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THE REPORT ON SUSTAINABLE DEVELOPMENT AND INVESTMENTS IN THE AGRICULTURAL SECTOR: THE ENVIRONMENTAL CAPITAL PERSPECTIVE

ЗВІТ ЗІ СТАЛОГО РОЗВИТКУ ТА ІНВЕСТИЦІЙ В АГРАРНОМУ СЕКТОРІ ЕКОНОМІКИ: ЕКОЛОГІЧНИЙ КАПІТАЛ

Abstract. Introduction. *Ukrainian agribusiness works in challenging conditions today, and the international community greatly supports it. The decision to grant Ukraine the status of a candidate for EU accession, adopted by the European Council in June 2022, and initiatives such as the provision of financial assistance under the Ukraine Facility program (June 2023) opened up new opportunities for the agricultural sector of Ukraine. The realization of these opportunities depends not only on Ukraine's ability to carry out reforms in the direction of European integration but also on the readiness of business entities to overcome the consequences of hostilities through recovery and reconstruction.* ***Purpose.*** *The article aims to provide scientific justification for the standardized forms of the Report on Sustainable Development and Investments (ESGI-report) in the agricultural sector of the economy for the preparation and publication of environmental capital indicators.* ***Methods.*** *The methods of induction and deduction, analysis, and synthesis formed the basis for developing environmental indicators for the ESGI report. The abstract-logical method became the basis for the study of the norms of European legislation and the leading systems for measuring sustainable development. The analogy method made it possible to propose indicative (reference) indicators for measuring sustainable development at the micro level.* ***Results.*** *The article systematizes the estimated and verifiable indicators of ecological capital. The first group includes risks and opportunities connected with climate change, the transition to sustainable technologies, and martial law. The second group comprises indicators that can be accurately measured with the help of calculators and technical means. They are related to the use of natural resources and the impact on the environment. To prepare the ESGI report, it is proposed that all materials posted on the Sustainable Reporting Platform (SR platform) be used: reporting forms, survey questionnaires, video recordings, as well as materials of webinars, presentations, and articles. The SR platform was developed within the framework of the MSCA4Ukraine program funded by the European Union.* ***Conclusion.*** *Attracting foreign investments for the post-war reconstruction of Ukraine's agribusiness is impossible without preparing and disclosing non-financial informa-*

tion about environmental capital at the micro level. One of the tools for disclosing such information is the ESGI report, which is posted on the SR platform. It is advisable to publish environmental indicators in standardized reporting forms to ensure their comparability with the data of other enterprises. At the same time, to assess the level of sustainable development, it is necessary to apply scientifically based reference values, which are based on best practices, statistical data and the company's own experience.

Keywords: *climate-smart technologies, precision and organic farming, low-carbon and energy-saving technologies, ESGI report, post-war reconstruction of Ukrainian agribusiness.*

