Economic Dominance of Resource Opportunities of Hunting Industry in the Environmental Policy of Ukraine

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Abstract: The purpose of this study is the substantiation of the economic dominance of the resource potential of the hunting industry, which is based on a methodical approach to the reproduction of hunting natural resources. A methodical approach to the reproduction of hunting natural resources with a high level of environmental sustainability of natural capital in order to evaluate the effectiveness of its use in the practical activities of hunting enterprises on the basis of the existing environmental policy of the country, integrated in the space of public-private partnership is justified. Qualitative signs of the economic dominance of the reproduction of hunting natural resources with a high level of environmental sustainability of the natural capital of the hunting industry have been determined. A block diagram of the reproductive process and a matrix of impacts of the hunting industry ecosystem on the resource potential of natural capital have been constructed. The toolkit and complex methodology of economic evaluation of the level of environmental sustainability of natural capital in the ecosystem of the hunting industry are substantiated. The economic indicators of the effective development of the hunting industry in Ukraine are analyzed. The methodology for assessing the level of security of the environmental sustainability of the natural capital of the hunting industry under the influence of stimulating and disincentive factors is proposed.

Keywords: Natural Capital; Hunting Enterprises; Ecosystem; Biomass; Wild Animals; Medicinal Herbs.

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1. INTRODUCTION

In the public imagination, the hunting industry appears as a type of activity that is associated with the organization of one of the extreme types of recreation of a certain social stratum of the population. In fact, this branch performs a much more important public function – promoting the protection of the natural environment, development of local territories, reproduction of resource opportunities, regulation of the population of hunting animals and birds, provision of services to participants of hunting, filling of the state budget (Muraviov, 2019; Rausch and Suchanek, 2021; Korneychuk and Kirichuk, 2018).

The hunting industry provides participants in economic relations with the formation and implementation of socio-economic, ecological and recreational processes in the country through organizational measures to increase its efficiency of functioning (Novikov, 2019; Yavorska et al., 2022; Zhansagimova et al., 2022). This enables the process of greening the economy by achieving a balance between the natural and economic resources of hunting enterprises, focused on the economic and ecological feasibility of management (Panova, 2019; Shinwari et al., 2022).

The introduction of ecological and economic tools that regulate the ecological aspects of activity by implementing methods of protecting hunting grounds from pollution relieves subjects of the hunting industry of problems of a functional, institutional, and organizational nature and substantiates the effectiveness of the activity as a whole. The works by V. D. Bondarenko and E. M. Rizun (2016), L. Medvid and H. Hovda (2013) are devoted to the organizational and economic aspects of the functioning of the hunting industry. Reforming and state regulation of environmental policy in the hunting industry are covered in scientific works by: K. Deininger and B. Minten (2002), M. Jonsson and D. Wardle (2009), N. Yashalova and D. Ruban (2014).

The priority of this research is the substantiation of the economic dominance of the resource potential of the hunting

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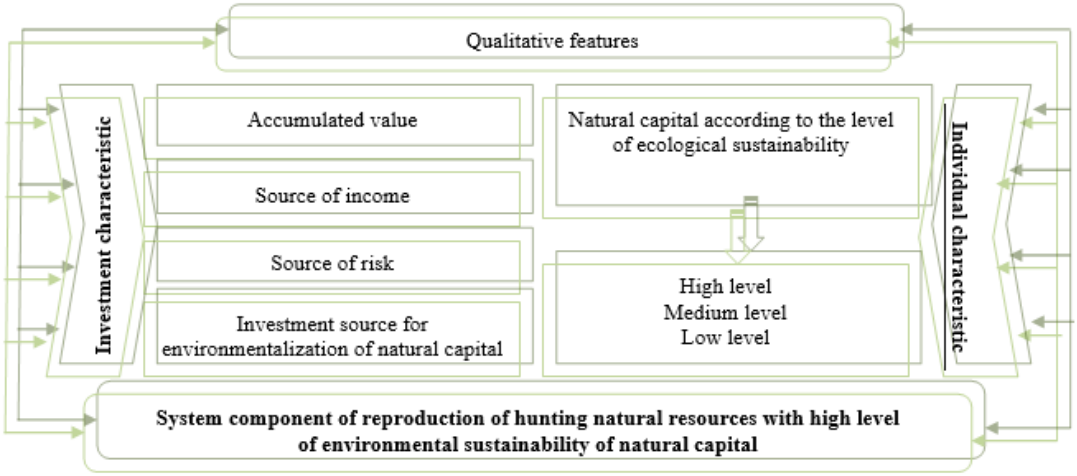

Fig. (1). Qualitative Signs of the Economic Dominance of the Reproduction of Hunting Natural Resources with a High Level of Environmental Sustainability of the Natural Capital of the Hunting Industry.

Source: constructed by the authors.

industry, which is based on a methodical approach to the reproduction of hunting natural resources with a high level of environmental sustainability of natural capital in order to assess its effectiveness in the practical activities of hunting enterprises on the basis of the existing environmental policy of the country, integrated in space public-private partnership.

2. MATERIALS AND METHODS

Determining the resource potential of the hunting industry takes into account the presence of an economic dominant that mobilizes the elements of reproduction of hunting natural resources with a high level of environmental sustainability of natural capital, which are determined: according to a quantitative approach – as an arithmetic sum of sources of investment provision of hunting natural resources; qualitatively – as a turnover of investment sources aimed at greening natural capital. To substantiate the economic dominance of the reproduction of resources with a high level of ecological sustainability of natural capital, it is necessary to consider each of its elements for the purpose of identifying functional characteristics inherent only in the potential of resource opportunities of the hunting industry. This approach allows using the developed methodological base, which is used in practical activities for the greening of natural capital objects determined in regulatory acts for the characterization of individual ecological and economic instruments(Berezina, 2017; Trusova et al., 2021b; Yavorska et al., 2022), which lay the foundation for ensuring the resource potential of natural assets, the price of which is determined by the structure of hunting natural resources in the ecosystem (Hawken et al., 1999; Panova, 2019).

That is, from the point of view of the effectiveness of the development of the hunting industry, part of the hunting natural resources through the ecological and economic tools of the ecosystem, which have qualitative characteristics, take an individual form of manifestation regarding the determination of the level of ecological sustainability of natural capital (Fig. **1**).

Depending on the directions of use of natural capital, namely: simple or extended reproduction of its resource capabilities, the distribution, exchange and use of investment sources in hunting natural resources becomes possible; involved investment sources in the past activate environmental and economic tools to determine the current level of environmental sustainability of natural capital ($LESNC^2$). According to the special characteristic, this is the existing (actual) level of environmental sustainability of the natural capital of the hunting industry. The current level of environmental sustainability of natural capital can be reproduced both at the already achieved level and below it ($LESNC^2 \leq LESNC^1$), and at a higher level ($LESNC^2 > LESNC^1$).

Thus, it can be asserted that the economic dominance of natural capital opportunities with the activation of the amplitude of the movement of investment sources and ecological and economic instruments allows choosing an integrated program of public-private partnership in the existing environmental policy of the country, which stimulates the growth of capital investments, the accumulation of additional income (as objects of investment reproduction) with the aim of obtaining profit and (or) achieving a positive ecological and economic effect in the ecosystem of the hunting industry (Trusova et al., 2021a, 2021d; Abayeva et al., 2018; Hryshchuk et al., 2020). However, the public-private partnership can provide guarantees with a time limit for the involvement of budgetary investment in the business cycle of hunting industry enterprises.

