyk, Voitenko, 2021). However, for small farming enterprises, the introduction and use of the latest digital technologies is, on the one hand, a vital necessity, and, on the other hand, it is associated with the need to solve some problems. This is because most of these enterprises are located in remote areas and have problems with financial, personnel, material, technical and other types of support. This situation is typical for most countries in the world. For example, the results of interviews with the most resilient small agricultural enterprises in Poland, Romania and Lithuania (20 entities in each country) using the

CRITIC-TOPSIS method of attitudes, behaviour and knowledge about the latest digital technologies show that small agricultural enterprises mostly do not use them (Stępień, Smędzik-Ambroży, Polcyn, Kwiliński, Maican 2023). This is primarily because although owners recognize and appreciate the benefits of the latest digital technologies, they are not convinced of the need to implement them in their business. Among the main obstacles to their implementation in small agricultural enterprises were the following: low level of knowledge (competencies) of employees and owners, lack of awareness of the cost of implementing and using the latest digital technologies, low interest due to small production scales and habituation to traditional, time-tested methods and approaches.

Given the strategic importance of small agribusiness for countries (ensuring food security of the country, as it is focused on the domestic market; promoting comprehensive sustainable development of rural areas; improving living standards in rural areas, etc. Thus, small agricultural enterprises widely use agricultural extension services in many countries. Employees of these services provide advice on a wide range of issues, including introducing and using the latest digital technologies, innovation, digital risk management, and using digital economy opportunities to improve economic security.

Another megatrend that involves the application and transformation of agricultural extension services to ensure economic security is the introduction of sustainable development principles and the transition to ESG (Environmental, Social, Governance) principles and standards. The implementation of ESG allows for the influence of financial performance on agricultural companies. It enables their proper management, which can lead to significant benefits in terms of operational efficiency, market access and the reputation of the economic entity. Integrating ESG aspects into a business strategy can contribute to the long-term sustainability and success of agricultural enterprises. Assessing the impact of each ESG component on the financial results of agrarian enterprises (ROE – return on equity, ROA – return on assets and EPS – earnings per share) is essential for assessing their stability and financial performance (Pirtea, Noja, Cristea, Panait 2021), and, accordingly, for ensuring economic security. It should be noted that the financial position of agricultural enterprises can be significantly affected by environmental protection costs. However, applying a sustainable approach to using natural resources, well-developed waste management and emission reduction can dramatically increase operational efficiency and lead to cost reduction (DeBoe 2020). In addition, in the context of growing consumer demand for environmentally friendly products, agricultural

enterprises implementing positive environmental practices can benefit from increased demand for their products and a positive reputation (Boakye, Tingbani, Ahinful, Nsor-Ambala, 2021).

The social component of an agricultural enterprise can be ensured by creating comfortable working conditions for employees, which can significantly affect its productivity (Malanski, Schiavi, Dedieu, 2019) and, therefore, financial indicators such as ROE and ROA, and accordingly affect the economic security of the entity. In addition, by cooperating and investing in local communities, agribusinesses can gain support and avoid potential conflicts and social problems. Such an approach can contribute to sustainable rural development, increase profitability and ensure economic security (Chen, Song, Gao, (2023)).

There is a complex relationship between ESG and financial performance. To ensure economic security, economic actors must identify the practices and indicators that are most effective.

In the future, the activities of agricultural extension services should be aimed at helping agrarian enterprises implement the principles of sustainable development and transition to ESG principles and standards, including environmental responsibility, social justice and effective corporate governance. This will allow economic entities to minimise environmental and social risks, enhance their reputation, attract investment, and gain competitive advantages in the market. Advising on ESG reporting, environmental management, and social responsibility is a promising and important area of agricultural extension services.

Rising geopolitical tensions, trade wars, international sanctions and military conflicts pose significant risks to the stability of economic activity. In Ukraine, in the context of the ongoing military aggression, many rural areas have already suffered and continue to suffer devastating losses, undermining the **economic security** of the agricultural sector. Large areas of agricultural land remain mined and temporarily occupied, posing a long-term **security** threat to these regions even after de-occupation. Damage to infrastructure, including critical facilities for storing and processing agricultural products, as well as the breakdown of agricultural machinery, threatens the country's **economic security**, reducing its production potential.

In the context of a full-scale war, agricultural enterprises face an acute shortage of workers due to mobilisation, which also negatively affects **economic security** through reduced production and possible disruption of sowing

and harvesting campaigns. Small agricultural enterprises are particularly vulnerable to these threats.

