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## Analysis of the Economic Efficiency of Expenditure for Environmental Protection in Agriculture

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### Abstract

The aim of this paper is to analyze the cost-effectiveness of sustainable environmental and agricultural developers.

To write this article, a methodology based on the analysis of demographic and socio-economic statistics, the analysis and interpretation of literature, as well as a study on the importance of environmental protection in agricultural development and methods of cost-efficiency analysis were used.

Agriculture is an economic branch of national strategic interest, called to ensure food security for the population and to produce and export. However, it is subject to natural and economic phenomena that directly influence agricultural production, such as: natural disasters, pests, diseases in the field of animal husbandry or changes in the prices of agricultural products. In order to counteract the negative effects of these phenomena and to ensure appropriate conditions of activity and development, agriculture needs important support from the state.

This paper brings added value in order to create a subsequent model of economic efficiency at the level of sustainable development in the agricultural field. That being said, it can be stated that certain elements developed in this article may represent the starting point of some practical approaches.

### Keywords

Economic efficiency, environment, agriculture, pollution.

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### Introduction

The links between the richness of the natural environment and agricultural practices are multiple. Agriculture has contributed over the centuries to the creation and maintenance of a variety of valuable semi-natural habitats (Anghelache, 2017). While many of these have been perpetuated by extensive agricultural practices and a large number of wildlife species have owed their survival, agricultural practices can also have a negative impact on natural resources (Collins, 2007). The policies of the European Union, and mainly the common agricultural policy (CAP), are therefore aimed at reducing the risk of environmental degradation, while farmers are encouraged to continue to play a positive role in preserving the rural landscape and protecting the environment.

With Romania's accession to the European Union, our country had to adopt special measures regarding agriculture, but, at the same time, it benefits from funds, subsidies directed to this sector. While

agricultural policies and official institutions have met all the criteria for accession to the European Union, the agricultural sector itself is not yet ready to make effective use of the opportunities that have arisen. The big problems that Romania faces in the agricultural sector are: the large number of subsistence and semi-subsistence farms, the large share of farmers in the total employed population, as well as the large number of elderly farmers, the still weak organization of agricultural producers in association, to which the lack of information on the market at the level of producers regarding the quality standards contributes (Cosmulese, 2017).

Expenditure on environmental protection in agriculture is justified and even imposed by the fact that within the European Commission, the set of measures aimed at reforming the Community Agricultural Policy (CAP) includes an important chapter on new guidelines in environmental management (e.g. guaranteeing natural food which are perfectly compatible with the ecological requirements, of a superior quality, better management of the natural resources, protection of the landscape, protection of the abiotic environment etc). At the macroeconomic level, the environmental protection expenditures made by the local public administration represent approximately 100 billion Euros and are related to the efforts to harmonize the environmental acquis, the creation / development of the infrastructure for the implementation and control of the application of the new legislation (Prus, 2012).

### **Review of the scientific literature**

Angelsen (2010) listed policies to reduce deforestation as well as their impact on agricultural production. Anghel, Lilea and Dumbravă (2017) considered the quality of the environment as being a component of sustainable growth. They addressed issues related to environmental protection and water quality conservation in the context of sustainable growth. Anghelache and Anghel (2017) analyzed the impact of waste on the environment in EU member states. Quamrul and Michalopoulos (2015) considered the influence of climate change on the spread of agriculture. De Groot, Brander, Van Der Ploeg, Costanza, Bernard, Braat and Van Beukering (2012) estimated and quantified globally the value of ecosystems and the services they provide.

Ali (2021) develops a sustainability model for the agricultural branch for the state of Ghana, correlating the need for food resources at the local level with future development possibilities.

Anghelache (2017) develops the idea of the needs for conservation and protection of environmental qualities in the context of economic growth

Moreover, Baffoe (2019) analyzes sustainable development in developing countries and brings to the fore the usefulness of the analytical hierarchy process in classifying the activities necessary for interventions for sustainable efficiency. Baum (2019) introduces in his study a modern, necessary concept, namely eco-efficiency as part of agricultural sustainability. Cosmulese (2017) addresses the importance of implementing European funds in all member states, focusing on Romania. These are absolutely necessary for sustainable development, including in agriculture.