Therefore, to stimulate the expanded reproduction of hunting natural resources, the own resources of hunting enterprises should be used to ensure a high level of environmental sustainability of natural capital. In order to eliminate the shortcomings of the current procedure regarding the selection of an alternative investment program, state support can be provided to hunting enterprises within the framework of stimulating ecological and economic levers for obtaining the expected additional income (ecological and economic effect), without losing their own investment sources, on the basis of which the future (high) level of environmental sustainability of natural capital is promising ($LESNC^3 > LESNC^2 > LE$-

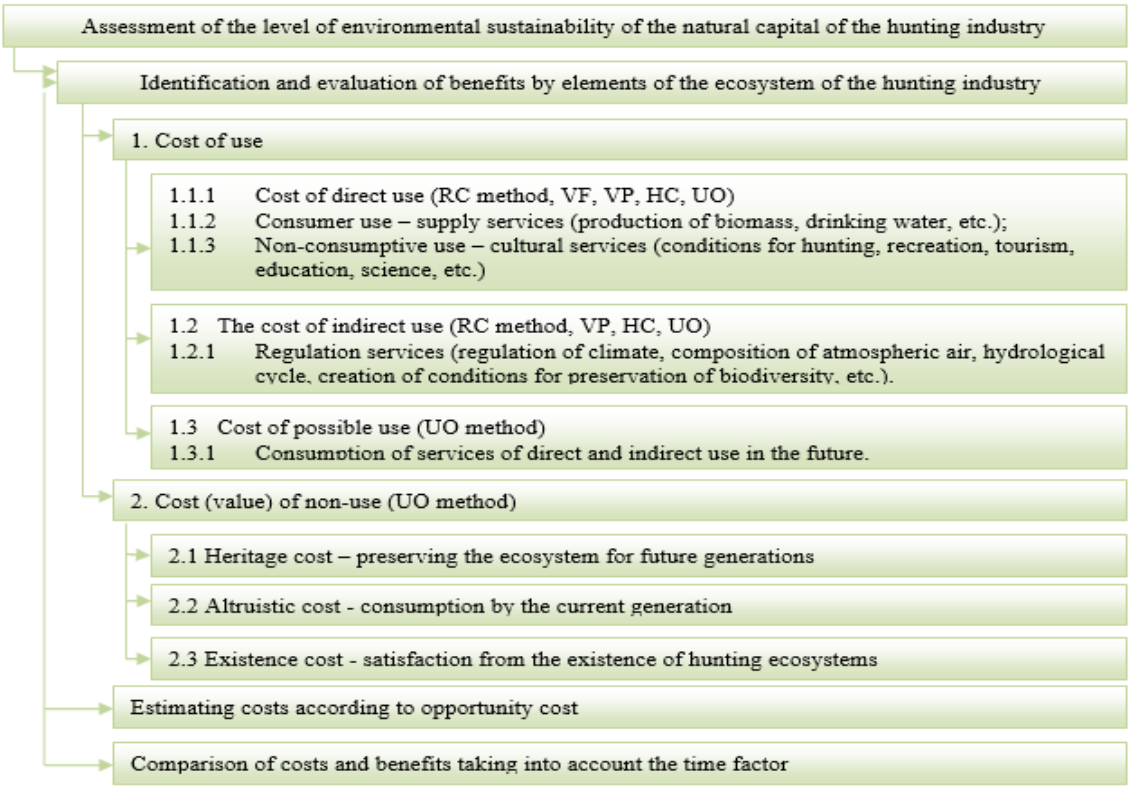

Figure (2). Toolkit for Assessing the Level of Environmental Sustainability of the Natural Capital of the Hunting Industry

Note: valuation methods: RC – market prices; VF – production function; VP – travel expenses; HC – hedonic pricing; UA – conditional assessment.

Source: built by the authors according to data Jonsson and Wardle (2009), Hsu et al. (2013), Trusova et al. (2022).

SNC[1]). However, as already noted, depending on the conditions and results of investments of hunting industry enterprises in previous periods, the future level of environmental sustainability of natural capital can ensure simple reproduction of hunting natural resources ($LESNC^3 \leq LESNC^1$).

Based on the results of the World Bank (Mas, 2005) a matrix of potential market and non-market effects of the ecosystem, which occur within and outside the boundaries of the hunting grounds, is built to identify the externalities of the natural capital of the hunting industry and their valuation (Table **1**).

Table 1. Matrix of Effects of the Ecosystem of the Hunting Industry on the Resource Potential of Natural Capital.

Nature of influences			
The place of influence	within the boundaries of the site	Valued by the market	Undervalued by the market
		biomass production (food, raw materials, energy, health)	increasing the attractiveness of hunting landscapes
		development of hunting	spiritual and cultural value of hunting grounds
		improving conditions for recreation	preservation of biodiversity
			impact on the microclimate
			absorption of pollution
	outside the boundaries of the site	weakening of erosion processes	strengthening the water protection and water regulation capacity of the hunting ecosystem
		regulation of the hydrological regime	increasing the release of oxygen into the atmosphere, reducing environmental pollution
		flood protection	impact on climate

Source: developed by the authors based on data Mas (2005).

Taking into account the above, for the integrated assessment of the high level of environmental sustainability of the natural capital of the hunting industry, not the market, but the ecological and economic value of costs and benefits is used (Muraviov, 2019; Shcherbak and Korneychuk, 2006; Yavorska et al., 2022). Different methods are used for the economic value of the benefits, depending on the nature of the assessment of the elements of the ecosystem of the hunting industry (Fig. **2**).

Considering the change in the additional value of the natural capital of the hunting industry over time, it is necessary to pay attention to the ecological value of services in the mechanism of the ecosystem, which occupy one of the central places in the reproduction process of hunting natural resources due to the changes in environmental conditions and

the consequences of the destructive economic activity of economic entities. Thus, the definition of expected added value (ecological-economic effect) as an algebraic sum of economic (positive) and ecological (both positive and negative) effects covers three interrelated components: D(resources of hunting origin – hunting birds, animals, mammals), Q (resources of plant origin – mushrooms, wild fruits, berries, medicinal raw materials, haystacks, beekeeping resources), R (recreational value of hunting grounds – increased productivity medicinal herbs, harvesting of mushrooms, wild fruits and berries, tourism, recreation, level of water protection services, drainage regulation) (Muraviov, 2019; Tyliszczak et al., 2017; Yavorska et al., 2022).

From the point of view of the effects of the ecosystem on the resource potential of hunting natural resources (Table **1**) and guided by the toolkit for assessing the economic value of benefits (Fig. **3**), authors offer a comprehensive methodology for assessing the level of ecological sustainability (effectiveness of greening) of natural capital in the ecosystem of the hunting industry (Table **2**). The given method of calculating the level of environmental sustainability of the natural capital of the hunting industry can be modified using the configuration of mathematical tools on the basis of an ecologically oriented management mechanism integrated into the existing environmental policy of the country through a public-private partnership. The tools combine both the analysis of options for reproduction of hunting natural resources and the calculation of correlation-dispersion deviations between the ecological and economic components of the ecosystem of the studied area.

Table 2. Comprehensive Methodology for Economic Assessment of the Level of Environmental Sustainability of Natural Capital in the Ecosystem of the Hunting Industry.