Анотація. *Сьогодні український агробізнес працює в надскладних умовах, а міжнародна спільнота докладає неабияких зусиль для його підтримки. Рішення про надання Україні статусу кандидата на вступ до ЄС, прийняте Європейською радою у червні 2022 року, та такі ініціативи, як надання фінансової допомоги за програмою Ukraine Facility (червень 2023 року), відкрило нові можливості для аграрного сектору України. Реалізація цих можливостей залежить не тільки від здатності України провести реформи у напрямку євроінтеграції, але і від готовності суб'єктів господарювання подолати наслідки бойових дій шляхом реконструкції та відбудови. Метою статті є наукове обґрунтування стандартизованих форм Звіту зі сталого розвитку та інвестицій в аграрному секторі економіки – ESGI-звіту (Report on Sustainable Development and Investments) для підготовки і оприлюднення показників екологічного капіталу. За допомогою методів індукції та дедукції, аналізу та синтезу розроблено екологічні показники ESGI-звіту. Використання методу аналогії дозволило запропонувати орієнтирні (референтні) показники для вимірювання сталого розвитку на мікрорівні. Абстрактно-логічний метод ліг в основу вивчення норм європейського законодавства та провідних систем вимірювання сталого розвитку. У статті систематизовано оціночні та підтверджувані показники екологічного капіталу. До першої групи віднесено ризики та можливості: кліматичні; пов'язані з переходом на сталі технології; пов'язані з воєнним станом. Друга група – це показники, які можна точно виміряти за допомогою калькуляторів, технічних засобів. Вони пов'язані з використанням природних ресурсів і впливом на навколишнє середовище. Для підготовки ESGI-звіту запропоновано використовувати всі матеріали, розміщені на Платформі звітності сталого розвитку (Sustainable Reporting Platform, – SR-платформа): форми звітності, анкети опитування, відеозаписи і матеріали вебінарів, презентації, статті. Розробка SR-платформи здійснена в рамках програми MSCA4Ukraine, яка фінансується Європейським Союзом. Залучення іноземних інвестицій для післявоєнної відбудови агробізнесу України неможливе без підготовки і оприлюднення нефінансової інформації про екологічний капітал на мікрорівні. Одним із інструментів розкриття такої інформації є розроблений нами ESGI-звіт, який розміщений на SR-платформі. Оприлюднення екологічних показників доцільно здійснювати в стандартизованих звітних формах для забезпечення їх порівнюваності з даними інших підприємств. При цьому для оцінки рівня сталого розвитку необхідно застосовувати науково-обґрунтовані орієнтирні значення, які базуються на кращій практиці, статистичних даних та власному досвіді підприємства.*

Ключові слова: *кліматично-розумні технології, точне і органічне землеробство, низьковуглецеві і енергозберігаючі технології, ESGI-звіт, післявоєнна реконструкція агробізнесу України.*

Introduction. The war in Ukraine further intensified the climatic and socio-demographic challenges. In these conditions, international and European investors, credit institutions, and insurance companies express their interest in participating in the reconstruction of agribusiness entities that are ready to move from traditional technologies to sustainable agricultural activities. However, these stakeholders need information to minimise risks when implementing such capital allocation initiatives.

Disclosure of information on sustainable development should be considered as an integral condition for increasing the competitiveness of large Ukrainian enterprises on international stock markets and as an effective mechanism for attracting private foreign investment in the reconstruction of small and medium-sized agricultural entities damaged by the war. However, today, Ukraine is still developing its strategy for implementing sustainable development reporting, which will be based on the implementation of European directives and standards.

The literature review shows that European researchers analyse the incentives that would make agricultural enterprises choose to transition to sustainable agricultural technologies. In particular, İlkay Unay-Gailhard and Štefan Bojnec, using econometric analysis, proved a direct connection between the financing of agri-environmental measures (AEM) of farms in Slovenia from the European Agricultural Fund for Rural Development (EAFRD) and the growth of employment in rural areas in green workplaces [1]. In another paper, these researchers used logistic regression models to show that a significant proportion of farms in Slovenia (between 27 and 43 %) were inconsistent over a five-years period and had withdrawn from participation in the AEM programme. They found that the probability of being a permanent participant in AEM increases significantly with increasing farm size and decreases in farms with high land productivity, capital intensity and off-farm income [2]. In addition, using logit regression analysis, the researchers concluded that the probability of participation in agri-environmental measures (AEM) is greater among large farms that already have knowledge and experience of the involvement in payments for the development of rural areas. Small farms are likelier to participate in AEM activities with increased land productivity [3].

In Ukraine, the Strategy for the Development of Agriculture and Rural Territories in Ukraine until 2030 has been recently developed [4]. Even though this strategy provides for achieving sustainable development goals in the agricultural sector, Ukrainian researchers pay insufficient attention to studying the accounting and reporting aspects of the transition to sustainable agricultural technologies. The systematization of sustainable development indicators, standardization of reporting forms, and study of incentives for preparing and publishing non-financial information to improve communication with interested parties (investors, employees, communities, etc.) still need to be addressed in Ukraine.