De Marinis (2020) makes a characterization of the participatory hierarchical analytical process in view of the allocation of resources in the projects for the development of Agricola Ionescu (2020) exposes in his study a new model in agriculture, based on indicators and ecological principles for a sustainable economy Krajewski (2016) develops the idea of economic growth emphasizing the impact of public spending on environmental protection. Luczka (2017) draws an integrated parallel in terms of sustainable consumption of resources, viewed both on the theoretical and practical level. Njegomir (2017), brings to the fore the idea of agricultural entrepreneurship, seen as a necessary element of dynamics and growth in the field, in close correlation with ecological privileges.

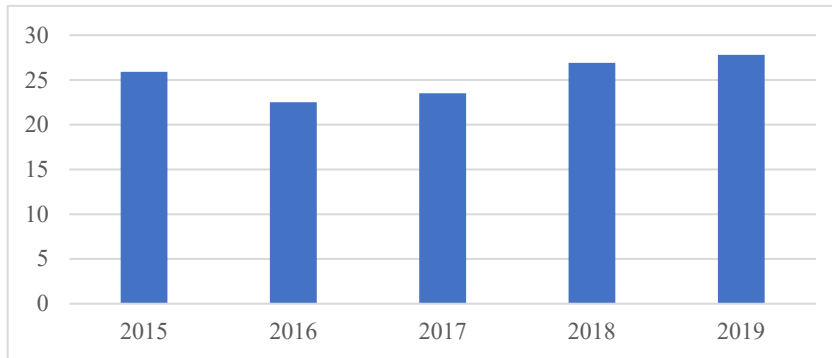
### **Research methodology**

The statistical methods used in the study of economic and ecological problems are complemented by the design of analysis models on the efficiency of agricultural spending. The approach varies from conceptual to methodological dimensioning for exploring the experimental field, which includes: information, comparative analysis, interpretations, deductive and inductive testing of ideas.

**Results and discussion**

*The situation of environmental protection, of the expenses made in this field*

Environmental protection expenditures represent payments made by producers of environmental protection services, as well as by polluting economic agents in the realization of those products and services in order to prevent, reduce and eliminate pollution (James, 2005). At the level of agriculture, as a branch of the national economy, environmental protection expenditure (CPM) is defined as public expenditure, which aims to prevent, reduce and eliminate any type of environmental degradation caused by productive processes in agriculture.



**Figure no. 1. Evolution of the "chemical fertilizer consumption" indicator**

Source: INSSE

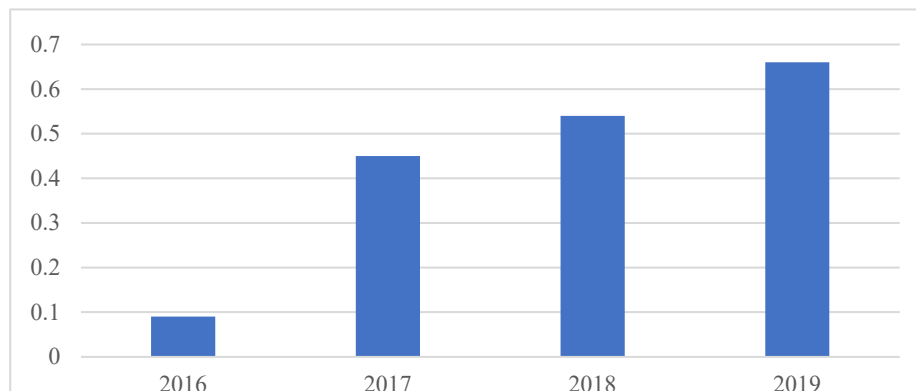
Pesticide consumption- shows the intensity of pesticides in agriculture (insecticides, fungicides, herbicides). The trend indicates the achievement of environmental objectives.

**Table no. 1. Evolution of the "pesticide consumption" indicator**

Type	Consumption of chemical fertilizers (kg / ha)			
	2016	2017	2018	2019
Agricultural land	0,85	0,74	0,56	0,5

Source: INSSE

Intensity of agriculture- aims to highlight changes in the productive or unproductive use of agricultural land. It is calculated as the ratio between the agricultural area of the current year and that of a reference year (Duram L., 2005).



