OPERATIONALIZATION OF AGRI-ENVIRONMENTAL MEASURES - WAY OF IMPROVING THE PERFORMANCE OF RURAL SOCIO-ECOLOGICAL SYSTEMS

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Abstract
Agriculture has marked the beginning of the changes from natural economy to non-natural economy, as the transition from traditional farming practices to the industrial ones. Theoretically, in terms of agri-environmental measures, the approach of the agriculture – environment relationship has as starting point the cybernetic model of socio-ecological system and, specifically, the land use in agriculture. While the pressure on food resources is increasing and the current development models have specific values, this paper proposes a reconceptualization of agriculture intensification and a new form of it, namely the informational intensification. Likewise, as a consequence of integrating environmental policy into the development policy of rural socio-ecological systems (CSE), this study proposes a system of indicators grouped as explanatory variables, impact variables, and economic variables.
Keywords
biodiversity, environment, impact, integration, intensification, socio-ecological systems

Introduction

The sectorial approach of reality used preponderantly nowadays is, more evidently, what limits the performance of the current development strategies and policies as well as of the development models in general. This leads often to substitute some problems with others (such as crossing over stagnation, unemployment, lack of competitiveness or economic measures within an economy, by affection of the conditions of functioning within an environment as a whole or its components). Likewise, this increases the efforts of adopting more corrective and less preventive measures. From such a perspective, taking into account the knowledge progress in the field of systematic ecology, the socio-ecological systems could be prefigured as spatial units of designing and implementation of decision-making system. An example of new guidelines at European Union level can be represented by the formulation and adoption of eco-conditionality and agri-environmental measures, as growth possibilities to increase the compatibility between rural socio-economic systems and their environment, respectively the co-evaluation between the two systems in the framework of rural socio-ecological system. The evaluation impact of decisions concerning the cross-conditionality and the agri-environmental measures provides an important support both for the justification of using these tools (which is obvious) and for the choice of forms and ways of implementation; it cannot be ignored the fact that, beyond the character of such unifying issues, we should take into account the legislative, institutional, informational, and ecological consciousness support identified at a scale of space and time.

1. Literature review

The main issues that occasionally help the critical assessment of literature review in this field compared to the relationship between the promotion of agri-environmental measures and the

performance of the socio-ecological systems may cover the approach, the conceptual system and the impact of environmental policies on the parameters of socio-economic systems.
In terms of the approach, it can be discussed the unanimity which supports with scientific arguments the application of general systems theory in analysing, diagnosing and improving the functioning of economic and social activities and their natural base. Of course, there were in time different certain steps, certain stages, so to make a transition towards systemic ecology from the present. (Botnariuc, 1999: pp.153, 5, pp..37; 11, pp.71; 4, pp.17; 14, pp.28).
The new elements, on one hand, are related to the theoretic recognition of a two-way relationship between the environment, as a system, and the socio-economic systems (i.e. ecosystems incorporates natural capital, capital created by man and socio-human capital), and, on the other hand, of the perception of reality as a hierarchy of ecological systems; taking into consideration the spatial scale, the maximum expression of the hierarchy of ecological systems is represented by the Ecosphere (located, of course, in a continuous expansion, in the same process of human society development). Assuming practice of systemic ecology is evidenced by the achievements in the area of transition from sectorial management to the integrated, holistic development (Vadineanu, 1998).
As reflection to the content attributed to the systemic ecology, the subject of this paper focuses on the intra-population and inter-population realities as well as those between populations and the physics-chemistry support of life within the hierarchy of ecological systems structured at spatial-temporal scale.
Certain confusion in the application of the principles of systemic ecology towards the identification of solutions for concrete problems is fueled by the notion of environment, being considered to be similar to that of "nature".
In relation to the infinite nature, it can be appreciated that the environment represents the natural, semi-natural and anthropic components of a system that influence the various economic and social activities, in spatial-temporal scale while, in return, they are influenced by those activities.
Without question, the conceptual and meta-biological accumulation that led to the systemic ecology were triggered and amplified by increased "state of conflict" between the environment and socio-economic systems, among which are also those in agriculture. Thus, the increasingly intensive character of agricultural practices has transformed this field into an important ordering and forecasting factor in relation to environmental conservation requirements. Theorizing the necessity and possibility of increasing agricultural production has found expression in the concept of "intensification", believed to be a sequence and additional allocation of inputs on one and the same land area, in order to increase the agricultural production in terms of economic efficiency (Oprea, 1980). Reported to the present reality, this conceptual formulation shows obvious limitations, emphasizing the material dimension of production and ignoring the social and environmental efficiency, namely ignoring the ecological efficiency.
Since the notion of "performance" of the socio-ecological systems directly refers to the concept of efficiency, I corroborate the effectiveness and intensification of agricultural production based on a new content assigned to them:

- Efficiency express the interrelation between the effect and effort in space determined by the effectiveness and the economy during a time horizon considered optimal / satisfactory (Negrei, 1996: pp.16).
- Intensification is a process of saturation of one resource with other resources, through a rational mobilization of the quantitative and qualitative potential, with the aim of increasing production in conditions of economic and social efficiency (Negrei, 1996: pp.158).

Theoretical and practical debate regarding the environmental policy impact (including agri-environmental measures) on the performance of the socio-ecological systems has a contradictory character, under the influence of some subjective and objective factors:

- The contradiction between individual time and the social one is reflected on the horizon in which efficiency is evaluated; for the socio-economic systems, the efficiency is projected on a short and medium term, while for the hierarchy of ecological systems are assumed very long deadlines and commitments;
- Some empirical studies (Negrei, 2004: pp.171-172) have shown that taking a more stringent environmental policy has not affected the evolution of the economic and social performance indicators. (explainable, if we consider, for example, that the pollution means also to waste resources whose reduction increases the competitiveness of the socio-economic systems);
- "Technocratic paradigm" (Laudato, 2015: pp.63) underappreciates the role of environmental policy, with some confidence that the development and technology will enable more the substitution of environmental components;
- The echo of some interest groups, from the economic, financial, politics, military spheres, in papers undertaken by name with resonance in the realm of science.

2. Results and discussion

2.1. Purpose

The purpose of assessing the relationship between agri-environmental measures and performance of rural socio-ecological systems is the development of knowledge concerning the impact of environmental policy on rural socio-economic systems. In fact, this paper tries to focus on the problematic situation in which agriculture exert an increasing pressure on the environment both by the volume of natural resources it uses and by the amount of pollutants that it generates. Of course, of the numerous causes / factors and effects subsumed to the mentioned problematic situation, I chose to target our approach only the official practices, those whose ecological conversion is stimulated by the agri-environment measures.

2.2. Context

We could summarize the context of assessing the policy of stimulating the greening of agricultural practices by the following three aspects:

- The recognition of the co-evaluative relationship of rural socio-economic systems, focused on agro-systems design and operation;
- The most of the land surface is available for agricultural production, considering that the decisions in this field are mainly the result of algorithmic approaches. Also, these decisions target profit maximization on the way of intensification and accentuation of the material dimension of agricultural production processes;
- The reconsideration of the place and role of small and medium agricultural holdings in the greening of agriculture.

The cybernetic model of the socio-ecological system (rural), which is illustrated in figure 1, is based on system status of both the environment and the economic and social entities from agriculture. As well, it highlights the material flows (substance, information, energy) and the mutual services flows between the two systems.