Article's purpose. The article aims to develop scientifically based indicators of ecological capital and standardized forms of the Report on sustainable development and investments in the agricultural sector of the economy (ESGI-report) for their preparation and publication. The ESGI report is one of the tools for attracting financial resources for the green reconstruction of agribusiness. This report is designed to demonstrate the impact of the enterprise on climate change, the level of social development and corporate governance. Its publication is necessary for assessing the value of the enterprise, reducing risks and improving the efficiency of investment, credit and insurance decisions.

Methods. The authors of this study used the following methods. The abstract-logical method was used to analyze European legislation and leading systems for measuring sustainable development. The methods of induction and deduction, analysis, and synthesis formed the basis of the development of environmental indicators for the ESGI report. Reference (indicative) indicators for measuring sustainable development at the micro level have been developed using the analogy method.

Results. Catastrophic consequences for the environment, population and economy accompany the ongoing Russian armed aggression against Ukraine. Many of the cultivated areas are already mined and continue to be contaminated with explosive objects. Warehouses and agricultural machinery are destroyed as a result of bombing. Logistics export routes are blocked. The population is forced to evacuate from the war zones.

The decline in world prices for agricultural commodities and the increase in the cost of production factors and transport costs lead to the fact that more and more agricultural producers in Ukraine are following a survival strategy, which involves the focus on immediate production needs, i.e. purchase of necessary quantities of production inputs (seeds, fertilizers, protective equipment, fuel and lubricants) and timely payment of taxes and wages. Accordingly, the strategy of sustainable development (transition to low-carbon and energy-saving, innovative technologies) is considered to be a long-term perspective (of more than 10 years or so) rather than something that can be implemented during martial law.

In these conditions, we are developing an ESGI report as a strategic tool for informational support for attracting foreign, primarily private, investments for the green reconstruction of the agricultural sector. The information displayed in this report should comply with the following principles: relevance, completeness, balance, consistency, comparability, verifiability, timeliness, and coherence.

The main users of the ESGI report are enterprise owners, investors, banking, financial and credit institutions, insurance companies, central and local governance bodies, civil society, and consumers.

The development of the ESGI report involves the use of international technical guidelines (IPCC, TCFD, CDP, GHG Protocol); systems for measuring sustainable development indicators (RISE, Dinak, Position Green); online calculators (RSPO PalmGHG Calculator, GHG Protocol Pulp and Paper tool, Cool Farm tool); international standards of sustainable development reporting (SASB ISSB; IFRS S1, S2; GRI GSSB, IIRC); and EU standards on sustainable development reporting (ESRS 1-2, ESRS E1-E5, ESRS S1-S4, ESRS G1).

At the time of this publication, the ESGI report (version 1.0) is being developed in MS Excel format and includes 28 indicators, 586 data entry lines, 28 matrices, 34 explanations, 3 charts, and 3 survey questionnaires of 23 questions each.

All materials related to the ESGI report (forms, questionnaires, webinars, scientific articles, etc.) are posted on the Sustainability Reporting Platform (SR Platform) [5]. The ESGI report is presented on the SR Platform in fragments in PDF format (for presentation in Ukrainian and English) [6]. Questionnaires, which are an integral part of the ESGI report (available in Ukrainian and English) [7], have been developed to prepare notes for the ESGI report.

Below, we present the indicators for disclosing information about environmental capital in the ESGI report.

In this study, ecological capital refers to the biosphere, which includes stocks of natural assets such as soil, forests, biological species, wildlife, and water resources. The formation and growth of environmental capital at the enterprise level means the investment of owned and borrowed assets in economic activity to minimise the negative impact on the environment and preserve the natural environment. Such investments contribute to the ecological capitalisation of the enterprise and increase its investment attractiveness.

The disclosure of environmental indicators in the ESGI report corresponds to the Sustainable Development Goals of the United Nations [8] (see Table 1) and the Goals of the European Green Deal [9].