**Figure no. 2. Evolution of the "agriculture intensity" indicator (%)**

Source: INSSE

The trend indicates that the situation is stable in terms of the degree of intensification of agricultural practices.

*Analysis of different types of environmental protection expenditures*

In order to analyze the level of environmental protection activities at macroeconomic level, as well as that of the expenditures for financing these activities, the following distinction must be made (Gheorghiu A., 2004):

- current expenses (expenses for the supervision and protection of the environment and which refer to the prevention or repair of the damages brought to it);
- capital expenditures or investments (include new or existing tangible capital goods purchased from third parties or produced for own use, with a duration of operation of more than one year, for the purpose of environmental protection.

These also include non-produced tangible goods such as land (Neven D., 2014). It includes additions, renovations and improvements that extend the life or increase the capacity of the equipment. Also included are goods and services incorporated in land, services related to the transfer of ownership of land, existing constructions, other incorporable assets.

- grants from the European Union (grants)

In Romania, the largest share in terms of environmental protection expenditures is held by non-specialized producers (68%). As the statistical data on environmental protection expenditures are not detailed by types of activities within the sectors, but are presented only globally, we cannot have an exact situation at the level of agriculture.

**Table no. 2. Evolution of environmental protection expenditures as a share of GDP in 2015-2019**

Nr. Crt.	Environmental protection expenditure	2015	2016	2017	2018	2019
1	Investment expenses	0,46	0,54	0,59	0,49	0,65
2	Current expenses	0,65	0,66	1,2	1,01	1,39
3	Total expenses	1,11	1,2	1,79	1,5	2,04

*Source: Institute for Economic Studies and Statistics*

There is a slight increase in CPM as a percentage of GDP from 2015 to 2019, when there is a reduction in current spending, and then the percentage rises sharply. Environmental investment accounts for 32% of the total, current expenditure 68%, while subsidies only 0.3%. The overall increase of the CPM share in the GDP, but also of their absolute figure, is mainly explained by the efforts that Romania makes for the harmonization and implementation of the European legislation in the field of environmental protection.

For the protection of the environment in agriculture, at national level, statistics are practically non-existent. However, we can make an analysis of the main areas subject to protection, of which agriculture has a significant part: soil, groundwater and biodiversity (Padash A., Ghatari A.R., 2020).

**Table no. 3. Expenditures for environmental protection in agriculture by fields in 2019 (thousand RON)**

Nr. Crt.	Domain	Total	Investments	Current expenses		Grants
				Internal	External	
1	Soil and groundwater protection	1949158,07	106532,63	4137,97	42999,37	3,8
2	Protection of natural resources and conservation of biodiversity	78252,41	28378,69	28286,88	25474,04	12,8
3	Total	-	143911,32	32442,85	68473,41	16,6

Source: Institute for Economic Studies and Statistics

By development regions, CPM registers very different values: 59.6% Bucharest-Ilfov region, 8.8% South-West Oltenia region and 7.6% South-East region, on the first places, and the lowest values are registered in the North-West region, 1.7%. In agriculture, environmental protection expenditures by development regions are as follows:

**Table no. 4. Expenditures for environmental protection by development regions in 2019 (thousand RON)**

Nr. Crt.	Region	Total	Soil and groundwater protection	Protection of natural resources and conservation of biodiversity
1	Total	-	190915,07	78152,41
2	North-East region	15675,43	8228,23	7447,2
3	South-East region	19952,94	5293,09	14659,85
4	South Muntenia region	9867,59	5390,42	3877,17
5	South-West Oltenia	23683,52	13398,71	10284,81
6	West region	14239,39	11110,22	3129,17
7	North-West region	4516,19	3276,61	1239,58
8	Center region	20549,08	19109,4	1439,68
9	Bucharest-Ilfov	160583,34	124508,39	36074,95

Source: Institute for Economic Studies and Statistics

As can be seen from the table, the Bucharest - Ilfov Region holds the supremacy in terms of the effort for a clean environment in agriculture, followed by the South-West Oltenia Region and the Center Region. The least money for the protection of the agricultural environment was spent in the North West Region.

#### **Analysis models used in the study of the economic efficiency of environmental protection expenditures in agriculture**

Efficiency is the quality of producing the expected positive effect (Baum R., 2019). Economic efficiency is the most general economic category that characterizes the results deriving from different variants expected for use (productive consumption, individual consumption, sale) or saving resources (human, material, financial) entered or not entered in the economic circuit.