Calculation Algorithm	Legend
Economic evaluation of resources of hunting origin according to the method	
$W_m = \sum_{i=1}^{I} \sum_{=1}^{T} (G_{it} - C_{it} - P_{it}^{H}) \times a_t \times M_{it}$	W_m – economic evaluation of 1 ha of hunting plot for hunting, EUR/ha; i – the number of types of economic availability of the population of wild animals, birds, mammals for hunting (i=1,2…I); T– the duration of the calculation period, which is determined by the reproduction period of the population of wild animals, birds, mammals for hunting (t=1,2…T); G_{it} – the price of 1 kg of products of hunting origin of the i-th species of the population of wild animals, birds, mammals in the t-th year, EUR/kg; C_{nt}– the full cost of 1 kg of products of hunting origin of the i-th species of the population of wild animals, birds, mammals in the t-th year, EUR/kg; P_{it}– normative profit of 1 kg of products of hunting origin of the i-th species of the population of wild animals, birds, mammals in the t-th year, EUR/kg; a_t – discount factor; M_{it}– economically available resources of non-hunting origin, kg.
Economic evaluation of resources of plant origin according to the method	
$J_n = \sum_{l=1}^{L} \sum_{r=1}^{R} (G_{it} - C_{it} - P_{it}^{H}) \times a_t \times M_{it}$	J_n – economic evaluation of 1 ha of hunting grounds under resources of plant origin, EUR/ha; l – the number of types of economic availability of medicinal herbs, harvesting of mushrooms, wild fruits and berries, haystacks, beekeeping resources (l =1,2…L); R– the duration of the calculation period, which is determined by the period of reproduction of medicinal herbs, harvesting of mushrooms, wild fruits and berries, haystacks, beekeeping resources (r =1,2…R); G_{it} – the price of 1 kg of products of plant origin l-th species in the r-th year, EUR/kg; C_{nt}– full cost of 1 kg of products of plant origin of the l-th species in the r-th year, EUR/kg; P_{it}– normative profit of 1 kg of products of plant origin of the l-th species in the r-th year, EUR/kg; a_t – discount factor; M_{it}– economically available resources of non-plant origin, kg.
Economic evaluation of the recreational value of hunting grounds according to the method	
Proposition $\sum_{i=1}^{I} (Q_i - C_i - p_i + F_i) \times K_{\partial}^{i} \geq 0$	I– the duration of the turnover of investment sources in the recreational value of hunting grounds, which are spent on the cultivation of medicinal herbs, harvesting of mushrooms, wild fruits and berries, beekeeping resources in the business cycle of enterprises in the hunting industry; Q_i – income from the sale of products in the i-th year, harvested in the process of growing medicinal herbs, harvesting mushrooms, will fruits and berries, in the economic cycle, EUR; C_i – expenses for medicinal herbs, harvesting of mushrooms, will fruits and berries, haystacks, beekeeping resources in the i-th year of the economic cycle, EUR; P_i– the amount of taxes paid by hunting industry enterprises for harvested products in the i-th year of the business cycle, EUR; F_i – state financial aid for recreation value of hunting growing medicinal herbs, gathering mushrooms, will fruits and berries, haystacks, beekeeping resources in the i-th year, within the framework of international aid, EUR; K_{∂}^{i} – is the discount factor for the flow of investment sources for the i-th year.
$EO_b = H \times Q_b$	EO_b – economic assessment of water protection services in the ecosystem of the hunting industry, EUR/ha; H – payment standard for special use of surface water resources, EUR/m^3; Q_b– is the maximum productivity of the water protection service in the ecosystem of the hunting industry, i.e. the additional amount of water resources formed per 1 ha of the catchment of hunting grounds, m^3.
Economic assessment of the level of environmental sustainability (effectiveness of greening) of the natural capital of the hunting industry	
Proposition $E_{ef} = \frac{\sum_{i} G_{ni} \times B_{ni} - \sum C_{pi} \times B_{pi}}{\sum_{i} B_{pi} \times (C_{pi} + E_n \times K_i)}$	E_{ef} – effective coefficient of added value from environ mentalization of natural capital in the business cycle of enterprises in the hunting industry; G_{ni} – the cost the work (services) of hunting enterprises based on the results of the i-th component of ecological and economic efficiency from the reproduction of hunting natural resources in the economic cycle, EUR/ha; B_{ni}, B_{pi} – coefficients of discounting investment costs associated with the use of the i-th component of ecological and economic efficiency from the reproduction of hunting natural resources in the economic cycle; C_{pi}– the cost of works (services) and components of ecological and economic efficiency from the reproduction of hunting natural resources in the economic cycle;, EUR/ha; E_n – regulatory ratio of investment investments; K_i– is the specific weight of investment investments when the i-th component of ecological and economic efficiency is introduced for the reproduction of hunting natural resources in the economic cycle, EUR/ha.

Source: developed by the authors based on data Hsu et al. (2016), Muraviov (2019), Trusova et al. (2021c), Trusova et al. (2021e), Yavorska et al. (2022).

The reproduction of hunting natural resources in the ecosystem of the hunting industry allows to assess the high level of ecological sustainability (efficiency of greening) of natural capital, determine the benefits for hunting enterprises and choose an effective method of restoration of hunting grounds, taking into account the interests of both the state and private individuals interested in investing funds in development of ecological environment.

3. RESULTS

The accumulated value of hunting natural resources in the ecosystem of the development of the hunting industry forms the added value of natural assets and ensures equivalence between the received income and losses of the operational cycle of hunting enterprises in the past period, subject to different qualitative characteristics of the economic dominant. Due to the fact that directing resources to the needs of ensuring the ecological sustainability of natural capital is the result of practical activities with a short-term time space, there is a need to preserve their value in the life cycle of hunting enterprises.

Potentially, every natural asset in the hunting industry has the ability to store value. However, most of them lose part of their resource potential under the influence of the environment or require additional costs for their preservation (Medvid and Hovda, 2013; Gryshchenko et al., 2019). A qualitative characteristic of investment resources for the reproduction of natural capital is their ability to preserve the accumulated value. At the same time, the value of natural capital is determined by the price of its investment sources, as well as the operational costs of hunting enterprises for the greening of hunting natural resources. In the plane of the value dimension, there is a need to allocate natural capital to hunting natural resources according to ecological and economic tools with different levels of their investment ability. On the one hand, hunting natural resources should be considered as resources with a high level of ability, which ensure the movement of additional value and compliance with the necessary cost proportions at all stages of the reproduction process, on the other – as resources, the formation, placement and use of which is carried out on the basis of payment. The last property of the value aspect of natural capital is closely related to their qualitative characteristic as the average level of hunting ability of natural resources, which provides additional income (Trusova et al., 2021c).

The source of income, as a qualitative sign of the economic dominance of the reproduction of hunting natural resources with a high level of environmental sustainability of the natural capital of the hunting industry, ensures the efficiency of the economic cycle of hunting enterprises and is considered as an ecological and economic effect of the orientation of investment sources to reproduce hunting natural resources in the ecosystem. The use of other resources "generates" the ability of investment sources to provide additional income from the services of hunting enterprises, which are associated with the organization of one of the extreme types of recreation of a certain social stratum of the population.

The source of risk as a qualitative sign of the economic dominance of the reproduction of hunting natural resources with a high level of environmental sustainability of the natural capital of the hunting industry provides a link between the generation of all ecological and economic tools by the level of ability and risk. In addition, an increase in additional income is accompanied by a higher level of risks (Dobrianska et al., 2012). Therefore, tactical and strategic methods of assessing the risk factors of the operational and investment chain are of great importance in the process of sustainable provision of resource capabilities of the hunting industry. Carrying out risk measures in the ecosystem, the subjects of the hunting industry try to integrate their own mechanism of ecologically-oriented management with the existing environmental policy in the country in a public-private partnership with the aim of harmonizing the movement of investment sources in natural capital, and thus delegate the functions of the economic system into an individual form of manifestation of the ecosystem for reproduction of biomass in hunting natural resources (Hsu et al., 2016; Mas, 2005; Basavegowda et al., 2015).

Investment sources for the greening of natural capital allow to partially accumulate its additional value in the short-term business cycle (Trusova, 2016). From this position, the investment portfolio is formed to reproduce the resource capabilities of the hunting industry, in the process of assessing the level of environmental sustainability of natural capital, the ability of investment resources to potentially form ecological and economic resources for their placement in hunting natural resources is partially fulfilled. However, for investment resources, the change in ability level is unique. This allows, firstly, stabilizing the limits of their change in time space, since during the period of changes in the value of natural capital assets, additional income does not necessarily lose its accumulative capacity (Trusova, 2016; Niyazbekova et al., 2022). Secondly, in the period of an extended business cycle, ensuring the liquid capacity of natural capital assets with the lowest operating costs for the preservation of hunting natural resources makes it possible to attribute a certain type of them to economic resources, and over time to transform them into ecological resources (Bondarenko and Rizun, 2016; Mel'nychuk and Hryshchenko, 2014).

Ensuring the reproductive process of hunting natural resources with a high level of ecological sustainability of natural capital is inherently dynamic and cyclical in nature, the duration of which is at least one year. However, the process of greening involves a continuous time space with the use of public-private partnership programs in the hunting industry within the existing environmental policy of the country. They function in the form of the movement of investment sources for the restoration of natural capital (hunting natural resources) (Fig. **3**). Thus, from the standpoint of the past, the level of environmental sustainability of the natural capital of the hunting industry is determined by the totality of resources mobilized for the effective economic cycle of hunting enterprises and is characterized as achieve done (LE-SNC[1]).