Table 1

Compliance of the ESGI Report's ecological indicators with the UN Development Goals

Report indicator	Goal 1. No poverty	Goal 2. Zero Hunger	Goal 3. Good health and well-being	Goal 4. Quality Education	Goal 5. Gender equality	Goal 6. Clean water and sanitation	Goal 7. Affordable and clean energy	Goal 8. Decent work and economic growth	Goal 9. Industry, innovation and infrastructure	Goal 10. Reduced inequalities	Goal 11. Sustainable cities and communities	Goal 12. Responsible consumption and production	Goal 13. Climate action	Goal 14. Life below water	Goal 15. Life on land	Goal 16. Peace, justice and strong institutions	Goal 17. Partnerships for the Goals
Material climate risks and opportunities	+	+											+				
Environmental risks and transition opportunities												+	+				
Environmental risks of military operations																+	
Energy consumption							+					+					
Water use						+						+		+			
Land and pesticide use		+				+						+	+	+	+		
Biodiversity and ecosystem transformation		+					+					+	+	+	+		
Waste management and the circular economy												+					
Greenhouse gas emissions			+			+						+	+	+	+		

Source: developed by the authors

The first three environmental indicators of the ESGI report ("Material climate risks and opportunities", "Environmental risks and transition opportunities", and "Environmental risks of military actions") are suggested to be evaluated by categories, probability, and rating points (see Table 2).

Each risk is assigned a score from -1 point (high probability with neutral impact, yellow colour) to -5 points (high probability with very negative impact, red colour). Each opportunity is scored from 1 point (low probability with neutral impact, light yellow) to 5 points (high probability with very positive impact, blue). Matrixes (see Table 3) are suggested to generalize such a point assessment for all environmental indicators.

Material climate risks include drought, increased average temperature, increased seasonal changes in precipitation, increased intensity of severe weather events (such as heat, floods, forest fires), increased intensity of rainfall, increased changes in wind speed, increased labour costs due to changes in production due to extreme heat, loss of fixed assets as a result of severe weather events, and increased insurance costs.

Such risks may also cause the emergence of climatic opportunities. For example, an increase in the average temperature, the level of precipitation, and the concentration of CO2, or a decrease in the number of frosty nights can lead to an increase in the production of winter cereals, their processing volume, and income. Furthermore, higher average temperatures and increased annual precipitation may cause an increase in the yield of sunflower seeds.

The main reasons for the risks of transition to sustainable agricultural technologies can be grouped into the following four categories:

- politics and law (e.g. increased taxation of greenhouse gas emissions);
- technology (e.g. options with lower greenhouse gas emissions);
- market (e.g. change in consumer behaviour);
- reputation (e.g. negative feedback from consumers).

Note that by sustainable agricultural activity, we understand activities whose main motives are not only economic profit but also environmental management and social responsibility.

Environmental risks of transition to technologies of sustainable economic activity can be grouped according to their duration (short-term, medium-term, long-term), causal categories (politics and law, technology, market, reputation), probability (high or low) and impact assessment (ranking points from -5 to -1). In particular, the examples of the risks with the greatest negative impact include an increase in the tax imposed on carbon dioxide emissions, the introduction of an emissions trading system, the regulation of carbon emission borders, an increase in energy prices etc.

We have classified environmental opportunities related to transitioning to technologies of sustainable economic activity, starting with those that have a positive impact with a score of 2 (such as an increase in production efficiency and participation in voluntary carbon credit markets) and ending with those that have a very positive impact with a score of 5 (such as the development of organic production and an increase in the scale of biomass processing to reduce energy costs).

The environmental risks of military actions can be assessed based on their duration (short-term, medium-term or long-term) and probability of occurrence (low or high). The ratio of these indicators makes it possible to set a score (from neutral (-1) or negative (-2 or -3) to very negative (-4 or -5)). The reduction of the impact of such risks to the level of the target indicator, e.g. from the year 2023, can be achieved through impact investment measures.