In such critical conditions, the government, recognizing the importance of **economic security** for national stability, is implementing several measures to support the agricultural sector, even in military operations. These measures, aimed at strengthening **the financial security of** farming producers, include providing soft loans under the government program "Affordable Loans 5-7-9%"; targeted grants; simplifying the use of agricultural machinery for small and medium-sized enterprises by allowing its operation without registration during the martial law period; temporary cancellation of additional certification procedures for seed material; and creation of specialized online platforms for optimizing logistics (prodsafety.org) and prompt collection of data on sowing needs (agrostatus.org). Implementing these initiatives is an essential step towards ensuring the **economic security of** the agricultural sector. However, to use these support tools effectively, small agricultural enterprises need timely information and a clear understanding of the algorithm of action. Although the procedures for obtaining assistance are generally simplified, geographically remote and less resource-intensive, small enterprises need qualified agricultural extension services consultants who can provide the necessary information and agricultural extension services and support the process of obtaining state support, which will help strengthen their **economic security**.

In the post-war period, highly qualified advisers' role in ensuring the agricultural sector's economic security will only increase. The de-occupied territories of Ukraine will need comprehensive revitalization and a full-fledged life, which will require the involvement of highly qualified specialists.

It is also essential to consider the global digitalization of the agricultural sector, which is a key factor for increasing **long-term economic security**. Already today, even in times of war, the use of agrarian drones allows for the prompt receipt of essential data on the condition of land plots and accurate soil analysis, which is a crucial element in ensuring the **economic security of** land use (Kirillov, Granovskaya, Kononenko 2024). In the post-war period, the active introduction of digital technologies will create unique opportunities to increase the effectiveness of revitalization measures, optimize production processes in agricultural enterprises, increase the competitiveness of domestic agricultural producers in domestic and foreign markets, and, as a strategic consequence, strengthen the country's **economic security** and food independence.

Climate change and the growing environmental awareness of society are placing new demands on economic activity. Diseases of biological assets

(plants and animals) pose significant risks to food security and environmental sustainability, negatively impacting the affected regions' environmental and socio-economic conditions. Climate change further increases the risks of epidemics by changing the evolution of pathogens (Singh, B. K., Delgado-Baquerizo, Egidi, Guirado, Leach, Liu, Trivedi, 2023). This significantly negatively impacts food production systems, thereby threatening food security. Food security should be considered a situation where all people have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (FAO 2018).

Over the past few decades, significant progress has been made in addressing global climate change, malnutrition and hunger, partly through increased food productivity. However, today, there is a growing demand for food and the extent to which the potential adverse effects of climate change are negative remains unclear. Most scientists believe climate change will exacerbate food security, the foundation of national security, economic development, and social stability. Food security directly affects the well-being and livelihoods of the population. When food production is safe, people can access the nutrients they need to stay healthy. This, in turn, contributes to social stability by reducing poverty, inequality and conflict. In addition, food and economic security supports industries such as agriculture, tourism and food processing (Lee et al. 2024). A stable food supply can also help to attract investment and thus promote economic growth and security.

Businesses need to consider environmental risks, implement sustainable business models and adapt to the requirements of environmental legislation. Agricultural extension services are essential in advising companies on ecological safety, introducing green technologies and transitioning to sustainable development.

An essential component of national security is social security, namely human security. The military aggression of the Russian Federation against Ukraine has become a new major challenge for Ukraine's social security. The COVID-19 pandemic and growing social inequality have exposed the vulnerability of economic systems and highlighted the importance of the social component of financial security. In today's environment, **ensuring the security of human society is a fundamental prerequisite for economic security and stable state development**. A sense of security among citizens is not only a key to unlocking human potential but also a critical factor for forming a mature civil

society, which, in turn, is the basis for a sustainable economy (Hrynyk, Sysoieva, 2022).

Security issues, especially in the context of external threats such as military aggression, directly impact economic stability. **Social protection guaranteed by the state is essential to economic security**, as it creates conditions for citizens' productive work, innovation and economic activity. In the broadest sense, investments in security, including social, economic and physical security, are **investments in the country's future economic prosperity**. Thus, ensuring the security of human society is a priority social task and a **strategically important factor for ensuring economic security and sustainable state development**.

Agricultural extension services can contribute to developing socially responsible business models, support social stability, and reduce social inequality, essential to overall economic security.

In general, agricultural extension services in the context of economic security have significant potential for development and transformation. It is possible to identify the leading prospects for its development. First of all, it is the expansion of the range of services and the focus on comprehensive security. Agricultural extension services will increasingly move away from highly specialized advice to providing comprehensive solutions covering various aspects of economic security. An integrated approach allows for considering the interrelationships between different areas of the enterprise and developing more effective protection strategies.

Another promising area of agricultural extension service is strategic partnerships instead of one-off consultations. Agricultural extension services establish long-term strategic partnerships with clients instead of providing one-off consultations to solve specific problems. This involves continuous monitoring of the economic situation, identifying new risks, developing proactive measures and supporting the enterprise at all stages of its development.