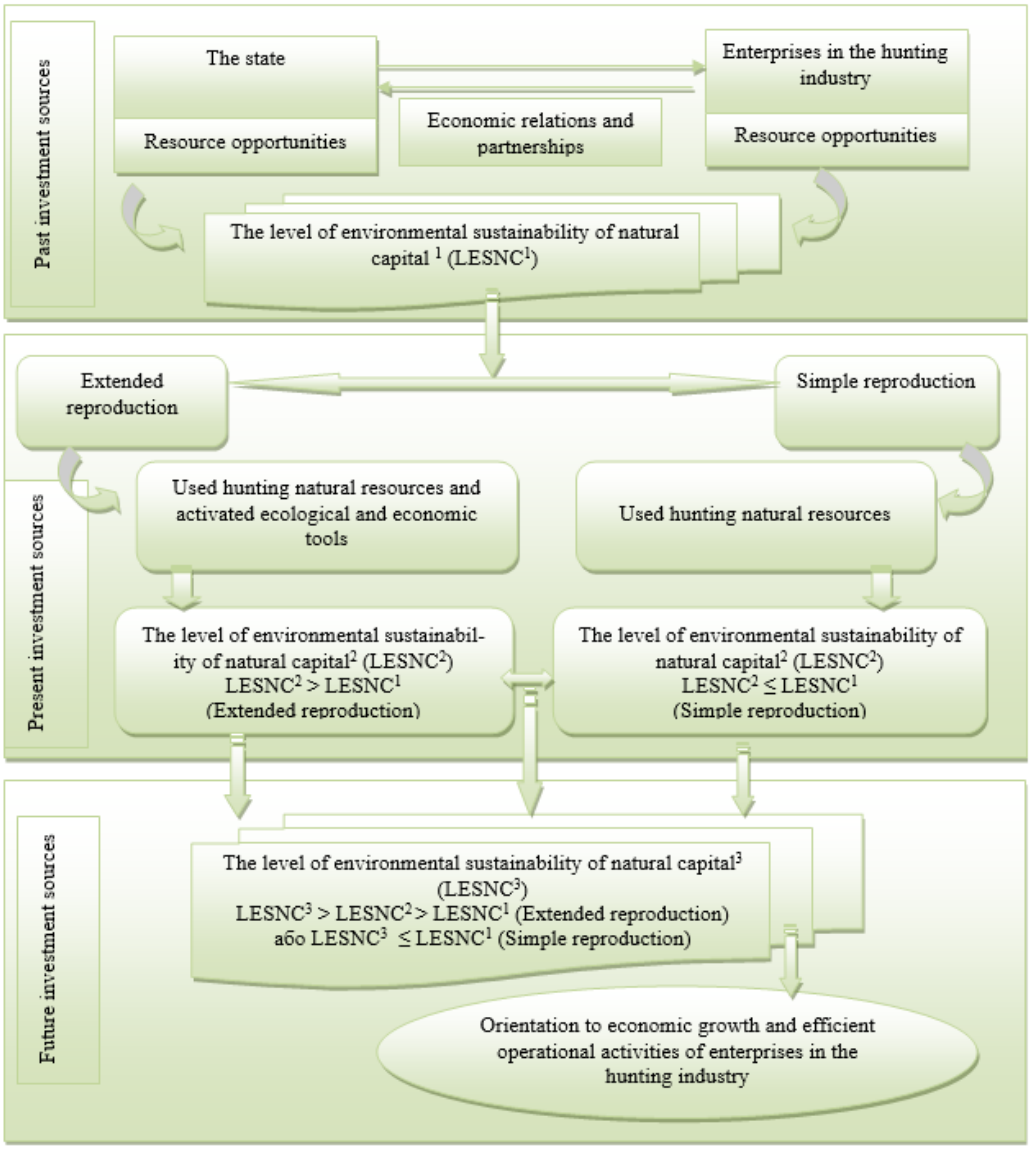

Figure (3). Block Diagram of the Reproduction Process of the Natural Capital of the Hunting Industry.

Source: developed by the authors.

The ecological direction of development and the expediency of using the resource opportunities of the hunting industry, especially in those cases when it comes to natural goods for public use, prompt state officials to implement new requirements in the country's environmental policy. This direction enables not only the reproduction of hunting natural resources in the ecosystem with its components on a sustainable basis, but also the increase of economic resources for the investment of natural capital and its preservation. The ecological direction of the resource capacity of the hunting industry neutralizes the consequences of damage to the surrounding natural environment in a certain period of time, and on the basis of ecological innovation, contributes to the minimization of costs and negative effects regarding the change in the quality of the use of hunting grounds, the reduction of the population of wild animals and their extinction. At the same time, directions for harmonizing the interests of the public-private partnership regarding the use of investment flows for the reproduction of the hunting industry are highlighted, with the aim of greening the economy and ensuring a high level of environmental protection (Myronenko et al., 2015; Niyazbekova et al., 2021).

The turnover of budgetary investment sources in the recreational value of hunting grounds, as a qualitative sign of a high level of environmental sustainability of the natural capital of the hunting industry, takes into account the income and expenses of hunting and plant origin, which arise in the first 10 years of growing medicinal herbs, harvesting mushrooms, wild fruits and berries in a certain area region of Ukraine.

Thus, the area of hunting grounds in Ukraine, which have recreational value, taking into account the conditions of its hunting and plant origin, in 2014 amounted to 37.5million hectares (66.9% of the total territory of Ukraine), in 2021–46.7million hectares (83.3% of the total territory of Ukraine), (Table **3**).

Table 3. Economic Indicators of the Effective Development of the Hunting Industry in Ukraine for 2014–2021.

Indicators	2014	2015	2016	2017	2018	2019	2020	2021
The area of hunting grounds, from the total area of the state (56 million hectares), %	66.9	69.1	68.4	69.3	69.4	68.2	68.9	83,3
Specific weight of users of hunting grounds whose recreational value takes into account their hunting and plant origin, %	16.1	16.2	16.6	16.9	17.1	17.7	17.9	17.8
Turnover investment costs for the reproduction of hunting grounds, the recreational value of which takes into account their hunting and plant origin, EUR/1000 ha	186.7	208.5	242.9	305.1	367.3	429.5	491.8	554
Production output per 1000 hectares of hunting grounds, EUR/ 1000 hectares	90.2	95.1	113.9	135.8	157.7	179.6	201.9	223.8

Source: calculated by the authors based on data Agriculture, forestry and fisheries (2017-2021) (2022), Prokopenko (2020, 2021, 2022).

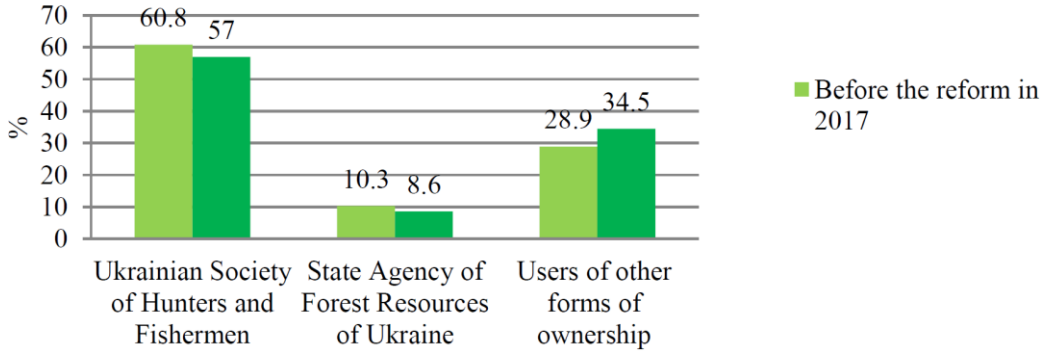

Fig. (4). Structural Allocation of Hunting Grounds Between Subjects of Their Use, the Recreational Value of Which Takes Into Account Hunting and Plant Origin in Ukraine in 2021.

Source: built by the authors according to data Agriculture, forestry and fisheries (2017-2021) (2022), Myronenko et al., 2015; PA "All-Ukrainian Hunting Union" (2019).