We have identified the following main environmental risks of military operations: the suffering of animals and

Table 2

ESGI report. The level of financial or economic impact of the risk or opportunity

Risk / Opportunity	Level		Explanation
	Points	Value	
Opportunity	4 or 5	Very positive	Will generate significant monetary benefits/advantages for the enterprise/ business operations and will be sustained over a long period
Opportunity	2 or 3	Positive	Will generate moderate monetary benefits/advantages for the enterprise/ business operations and will be sustained over a medium-term period
Risk / Opportunity	1 or -1	Neutral	Will have a minimal positive/negative impact on the enterprise/business operations and will be sustained over a short period
Risk	-2 or -3	Negative	Will create a moderate financial impact on the enterprise/business operations and will be sustained over a medium-term period
Risk	-4 or -5	Very negative	Will create a significant financial impact on the business/business operations and will be sustained over a long period

Source: developed by the authors

Table 3

ESGI report. Matrix. Assessment of the impact of material climate risks and opportunities

Impact	Probability of			
	Risks		Opportunities	
	Low	High	Low	High
Very positive			4	5
Positive			2	3
Neutral		-1	1	
Negative	-2	-3		
Very negative	-4	-5		

Source: developed by the authors

birds from hostilities, contamination of land with explosive objects and substances, large-scale emissions of greenhouse gases, destruction of forests, contamination of surface and underground water with chemical substances, destruction of premises, equipment, crops, power outages, blockade of seaports, complications of logistics, and cyber attacks.

If the market for sustainability measurement and reporting is still absent, then the reference values for sustainability indicators can be drawn from existing best practices. For example, our calculations based on the data from sustainable development reports of agricultural holding companies in Ukraine [10, 11] were used to develop reference values for the areas of grain and industrial crop production in the temperate-continental climate of Ukraine. It is anticipated that, with the development of the market for tools for sustainability measurement and reporting in the agricultural sector, reference levels can be derived also based on statistical data for particular regions of Ukraine where a respective enterprise operates.

The reference values should be compared with the actual data, and respective matrices should be used to convert these comparisons into points. Currently, 2023 can serve as the base year with reference values while the next two years – 2024–2025 – are being compared against it, and the target year (2030) has an expected indicator.

When forming matrices, it is necessary to divide actual data into estimated (unconfirmed) and confirmed (data from tools, measurements, and surveys). Their comparison with reference indicators allows to assess the level of sustainable development as follows:

– "not stable" level – with estimated (point –4) and confirmed (point –5) reliability. It indicates non-application of sustainable agricultural practices and unwillingness to attract sustainable investments in the enterprise or economic operations;

– "moderately unstable" – with estimated (point –2) and confirmed (point –3) reliability. This level indicates a moderate reluctance to attract investments in the enterprise or economic operations;

– "indicative" – with estimated (point 1) and confirmed (point -1) reliability. This is the limit between "sustainable" and "unsustainable" levels. It corresponds to the reference practice of sustainable agricultural activity and the neutral need for sustainable investments;

– "moderately stable" – with estimated (point 2) and confirmed (point 3) reliability. This level indicates a partial application of sustainable agricultural practices and a moderate attractiveness for attracting sustainable investments in the enterprise or economic operations;

– "stable" – with estimated (point 4) and confirmed (point 5) reliability. This level indicates a wide application of sustainable agricultural practices and the attractiveness of attracting sustainable investments in the enterprise or economic operations.

The "Energy consumption" indicator focuses on energy consumption and energy intensity. As a reference level, we propose using 13.79 GJ/ha of energy consumption per 1 ha (see Table 4).

Calculators should be used to convert energy units of various fuel types (for example, kWh into MJ) [12, 13].

In the "Water use" indicator, it is advisable to disclose data on water intake, water consumption and water capacity. Water consumption per 1 ha of 660 litres/ha can be taken as a reference indicator (see Table 5). The

Table 4

ESGI report. Energy consumption and energy intensity (fragment)

Key indicators	2023 base year
Total energy consumption by sources, gigajoules (GJ)	
Use non-renewable fuel	
Use renewable fuel (straw, husks), including:	
Electricity	
Heating	
Electricity sold to the network	
Share of renewable fuel in total energy consumption, %	
Energy intensity	
Reference level	
Energy consumption per 1 ha of area, GJ/ha	13,79
Energy consumption per 1 ton of harvested grain, MJ/t	398,40

Source: developed by the authors based on [10]

Table 5

ESGI report. Water intake, water consumption and water capacity (fragment)

Key indicators	2023 base year
Total water intake by sources, *megalitres,* including:	
Groundwater	
Surface waters	
Utility providers	
Rainwater	
Purified wastewater	
Water capacity	
Reference level	
Water consumption per 1 ha of area, *litres/ha*	660,12
Water consumption per 1 ton of harvested grain, *litres/t*	19,07

Source: developed by the authors based on [10]

enterprise also should disclose information about permits obtained for special water use and discharge of wastewater into the sewage system.