Practical agricultural extension services should focus on preventive measures to prevent crises and minimize potential losses. This involves developing risk management systems, conducting stress testing, developing contingency plans and implementing early warning mechanisms.

In the future, agricultural extension services should be more personalized and adapted to each client's individual needs and characteristics. This involves an in-depth analysis of the company's activities, industry, size, organizational structure and other factors that affect its economic security.

Today, agricultural extension services already cover the field of digital technologies. In the future, introducing digital technologies will fundamentally change the format and methods of providing agricultural extension services. Online platforms, mobile applications, cloud services, webinars, video conferencing and other digital tools will make agricultural extension services more accessible, efficient and convenient. Digitalization will allow advisers to communicate more effectively with clients, conduct remote consultations and provide real-time support. In addition, using the latest digital technologies, such as Big Data and AI, opens up new opportunities for analyzing economic risks and developing more accurate forecasts. AI can automate data collection and processing, detect anomalies and threats, produce personalized recommendations, and make informed decisions. Big data analysis will allow agricultural extension services to understand economic processes better, identify hidden patterns, and develop more effective economic security strategies. However, introducing and using digital technologies leads to certain risks and threats. Accordingly, in the face of growing cyber threats, cybersecurity is becoming an integral part of economic security. When providing their services, agricultural extension services should assess cyber risks, develop and implement cyber defense strategies, implement information security systems and conduct ongoing staff training in cyber hygiene. Cybersecurity should be integrated into all aspects of agricultural extension services, from risk assessment to development strategies.

In the future, the multifunctionality of agriculture will deepen. Accordingly, agricultural extension services should support the multifunctionality and diversification of small farm enterprises. This includes advising on developing agritourism, organic production, agricultural processing, provision of social services in rural areas and other non-traditional activities that will increase agribusinesses' economic sustainability and competitiveness.

Agricultural extension services should facilitate the transition to a green economy and circular economy, which involves the efficient use of resources, waste minimization, and the introduction of renewable energy sources and environmentally friendly technologies. Advice on green innovations, energy efficiency, waste management and circular business models should be essential to agricultural extension services.\

Extension workers can ensure quality and relevant services only if they continuously update their competencies, learn new technologies and techniques, and expand their interdisciplinary experience. Continuous training, certification and exchange programs should be prerequisites for ensuring high-quality extension services.

Agricultural extension services should be aimed at providing off-the-shelf solutions, transferring knowledge, and developing competencies among clients' staff. This will allow businesses to solve current problems and acquire the ability to analyze risks, create economic security strategies and adapt to changing conditions. Educational programs, training, workshops, and mentoring should become essential tools for agricultural extension services.

Ensuring economic security requires an interdisciplinary approach that combines knowledge in various fields, such as economics, finance, law, information technology, ecology, sociology and governance. Accordingly, agricultural extension services should create interdisciplinary teams with experts from different fields to provide comprehensive and practical solutions.

The effective functioning of the agricultural extension service institution is possible only with the support of the state. The state should create a favorable environment for developing agricultural extension services in economic security, namely, developing a legislative framework, providing financial support to agricultural extension services, making information platforms, promoting professional certification of advisers, and ensuring the quality of agricultural extension services. The state regulation of agricultural extension services should increase efficiency and ensure customer confidence.

In the face of global challenges, international cooperation in extension is becoming increasingly important. The exchange of experience, best practices, and joint development of innovative methods and training programs can improve the quality and effectiveness of agricultural extension services internationally.

In the face of increasing global challenges and technological change, agricultural extension services are becoming a key tool for enhancing the economic sustainability and competitiveness of enterprises, industries and national economies. Expanding the range of services, using digital technologies, focusing on sustainable development, developing competencies, and strengthening international cooperation are the main directions for the future transformation of agricultural extension services. Overcoming the existing challenges and obstacles, such as lack of trust, shortage of qualified specialists and high cost of services, requires joint efforts of the state, business, academic institutions and professional associations. Investing in the development of agricultural extension services is strategically vital for ensuring economic security and sustainable development in the face of global uncertainty and rapid change.

In the context of globalization, turbulent economic processes, digital transformation, climate change, geopolitical instability and war, ensuring the

agricultural sector's financial security is paramount. Agricultural extension services are essential for increasing agrarian enterprises' resilience and adaptability to these challenges.

Agricultural extension services should be transformed, moving away from highly specialized advice to providing comprehensive, integrated solutions covering various aspects of economic security (financial, digital, environmental, social, food, cybersecurity, etc.). At the same time, promising areas for the future development of agricultural extension services include covering digital transformation, implementation of ESG principles, sustainable development, cybersecurity, risk management in war and post-war recovery; providing individualized services that take into account the specifics, size and needs of each agricultural enterprise; active use of digital technologies (online platforms, mobile applications, Big Data, AI) to increase the accessibility, efficiency and effectiveness of agricultural extension services; focusing on preventive measures, and State support in the form of legislative support, financial support, creation of information platforms, promotion of professional certification and quality control of services is also significant for the development of agricultural extension services.