Most of the hunting grounds in Ukraine, the recreational value of which takes into account their hunting and plant origin before the reform in 2017, were used by the public hunting organizations – the Ukrainian Association of Hunters and Fishermen (UAHF) – 23.7 million hectares, the enterprises of The State Agency of Forest Resources of Ukraine (SAFRU) – 4 million hectares and users of other forms of ownership – 10.7 million hectares. After the reform in 2021, the total area of hunting grounds increased by 20.4%, i.e., to 46.7 million hectares. Accordingly, this led to significant changes between the subjects of the structure of the allocation of hunting natural resources. Thus, the specific weight of the area of hunting grounds secured by the Ukrainian Association of Hunters and Fishermen increased by 12% and amounted to 26.6 million hectares, the share of the area in use by other forms of ownership, the share of hunting grounds for the cultivation of medicinal herbs, mushroom harvesting, wild fruits and berries increased by 50.6% and amounted to 16.1 million hectares, the area of hunting grounds of enterprises of the State Agency of Forest Resources of Ukraine did not change, but their specific weight in the overall structure decreased by 1.7% (Fig. **4**).

In European countries, one of the main factors of effective greening of natural capital and reproduction of hunting grounds, the recreational value of which takes into account hunting and plant origin, is their use on an area of 3-7 thousand hectares (Protsiy, 2015; Safonov et al., 2018). In 2021, in Poland, Hungary and Slovakia, the specific weight of hunting areas in the total area of the countries was 82.1%, 84.9% and 89.8% respectively. In Ukraine, the number of wild animals compared to European countries is several times lower as a result; the hunting of animals per 1 hunter is hundreds of times lower. The reason for this is the flourishing of poaching. In particular, the amount of established fines for violation of hunting rules does not have a deterrent effect (average fine in 2018 – 7 EUR, in 2021 – 14 EUR). At the same time, criminal liability for offenses and causing environmental damage to natural capital in the regions of Ukraine involves a fine of more than 8thousand EUR (Fig. **5**).

In European countries, the effectiveness of the greening of hunting natural resources is profitable, with a developed market for both hunting (meat of wild animals) and the cultivation of medicinal herbs, harvesting mushrooms, wild fruits and berries. However, unfortunately, in Ukraine, the ecological and economic effect of the reproduction of hunting natural resources is unprofitable, due to the fact that 72% hunting grounds, the recreational value of which takes into account their hunting and plant origin, are not provided with investments for their reproduction. Thus, in 2018, the revenues of enterprises of The State Agency of Forest Resources of Ukraine covered investment costs by only36.8% and enterprises of the Ukrainian Association of Hunters and Fishermen– by only 38.3%. In 2021, their proportion was equal to only 41.7% and 43.4% respectively. In Ukraine, the environmental policy of the state with such potential of the industry and a sufficient number of participants is not able to increase the GDP (Fig. **6**).

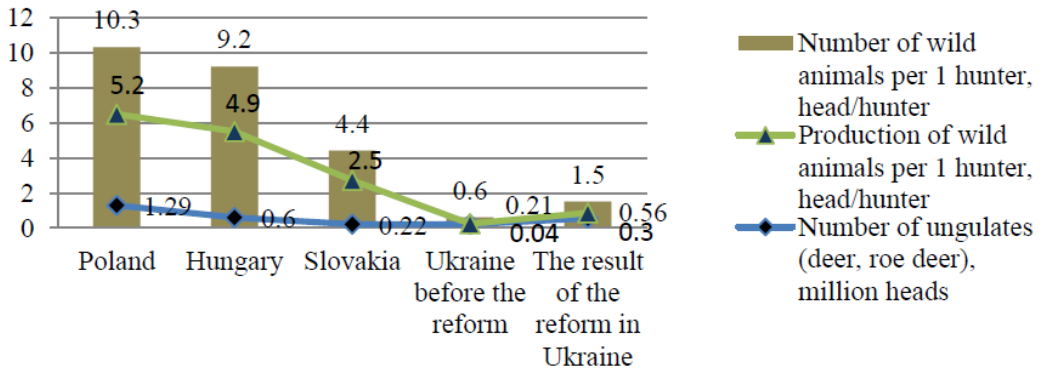

Fig. (5). Possibilities of the Natural Capital of the Hunting Industry by the Resource Component of Hunting Origin in the Countries of Europe and Ukraine for 2021.

Source: built by the authors according to data Agriculture, forestry and fisheries (2017-2021) (2022), Myronenko et al., 2015; PA "All-Ukrainian Hunting Union" (2019).

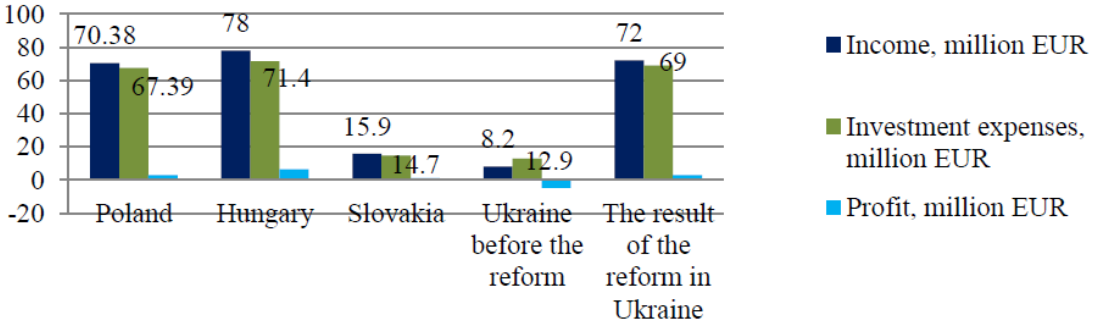

Fig. (6). The Ecological and Economic Effect of the Reproduction of Hunting Natural Resources in the Countries of Europe and Ukraine in 2021.

Source: built by the authors according to data Agriculture, forestry and fisheries (2017-2021) (2022), Myronenko et al., 2015; PA "All-Ukrainian Hunting Union" (2019).

However, budgetary investment costs for the reproduction of resource opportunities of the natural capital of the hunting industry of Ukraine are increasing every year. On average, for 2014-2021, they increased by 49% and amounted to 11.83 million EUR. A significant part of them (4.71 million EUR) is spent on protection and environmental measures, carrying out biotechnical measures, registration of wild animals, expenses on organizing hunting grounds for growing medicinal herbs, gathering mushrooms, wild fruits and berries (Figure 7). Other expenses make up the majority (7.11 million EUR). These include payment of wages, purchase of equipment, spare parts, etc.

However, out of the total amount of budget expenditures, only 20% is allocated to the greening of hunting natural resources. At the same time, the coordinating body that implements the state environmental policy in the hunting industry is the State Agency of Forest Resources of Ukraine. This situation is a combination of two conflicting missions, since the income from budget investments in ecological processes of reproduction of the recreational value of hunting grounds is only 1.5% of the total income of forestry. Therefore, the hunting industry remains outside the attention of the forest department. In addition, the volume of GDP from the hunting industry does not allow creating a separate central body of executive power. In Ukraine, the highest percentage of investment expenditures from the national budget for the reproduction of the resource potential of the natural capital of the hunting industry in 2021 was recorded in Zhytomyr, Kyiv, and Chernihiv regions (Fig. **8**).

Budgetary revenues from the use of hunting natural resources, taking into account the ecological tax on the reproduction of the industry during 2014-2021, increased by 43.2% and amounted to 5.27 million EUR. The largest percentage of budget revenues from state revenues was in Chernihiv, Poltava, Vinnytsia, and Sumy regions. At the same time, insignificant incomes (less 1%) from the management of hunting farms are in Ternopil region. Investment income is credited to the state hunting fund, which is used for the protection, environ mentalization and reproduction of hunting natural resources. The funds of the Fund ensure the implementation of the state environmental policy in the field of forestry and hunting; the number of expenditures from the State Budget of Ukraine by their valueis reduced.