In the "Land and pesticide use" indicator, the enterprise should show the total amount of applied pesticides, determined by the State Register of Pesticides and Agrochemicals, permitted for use in Ukraine. Table 6 presents the hygienic classification of pesticides by class and degree of impact on the human body and animals.

This indicator also has to reveal the level of control of the land area through the registration of ownership rights and use of land plots in the State Register of Real Rights (Table 7).

To assess the "Biodiversity and Ecosystem Transformation" indicator, two types of assessments need to be conducted: an environmental impact assessment and a strategic environmental assessment.

When assessing the impact on the environment, analysis of any consequences of the planned activity on the environment is carried out, including the consequences on the safety of the people's life and health, flora, fauna, biodiversity, soil, air, water, climate, landscape, natural territories and objects, historical monuments and other material objects.

During the strategic environmental assessment, emphasis is placed on determining, describing, and evaluating the consequences of implementing state planning documents on the environment, including public health, and the development of measures to prevent, reduce, and mitigate possible negative consequences.

As a reference indicator, it is proposed to use the area of land plots under orchards, perennial crops, and ponds (see Table 8).

Waste should be correctly classified to prepare data and disclose the "Waste Management and Circular Economy" indicator. According to Article 246 of the Tax Code of Ukraine, the hazard class and level of hazard of waste determines the environmental tax rate for their disposal (see Table 9).

Table 6

Hygienic classification of pesticides

Class	Degree of impact on human body and animals
I	Powerful or extremely dangerous drugs (a large part of which is already prohibited for use (DDT))
II	Highly toxic or dangerous drugs (Decis 100, Basudin, Bi-58)
III	Moderately toxic or moderately dangerous pesticides (Aktellik, copper chloride, copper sulfate, Karbofos)
IV	Low-toxic or low-risk drugs (Bordeaux mixture, Trichodermin, Pseudobacterin, Lepidocide, Bitoxybacillin, Fitoverm, Metawhite)

Source: developed by the authors

Table 7

ESGI report. Land use and circulation of pesticides (fragment)

Key indicators	2023 base year
Total area of land plots in ownership/use, including*:*	
Area of land plots, ownership/use rights of which are registered in State Register of Real Rights:	
in ha	
in % of total area	
Area of land plots with minimal or zero tillage:	
in ha	
in % of total area	
Intensity of pesticide use	
Reference level	
Amount of applied pesticides per 1 ton of crop, *kg/t:*	
– Wheat (yield 4.57 t/ha)	0,196
– Sunflower (yield 2.12 t/ha)	0,860
Amount of pesticides applied per 1 ha of the area treated with pesticides, *kg/ha*	1,514
Amount of pesticides applied per 1 ha of the area treated with pesticides by crop, *kg*	
– Wheat	0,896
– Sunflower	1,823

Source: developed by the authors based on [14]

Table 8

ESGI report. Restoration of biodiversity and ecosystems (fragment)

Key indicators	2023 base year
Environmental monitoring indicators	
Air quality	
Groundwater quality	
Soil quality	
Noise and/or vibration	
Reference area of land plots under siderates, perennial crops, ponds:	
in ha	0,3
in % of total area	0,06

Source: developed by the authors

According to estimated and confirmed data regarding hazard classes, the intensity of waste generation determines the level of sustainable development. For a comprehensive assessment of this level, we offer 118.77 kg/ha as an indicative value of the volume of generated waste per 1 ha of area (Table 10).