In other words, economic efficiency is measured either as an absolute sum from the difference between the value of the effect and the value of the effort, or as a level obtained by the ratio between the effect

and the effort or vice versa. Increasing economic efficiency can be achieved by increasing the effects in relation to efforts at a faster pace (Ionescu R.V., 2020). As it is known, the level is the most conclusive indicator in terms of economic efficiency, the only one comparable in time and space.

The efficiency of environmental protection programs in agriculture depends both on the efforts made at the microeconomic level (agricultural holding) and at the macroeconomic level (agriculture as a branch of the national economy considering the structuring of Romania by areas and regions). Thus, the efforts, in the form of environmental protection expenditures, aim at goals grouped into two main categories: preventive environmental protection expenditures and expenditures intended to reduce the level of pollution (ecological reconstruction, post-factum expenditures).

The general formula for the level of efficiency of environmental protection expenditures is:

$$ECPM = \frac{\text{Reducing the negative environmental impact}}{\text{Expenses needed to reduce the impact}} \quad (1)$$

Agriculture, the main supplier to the food industry, is perhaps the most important branch, as it provides food to the population, and the quality of food has a direct impact on people's health (Łuczka, 2017). Thus, in the field of agriculture, the efforts for environmental protection are in the direction of the transition to ecological-sustainable agriculture, which guarantees both food security and environmental protection against pollution from agricultural sources.

Analyzing the economic efficiency in an ecological agriculture, a series of shortcomings can be identified:

- low level of yields (especially during the transition to organic farming, until the establishment of an ecological balance of ecosystems, after which the level of production obtained tends to stabilize);
- the capitalization price of ecological products is higher than that of conventional products;
- the need to support organic agriculture (premiums, tax exemptions);
- organoleptic characteristics sometimes deficient in some ecological products (there is compensation, however, due to their high nutritional value);
- the presence of fake organic products on the market - this implying efforts in the sense of improving (streamlining) the control and certification system of organic products (green label);
- lack of research and extension assistance for organic farming (high costs for research and development and professional training of agricultural workers)

The current stage reached by humanity, characterized by a high degree of pollution and consumption of depletable resources, imposes on the forefront of the concerns of decision makers the issue of sustainable development, the development of methodological tools for substantiating decisions (Torquati, 2014). As a direct effect of environmental protection expenditures, we nominate the quality of agricultural production and environmental factors- factors of production in agriculture (water, soil, etc.).

## Conclusion

The analysis shows that the evolution of efficiency indicators of operating costs and environmental protection at 1000 lei operating income registers favorable dynamics due to the increase on the one hand of the volume of production sold and on the other hand of total operating costs, but also those for environmental protection. However, a detailed analysis of the influence of the factors on the evolution of the mentioned efficiency indicators and especially of the meaning of these influences is required:

- The increase in the total volume of operating expenses and environmental protection expenses had negative influences, but which were covered by an increase in revenues generated by them (operating income and the value of production sold).
- At the level of 2018 as well as of 2019 the expenses for environmental protection have a very low value and their structure is very simple.

Regarding the economic efficiency, it is found, according to the performed calculations, an increase of

the economic efficiency of the environmental protection expenses, but these expenses include only expenses occasioned by the payment of environmental taxes and authorizations and of the minimum environmental protection actions that the farm initiated in accordance with the requirements of applicable law.

Operating and environmental protection costs per 1000 lei of production sold are two important indicators that speak about the efficiency of the agro-industrial farm's commercial activity. The values of both indicators register positive evolutions, as a result of the influences exerted by the modification of the structure of the sold production, the reduction of the production costs and the increase of the prices, at the majority of the sold products. Therefore, the increase in profitability took place exclusively as a result of the restructuring of production and the increase in sales prices.

Total gross profit increases during the analyzed period, which demonstrates a proper management of resources and a high level of competitiveness of products and the farm in general in the market. The increase in environmental protection expenditures contributes to an important extent to the reduction of the gross profit related to the exploitation activity and the environmental protection component. An improvement in the profitability situation is found in the case of trading activity, where the value of the indicator

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