4. DISCUSSION

From the position of public-private partnership regarding the determination of the economic dominance of the resource opportunities of the hunting industry, it is proposed to unite 8 hunting enterprises in the regions of Maly Polissia (Lviv,

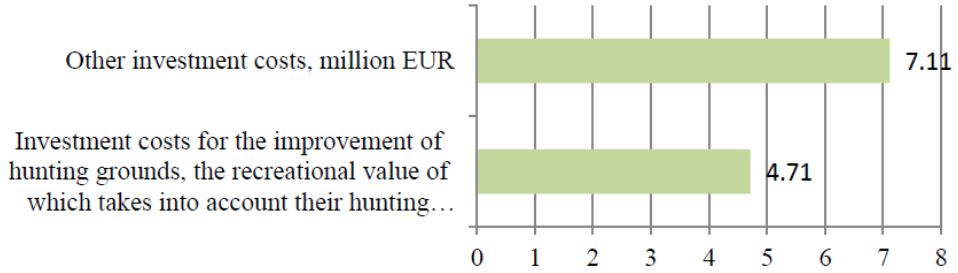

Fig. (7). The Volume of Budgetary Investment Costs for The Reproduction of Resource Opportunities of the Natural Capital of the Hunting Industry of Ukraine on Average for 2014-2021.

Source: built by the authors according to data Agriculture, forestry and fisheries (2017-2021) (2022), Myronenko et al., 2015; PA "All-Ukrainian Hunting Union" (2019).

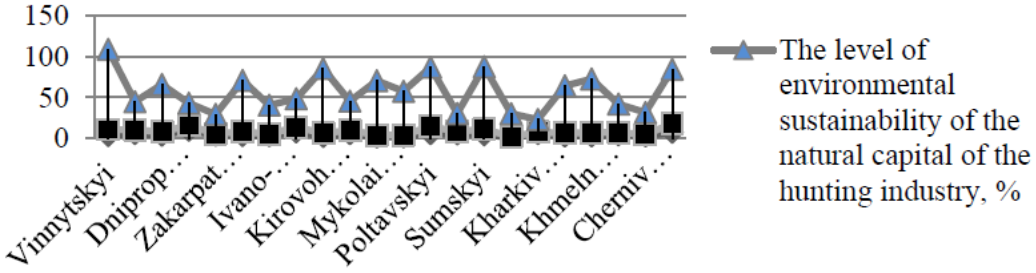

Fig. (8). The Level of Environmental Sustainability of the Natural Capital of the Hunting Industry in the Regions of Ukraine in 2021.

Source: built by the authors according to data Agriculture, forestry and fisheries (2017-2021) (2022), Myronenko et al., 2015; PA "All-Ukrainian Hunting Union" (2019).

Ternopil, Khmelnytskyi and Rivne regions) at the level of the State Regional Administration of Forestry and Hunting of Ukraine (212.8 thousand hectares – 8% territory of hunting grounds),9 hunting enterprises of the Ukrainian Association of Hunters and Fishers(1.841 million hectares – 67% territory of hunting grounds), 42hunting enterprises of users of other forms of ownership (705.8 thousand hectares – 25% territory of hunting grounds).The main mission of such an association is the cultivation of medicinal herbs, harvesting of mushrooms, berries, vines, bark, maple and birch sap with the aim of increasing own and budgetary investment income to reproduce the recreational value of lands that take into account hunting and plant origin (Allaberdiev et al., 2021; Kornilova et al., 2022).

For the implementation of this measure, the level of environmental sustainability of the natural capital of the united hunting enterprises was calculated on the basis of the ABB analytical tool, which in the decision-making process, with the observation of objective reality regarding profit maximization, ensures the prevention of undesirable consequences (asymmetry of information, failure to take into account external effects, cost of public goods, etc.) (Hsu et al., 2013; Komilova et al., 2021). In the ABB theory, the economic value of costs and benefits is used to determine the assessment of the level of environmental sustainability of natural capital. The assessment of the value of the benefits in reproducing the recreational value of the lands, taking into account the hunting and plant origin, begins with the value of hunting natural resources with the production of food products – biomass, in particular medicinal herbs, technical crops, the collection of mushrooms, berries, vines, bark, maple and birch sap and of their products –in terms of classification *CICES*, which belongs to the group of values of direct consumer use in terms of the theory of economic evaluation (Medvid and Hovda, 2013; Tyliszczak et al., 2019; Karshalova et al., 2017).

In the conditions of Maly Polissia, there are significant resource reserves of hunting grounds of plant origin (medicinal herbs, mushrooms, wild fruits and berries), which significantly affect the well-being of the local population (Hayes, 2006). The monetary assessment of the value of the reserves of hunting grounds of plant origin was carried out according to the method (Yavorska et al., 2022), which provides the following information: the price of 1 kg of products is defined as the average value that was formed on the market at the time of the research (data as of 2021); the cost price of 1 kg of products is calculated according to costing articles; economically available reserves of resources of hunting grounds of plant origin – the productivity of each type of product is determined on the basis of projects of prospective plans for the organization and development of hunting enterprises (Medvid and Hovda, 2013; Komilova et al., 2019; Muraviov, 2019).

In order to assess the level of environmental sustainability of the natural capital of the combined hunting enterprises of Maly Polissia on the basis of public-private partnership by using own and budgetary investments in the project (taking into account unappreciated by the market, but critically important for human life and activity, public benefits), a comparison of the effectiveness of commercial environ mentalization and social (ecological and economic) efficiency was carried out on the example of one hunting enterprise, which

is included in the process of restoring the recreational value of hunting grounds of plant origin (Table **4**).

Table 4. Evaluation of the Efficiency of Commercial Greening and the Social (Ecological And Economic) Efficiency of the Business Cycle of the Hunting Enterprise of Maly Polissia of Ukraine on the Basis of Public-Private Partnership in the Process of Reproducing the Recreational Value of Hunting Grounds of Plant Origin.

Indicator Efficiency	**Efficiency of Commercial Greening (*d = 3%)***	**Social (Ecological and Economic) Efficiency (*d = 2.5%)***
Net present investment value of project (NPIV), thousands EUR/ra	103	2463
Investment profitability index of project (IRI), %	1.41	55.82
Investment profitability rate of project (RRI), %	3.38	2.90
Payback period of investments in project (IPP), years	10	5

Source: calculated by the authors.

The level of environmental sustainability of the natural capital of the combined hunting enterprises of Maly Polissia was determined due to the sensitivity of performance indicators, in particular NPIV, to changes in key factors (Table **5**). The conducted sensitive analysis made it possible to investigate the level of environmental sustainability of the natural capital of the hunting industry due to the change of such factors as: the percentage of discounting, the price of reserves of hunting grounds of plant origin, the price per ton of medicinal herbs, the collection of mushrooms, wild fruits and berries, the amount of willingness to pay for the reproduction of the recreational value of hunting grounds land of plant origin in the interests of future generations. The range of deviations

Table 5. Sensitive Analysis of the Level of Environmental Sustainability of the Natural Capital of the Hunting Industry Based on The Results of the Calculation of the Efficiency of Commercial Greening and the Social (Ecological-Economic) Efficiency of the Economic Cycle of the Combined Hunting Enterprises of Maly Polissia of Ukraine (on the Basis of Public-Private Partnership, Which Ensure the Reproduction of the Recreational Value of Hunting Grounds of Plant Origin).