Assessing the "GHG emissions" indicator is the most complex step in analyzing the enterprise's environmental capital because it is needed to clearly define the locations of greenhouse gas (GHG) emissions and to translate their volumes into the equivalent of carbon dioxide (CO2). Water vapour (H2O), carbon dioxide (CO2), nitrous oxide (N2O), methane (CH4), and ozone (O3) are the main GHGs in the Earth's atmosphere.

The GHG Protocol Corporate Accounting and Reporting Standard [16] classifies GHG emissions in three areas: 1) direct emissions from own or controlled sources; 2) indirect emissions from purchased energy consumed by the reporting enterprise; and 3) other indirect emissions. The volumes of GHG of the third area in units of tCO2equivalent must be estimated in terms of fifteen categories: purchased goods and services, capital goods, fuel and energy activities (excluding areas 1–2), outgoing transportation and distribution, production waste, business trips, employee commuting, use of leased assets, downstream transportation and distribution, processing of sold products, use of sold products, processing of sold products after the end of their service life, transitional leasing assets, franchises, and investments. As a reference level, we suggest taking GHG emissions of 4100.00 kg CO2equivalent per hectare (see Table 11).

Since assessment of the volume of greenhouse gas emissions requires measuring such volumes not only at the enterprise level but also in the entire value chain (from the supply of raw materials to the sale of finished products), appropriate methodological recommendations and calculators (see Table 12) are necessary to achieve this goal.

Table 9

Classification of waste by hazard level

Danger class	Level of hazardousness of waste
I	Extremely dangerous
II	Highly dangerous
III	Moderately dangerous
IV	Non-hazardous non-toxic waste

Source: norms of the Tax Code of Ukraine [15]

Table 10

ESGI report. Generation and use of waste (fragment)

Key indicators	2023 base year
Total volume of processed waste, *ton, including:*	
Submitted for recycling	
Finally buried	
Used at the enterprise	
Sold to third parties	
Transferred to other users	
Intensity of waste generation	
Reference level	
Volume of generated waste per 1 ha of area, *kg/ha*	118,77
Volume of generated waste per 1 ton of harvested grain, *coefficient*	0,0034

Source: developed by the authors based on the [10]

Table 11

ESGI report. Greenhouse gas emissions (fragment)

Key indicators	2023 base year
VIII. Intensity of GHG emissions	
Reference level	
GHG emissions per volume of harvested crop, *kg CO2equivalent/1 ton of crop:*	
– Wheat	264,40
– Sunflower	419,90
GHG emissions per 1 ha of area, *kg CO2equivalent/ha*	4100,00
GHG emissions per crop area, *kg CO2 equivalent/ha*	
– Wheat	1626,40
– Sunflower	1281,80

Source: developed by the authors based on [10]

Table 12

Classification of greenhouse gas emissions and methods for assessing their volumes

Characteristic	The method for determining volumes
1	2
Direct emissions from own or controlled sources	1. Online calculators for greenhouse gas accounting and assessing their reduction and absorption scenarios:
	RSPO PalmGHG Calculator [17]
	GHG Protocol Pulp and Paper tool [18]
	Cool Farm tool [19]

Continuation of the Table 12

1	2
	FAO EX-ACT tool [20]
	Workiva [21]
	TraceX [22]
	Ansarada [23]
	2. Methodical recommendations for greenhouse gas accounting:
	IPCC Guidelines for National Greenhouse Gas Inventories [24]
	GHG Protocol Agricultural Guidance. Interpreting the Corporate Accounting and Reporting Standard for the agricultural sector [25]
Indirect emissions from purchased energy consumed by the reporting entity	Location-based method: quantification of greenhouse gas emissions based on average energy generation emission factors for defined geographic locations, including local, subnational, or national boundaries.
	Market-based method: quantification of greenhouse gas emissions based on GHG emissions emitted by the generators from which the reporter contractually purchases electricity bundled with contractual instruments, or contractual instruments on their own (GHG Protocol. Scope 2 Guidance) [26]
Other indirect emissions, in particular, during transportation, business trips	GHG Protocol Corporate Accounting and Reporting Standard
	The Corporate Value Chain (Scope 3) Accounting and Reporting Standard [27]

Source: developed by the authors

Using the obtained data on the environmental aspect of sustainable development for the base year 2023, a pie chart can be constructed that identifies the level of sustainable development for each indicator (Figure 1).