Developing agricultural extension services is a strategic investment in enhancing economic security and sustainable rural development, ensuring the country's food independence and the competitiveness of domestic agricultural producers in domestic and foreign markets.

10.6 Conclusions

Economic security has ceased to be the sole prerogative of nation-states. It has transformed into a fundamental prerequisite for sustainable development at all levels of the economic system, from global, interstate relations to the financial stability of an individual. The conceptual evolution of economic security has gone from the classical understanding of protecting state interests to a multidimensional phenomenon that encompasses economic sustainability and growth, social justice, environmental balance, technological independence and political stability. In the face of unprecedented global challenges, such as financial and economic crises, pandemics, climate change, geopolitical conflicts and mass digitalization, economic security is becoming an existential necessity, de-

termining the ability of nations and individual business entities not only to survive but also to develop dynamically, preserving their own identity and competitiveness.

For Ukraine, which is currently at the forefront of the struggle for its sovereignty and identity, in the context of military aggression and simultaneous aspirations for European integration, economic security issues are becoming particularly acute and determine the national perspective. Strengthening economic security is a key condition for economic recovery, ensuring the welfare of citizens, integration into the European economic area, and long-term resilience to external and internal threats.

Small agribusiness is the backbone of the country's economic security architecture. Despite their relative economic fragility, small agricultural enterprises play a crucial role in ensuring the country's food security by providing the domestic market with quality and affordable products, supporting employment in rural areas, preserving the unique agricultural landscape and traditional way of life in rural areas, as well as contributing to economic diversification and ensuring sustainable rural development. At the same time, small agricultural enterprises are the most vulnerable segment of the farm sector, objectively inferior to large agro-industrial entities in most key indicators, from resource provision and access to finance to innovation and opportunities to enter new markets. That is why the priority of the state policy aimed at supporting and comprehensively strengthening the economic security of small agribusiness as a guarantee of sustainable development of the agricultural sector and the national economy is substantiated.

Thus, agricultural extension services are a highly effective tool for improving the economic security of small farm enterprises, acting as a catalyst for positive changes aimed at compensating for the objective limitations of small businesses, primarily in terms of information, technology and management. Agricultural extension services provide small agricultural enterprises with access to expert information, advanced agricultural technologies, effective management practices and modern business models. This, in turn, contributes to increasing the competitiveness, productivity, adaptability, innovativeness and overall economic sustainability of small agricultural enterprises in a dynamic and highly competitive market environment.

The economic security of the state and individual industries is derived from the aggregate security of all business units. In this context, accounting and analytical support for the management of small agricultural enterprises is of particular importance, which, in combination with the agricultural extension

service backing, is the basis for making sound management decisions, effective risk management, optimizing the use of resources and ensuring the economic security of the enterprise. It is advisable to integrate agricultural extension services into small agricultural enterprises' strategic management and accounting systems as an integral part of their financial security.

In the era of global digital transformation and the emergence of the Society 5.0 paradigm, the role and functions of extension are undergoing a radical transformation and significant expansion. Digital technologies open up unprecedented opportunities to increase the efficiency and scale of extension services, providing small agricultural enterprises with access to information, knowledge and expert support regardless of their geographical location and organizational capacity. Digital agricultural extension services, including online platforms, mobile applications, remote consulting, and analytical tools based on artificial intelligence and big data, are becoming a key trend in the development of agricultural extension services aimed at building digital competencies of both agricultural producers and advisors, introducing innovative digital technologies in agribusiness management, ensuring digital security and supporting the transition of small farm enterprises to a multifunctional agricultural model that is entirely in line with the priorities of the European Union.

Prospects for further research are seen in the in-depth development of specific mechanisms for the implementation of digital agricultural extension services for small agricultural enterprises, assessment of the economic and social efficiency of various forms of agricultural extension service support, development of innovative models for the organization and financing of agricultural extension services in the digital economy, as well as the development of strategies for the development of agricultural extension services aimed at ensuring the economic security of the agricultural sector in the face of constant changes in the external environment and global challenges.

Agricultural extension services are a powerful catalyst for qualitative changes in small agribusiness, contributing to a dramatic increase in economic security, sustainable development, competitiveness and adaptability in today's dynamic environment of global challenges and digital transformation of the economy. Investments in developing agricultural extension services and intensifying their activities should be seen as a strategically significant contribution to strengthening the economic security of the agricultural sector and the national economy of Ukraine as a whole.

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