Deviation, %		**-50%**	**-40%**	**-30%**	**-20%**	**-10%**	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**
Assessment of the efficiency of commercial greening												
Discount rate												
3.00%		1.50%	1.80%	2.10%	2.40%	2.70%	3.00%	3.30%	3.60%	3.90%	4.20%	4.50%
NPIV	103	994.0	724.8	511.7	342.9	209.1	103.0	18.7	-48.1	-101.3	-143.5	-177.0
Price of reserves of hunting grounds of plant origin per ton												
430		215	258	301	344	387	430	473	516	559	602	645
NPIV	103	-163.5	-110.2	-56.9	-3.6	49.7	103.0	156.3	209.6	262.9	316.2	369.5
Assessment of social (ecological and economic) efficiency												
Discount rate												
2.50%		1.25%	1.50%	1.75%	2.00%	2.25%	2.50%	2.75%	3.00%	3.25%	3.50%	3.75%
NPIV	2463	4122	3688	3307	2983	2704	2463	2253	2070	1910	1769	1644
Price of reserves of hunting grounds of plant origin per ton												
430		215	258	301	344	387	430	473	516	559	602	645
NPIV	2463	2070	2149	2227	2306	2385	2463	2541	2619	2696	2774	2852
Price of medicinal herbs, harvesting of mushrooms, wild fruits and berries per ton												
469		234.5	281.4	328.3	375.2	422.1	469.0	515.9	562.8	609.7	656.6	703.5
NPIV	2463	2374	2392	2410	2428	2445	2463	2481	2499	2516	2534	2552
Value of willingness to pay for reproduction of the recreational value of hunting grounds land of plant origin in the interests of future generations												
72.6		36.3	43.5	50.8	58.1	65.3	72.6	79.8	87.1	94.4	101.6	108.9
NPIV	2463	1427	1635	1843	2050	2257	2463	2669	2876	3082	3288	3494

Source: calculated by the authors.

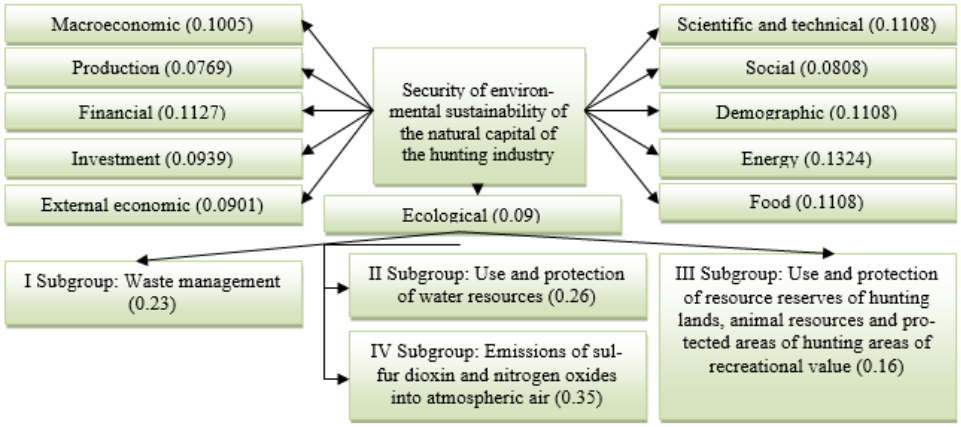

Fig. (9). The Sphere of Security of Environmental Sustainability of the Natural Capital of the Hunting Industry.

Source: built by the authors based on data Panova (2019).

within (+/-50%) was chosen for the calculations. The sensitivity analysis made it possible to determine that both factors selected for analysis (the percentage of discounting and the price of hunting land reserves) revealed a high level of environmental sustainability of natural capital due to the sensitivity of the value NPIV to changes in the values of the factors.

Thus, the level of ecological sustainability of natural capital, under the condition of the effectiveness of commercial greening for one hunting enterprise of Maly Polissia, without public-private partnership, leads to a negative result (sensitivity NPIV is chosen for 20% its deviation). That is, the value of the value NPIV: when the discount percentage changes by 20% (to 3.60%), leads to a negative value of the net present investment value of the project (-48.1thousand EUR/ha); if the price of reserves of hunting grounds of plant origin is reduced by 20% (344 EUR/ton), the value of NPIV will be (-3.6 thousand EUR/ha).

At the same time, the level of environmental sustainability of the natural capital of the hunting industry of the united hunting enterprises of Maly Polissia, under the condition of social (ecological and economic) efficiency, under the condition of public-private partnership, is not critical. That is, the sensitivity NPIV to the selected factors (discount percentage, price of reserves of hunting grounds of plant origin, price per ton of medicinal herbs, harvesting of mushrooms, wild fruits and berries, willingness to pay for reproduction of the recreational value of hunting grounds of plant origin) is not critical. Their change by 20% leads to a positive result: when the discount percentage changes by 20% (to 3.00%), the value of the net present investment value of the project will be equal to 2070 thousand EUR/ha); if the price of stocks of hunting grounds of plant origin is reduced by 20% (344 EUR/ton), the value of NPIV will be 2306 thousand EUR/ha; if the price per ton of medicinal herbs, harvesting of mushrooms, wild fruits and berries changes by 20% (562.8 EUR/ton), the value of NPIV will be 2499 thousand EUR/ha; if the value of the willingness to pay for the reproduction of the recreational value of hunting grounds of plant origin changes by 20% (58.1 EUR/ton), the value of NPIV will be 2050 thousand EUR/ha.

There are specific directions of public-private partnership of subjects of the hunting industry, which are related to the environmental policy of the state and which, under the influence of environmental instruments on the resource capabilities of natural capital, are directly related to the ecological and economic state of the environment in Ukraine. In order to optimize the criteria for the reproduction of hunting natural resources of hunting enterprises based on public-private partnership, proposals have been developed to improve the current assessment methodology by introducing an integral safety indicator of environmental sustainability of natural capital. Taking into account the availability of an information base of environmental indicators that affect the level of security of environmental sustainability of natural capital, it is advisable to take into account the following groups of indicators: 1) waste management (4 indicators); 2) use and protection of water resources (7indicators); 3) use and protection of resource stocks of hunting grounds, animal resources and protected territories of hunting areas of recreational value(10indicators); 4) emissions of sulfur dioxide and nitrogen oxides into the atmospheric air (6indicators It is expedient to integrate them into the method of calculating the security of environmental sustainability of natural capital (Fig. **9**). The weight factor for the group of environmental indicators (0.09) is determined at the level between the macroeconomic and investment groups of indicators.

The state of the safety environment of the environmental sustainability of the natural capital of the hunting industry of Ukraine is assessed by comparing the calculated safety indicators with their limit values (from 0 to 0.5 – critical state; from 0.5 to 0.8 – dangerous; from 0.8 to 1 – satisfactory). The generalized integral safety indicator of environmental sustainability of the natural capital of the hunting industry in the state is calculated according to the following formulas (in additive form – I_A, or multiplicative form – I_M) (1) (Panova, 2019):

$$I_A = \sum_{i=1}^{n} a_i I_i^A, \; I_M = \prod_{i=1}^{n} (I_i^M)^{a_i}, \qquad (1)$$

where, I_A, I_M – are partial indicators (for the additive and multiplicative form) of the *i*-th sphere of security of the envi-

ronmental sustainability of the natural capital of the hunting industry in the state; *n*– the number of safety spheres of environmental sustainability of the natural capital of the hunting industry; a_i– weighting factors for which the following condition is fulfilled (2) (Panova, 2019):

$$\sum_{i=1}^{n} a_i = 1,\ a_i \geq 0,\ i = \overline{1,n}, \quad (2)$$

The calculation of the weighting factors to take into account the group of environmental indicators was performed as follows (3) (Panova, 2019):

$$a_i = a_i(1 - a_{11}),\ i = \overline{1,10}, \quad (3)$$

where, a_i – the weighting factors for which the condition is fulfilled (Formula (2)); $a_{11} = 0.09$ – a weighting factor for a group of environmental factors. That is, both the order and the proportions of the weighting factors were preserved.

For a group of environmental indicators (its index is – 11) for each year, integral indicators within the group (additive – I_{11}^{A} and multiplicative – I_{11}^{M}) are calculated according to (4) (Panova, 2019):

$$I_{11}^{A} = \sum_{j=1}^{m_{11}} a_{11} q_{11j},\ I_{11}^{M} = \prod_{j=1}^{m_{11}} qQ_{11j}^{a_{11j}}, \quad (4)$$

where, q_{11j} – is the normalized value; a_{11j} – weight factor of the *j*-th environmental indicator; m_{11} – the number of indicators.