Conclusions. Climate change has pushed Europe to adopt a green course to become the first climate-neutral continent. Since June 2022, as a candidate for joining the EU, Ukraine has chosen a strategic Euro-Atlantic path of development, in which a key role is assigned to the transition of the economy to low-carbon, energy-saving and innovative technologies.

However, the ongoing full-scale Russian invasion of Ukraine creates extremely difficult working conditions for domestic agribusinesses. During martial law, a significant part of the agricultural sector of Ukraine is compelled to suspend the implementation of no-till, precision, organic farming technologies and concentrate on a survival strategy aimed at preserving jobs and maintaining the functioning of production facilities. Medium- and large-size enterprises that are interested in carbon farming programs and transition to sustainable agricultural practices face the lack of a clear state strategy regarding financial sup-

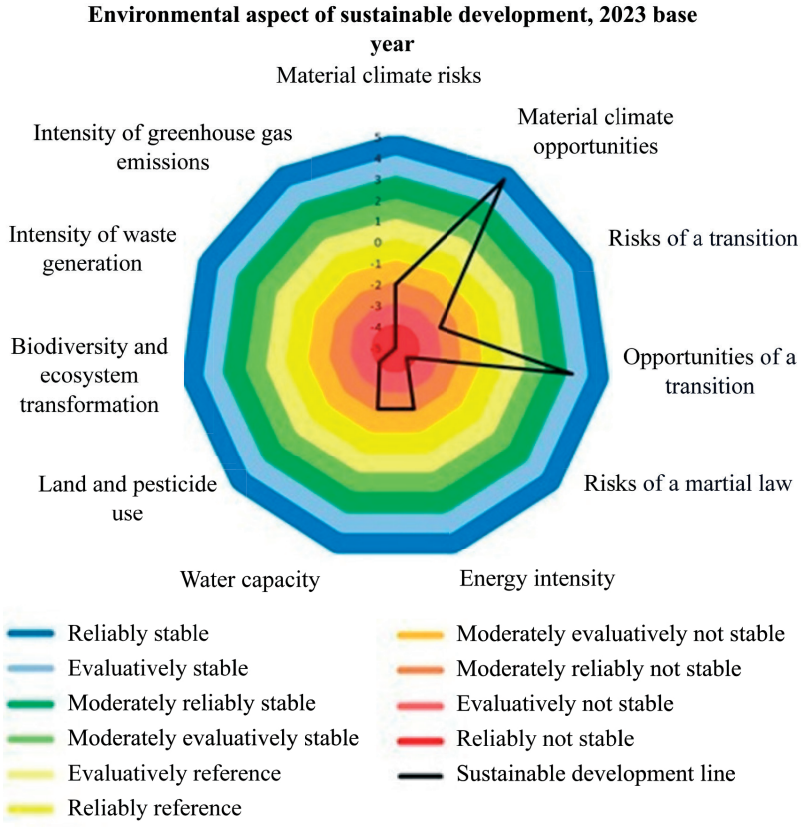

Figure 1. ESGI report: Diagram of environmental aspect of sustainable development

Source: developed by the authors

port for such a transition and disclosure of the necessary non-financial information.

Considering all these issues, we are developing the ESGI report on the SR platform. The key aspect of this report is the disclosure of information about environmental capital, which is designed to reduce climate investment risks and increase the attractiveness of Ukrainian agribusinesses for green investments in the post-war period. The ESGI report forms and environmental indicators we propose will contribute to solving the problem of agricultural enterprises' insufficient awareness of sustainable development. In addition, the results of this study promote the disclosure of non-financial indicators to attract investments in organic farming technologies, greenhouse gas emissions reduction, renewable energy, digitalization and circular economy.

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