Normalized values are calculated according to the following formulas (Panova, 2019). For indicators of stimulants (5):

$$q_{11j} = \begin{cases} x_{11j} / x_{11j}^{*},\ if\ x_{11j} \leq x_{11j}^{*}, \\ x_{11j} = 1,\ otherwise, \end{cases}, \quad (5)$$

where x_i – is the value of the indicator (Table **6**); x_i^{*} – the optimal value of the indicator (for stimulator indicators – the maximum value from the sample, for destimulators – the minimum);

for indicators of destimulators (6):

$$q_{11j} = \begin{cases} x_{11j} / x_{11j}^{*},\ if\ x_{11j} \geq x_{11j}^{*}, \\ x_{11j} = 1,\ otherwise, \end{cases}, \quad (6)$$

On the basis of the weighting coefficients of ecological indicators representing the resource potential of the natural capital of the hunting industry, its integral safety levels in Ukraine (in additive and multiplicative form) were determined, which are shown in Figure (**10**).

Thus, the resource capabilities of the natural capital of the hunting industry of Ukraine for 2023-2025 demonstrate an increase in its level of security and ecological sustainability, provided that the state of the ecosystem is stabilized, which is the basis for the reproduction of hunting grounds, the recreational value of which is determined by the amount of biomass and measures for its protection (conservation).

The ecosystem of the hunting industry can be regenerated under the condition of rational use of water resources, reduction of the volume of waste, emissions of sulfur dioxin and nitrogen oxides into the atmosphere. In addition, the macroeconomic and investment dominant level of security of environmental sustainability of natural capital has a close connection with a group of environmental indicators that are interdependent and complement each other to justify global changes in the environmental policy of the state, ensure social well-being and health of the population, improve the environmental component in the business cycle of hunting enterprises and their effective development on the basis of public-private partnership.

Table 6. Weighting Coefficients by Subgroups of Environmental Indicators That Determine the Resource Potential of The Natural Capital of The Hunting Industry of Ukraine.

No. of Subgroup	No. of Indicator	The Name of the Indicator	Subgroup Weighting Factor	Weight Factor a_{11j}
I	1	Waste generated (total), thousand tons	0.3191	0.073402
	2	Waste disposed, thousand tons	0.1528	0.035155
	3	Waste was removed to specially designated places, thousand tons	0.2937	0.0675549
	4	Availability of waste in specially designated places on the territory of hunting enterprises at the end of the year, thousand tons	0.2344	0.053893
II	5	Water taken from natural water bodies, million m^3	0.1560	0.040549
	6	Fresh water consumed, million m^3	0.1629	0.042343
	7	Total removal of return water (total), million m^3	0.1652	0.042942
	8	Removal of polluted water (total), million m^3	0.1334	0.034672
	9	Removal of polluted waters (from them without treatment), million m^3	0.1253	0.032590

	10	Removal of normatively treated water, million m^3	0.1654	0.043011
	11	Capacity of treatment facilities, million m^3	0.0919	0.023893
III	12	The volume of products, works and services of the hunting industry (in actual prices). million EUR.	0.1104	0.017661
	13	Harvesting of stocks of plant origin from the area of hunting grounds (total), thousand tons	0.1104	0.017661
	14	Reproduction of hunting natural resources, thousand ha	0.0803	0.012856
	15	Area of hunting grounds, thousand ha	0.1111	0.017775
	16	The total number of hunting animals (ungulates), thousand heads	0.1196	0.019137
	17	The total number of hunting animals (fur-bearing animals), thousand heads	0.0878	0.014047
	18	The total number of hunting animals (feathered game), thousand heads	0.1251	0.020011
	19	Protected territories of hunting areas of recreational value (quantity), pcs.	0.1176	0.018817
	20	Protected territories of hunting areas of recreational value (area), thousand ha	0.1207	0.019320
IV	21	Volumes of sulfur dioxide emissions (total), thousand tons	0.1857	0.064978
	22	Volumes of sulfur dioxide emissions (including by stationary sources), thousand tons	0.1833	0.064151
	23	Volumes of sulfur dioxide emissions (including by mobile sources), thousand tons	0.1893	0.066268
	24	Volumes of emissions of nitrogen oxides (total)	0.1913	0.066946
	25	Volumes of emissions of nitrogen oxides (including by stationary sources). thousand tons	0.0607	0.021234
	26	Volumes of emissions of nitrogen oxides (including by mobile sources), thousand tons	0.1898	0.066423

Source: calculated by the authors.

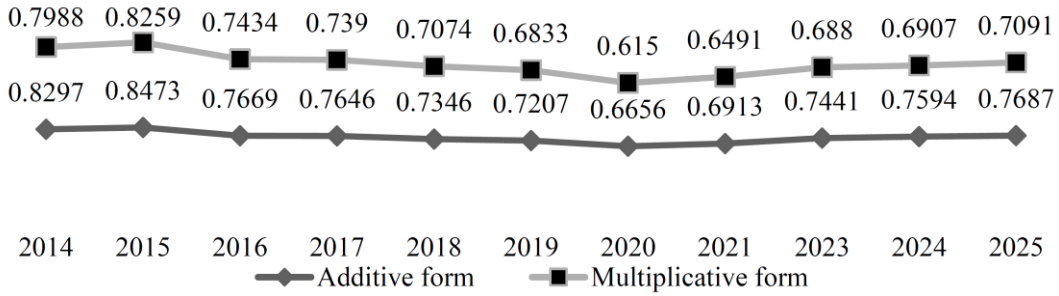

Fig. (10). Level of Security of Ecological Sustainability of the Natural Capital of the Hunting Industry of Ukraine (Additive and Multiplicative Form) for 2014-2021 and for 2023-2025, %.

Source: constructed by the authors.

It is proposed to create a State Agency for Fishery and Hunting. This will make it possible to strengthen measures to improve the ecosystem of the industry in order to effectively reproduce biomass both in water bodies and in hunting grounds. In the short-term perspective (for 3 years – 2023-2025), in order to reproduce resource opportunities and increase the level of safety and environmental sustainability of natural capital, it is proposed to create new hunting enterprises with the introduction of ecological innovations, which will allow to increase the stock, namely: create 3500 new hunting enterprises, with 14 thousand jobs (at the rate of at least 3 jobs for each new hunting enterprise and hunting pa-

trols) in rural areas; to increase the number of hunting animals, including ungulates to 340 thousand heads, fur animals – to 2.7 million heads, feathered birds – to 16.7 million heads.

The annual salary payment for the industry will amount to 37.037 million EUR, deductions from salaries to the budget and funds 14.814 million EUR, fees for the use of hunting natural resources – 687.83 million EUR for simple and expanded reproduction of resources of hunting and plant origin. The amount of investment in the infrastructure of the hunting industry will amount to 66.137 million EUR.

5. CONCLUSIONS

The hunting industry of Ukraine has all the necessary conditions of geographical, climatic, regulatory and economic development for the successful and effective reproduction of natural capital. At the same time, the functioning of the hunting industry is affected by many negative factors, including: the instability of the economic environment, a high level of poaching, imperfect state management mechanisms, and an insufficient number of specialists. A negative feature of the provision of environmental policy at the state level is its lack of coordination with economic incentives for the use of hunting grounds and the efficient and rational use of natural resources. As a result, the main economic indicators of this industry are characterized by a low number of hunting species of animals and, as a result, high indicators of unprofitability. Investment costs in the hunting industry exceeded income more than twice. This is the main reason for the degradation of this industry. Among the positives, authors can single out the fact that while the area of hunting grounds is decreasing, the number of hunting enterprises continues to increase. Authors consider this a positive phenomenon, as the number of large hunting enterprises in which natural resources are used inefficiently is decreasing.

Authors believe that the ecological risks of technogenic pollution of natural resources, which are the cause of the decrease in the level of ecological sustainability of the natural capital of the hunting industry, should be assessed within the boundaries of the natural and economic territorial system. Such a system should consist of interconnected and interdependent in space and time natural components (geomass), which have different degrees of economic transformation and negative impact, forming a qualitatively new geosystemic integrity. Certain types of geomasses should belong to the natural components of the geosystem: lithomasses (rocks), pedomasses (soils), aeromasses (air), hydromasses (soil, surface and atmospheric waters), biomasses (biota). It is expedient to assess the impact of ecological risks of man-made pollution on the sustainability of the natural capital of the hunting industry on the basis of the transition of quantitative changes in the content of man-made substances in geomasses to qualitative changes in geosystems and potential functions of their use.

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