Given the specific interdependencies, the operating mode of "M" and "SSE" is reflected, for example, in the bioproductive available area (SBD), respectively bioproductive required area (SBN), by whose comparison it can be determined the trends towards sustainability or non-

sustainability. By its content and purpose, I appreciate that the rural socio-ecological system must become the spatial unit of design, testing, implementation and evaluation of the decision-making system specific to the activities from this field. The relations with the environment become increasingly conflicting because of the volume, structure and characteristics of the resources on which rely the current practices in agriculture that are reflected significantly on the performance of the rural socio-ecological system. Starting from such a finding, it is taking shape the need for rural areas, in general, as well as agriculture, in particular, to identify and implement measures to reduce material consumption (dematerialization), of decoupling the increasing agricultural production of the waste and pollutants "production".

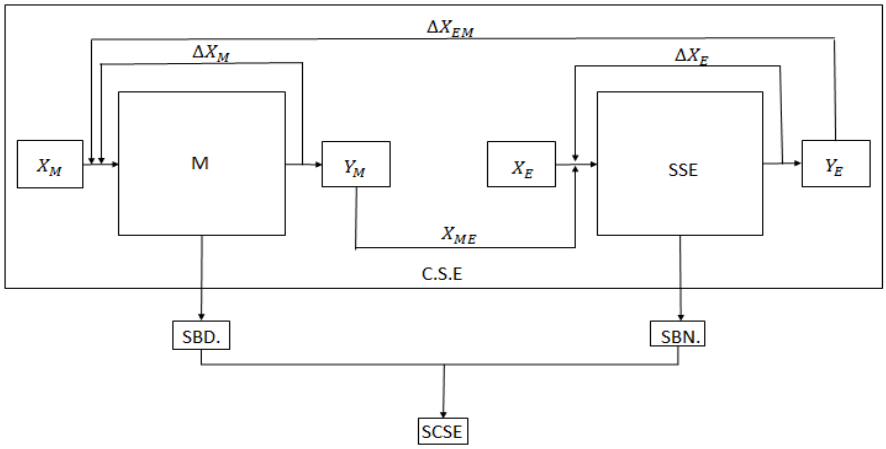

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Fig. 1 Cybernetic model of the socio-ecological system

M = the system “environment”
X_M = inputs for “M”
X_E = inputs for “SSE”
Y_M = outputs for “M”
Y_E = outputs for “SSE”
ΔX_M = correction inputs for “M”
ΔX_E = inputs for system “SSE”
X_{ME} = the flow of resources “M” ⟶ “SSE”
X_{EM} = the flow of resources “SSE” ⟶ “M”
SSE = socio-economic system
SBD = bioproductive available area
SBN = bioproductive required area
CSE = socio-ecological system
SCSE = the sustainability of socio-ecological system

At the same time, increasing the compatibility between the environment and the rural socio-economic system requires redesigning the dimension and size of activities, specifically to the size and dimension of the material and services flows generated by the specific environment. From this perspective, finding a satisfactory solution on the ratio between small, medium and

large agricultural holdings represents an important prerequisite for the balanced expression and manifestation of all functions of natural capital. Thus, assuming environment-agriculture relationship indicators should be done for designing and monitoring the satisfactory solution. These indicators should target causal factors, their effects as well as corrective and preventive efforts, consistent with the DPSIF model (control factors – pressure factors – the status of environmental components –the environmental impact - decision makers' responses).
Consequently, this paper proposes the following indicators regarding the environment-agriculture relationship:

1. Explanatory variables of environmental impact: structure of cultivated areas, mobility of land structures by category of use, agricultural farm size, animal density / 100ha agricultural land, availability of agricultural land per capita.
2. Environmental impact variables on the pressure on available resources (water consumption for irrigation, consumption of fertilizers and other substances of plant protection, number of hantri / 100 ha arable land, energy consumption), as well as, pollution (the groundwater pollution with nitrites, nitrates, etc., air pollution with particulate matter, soil erosion, soil salinization and acidification, soil compaction, annual loss of humus, silting of riverbeds).
3. Economic variables: combating pollution charges, the monetary evaluation of external effects, the system of taxes, subsidies, the level and structure of services input prices and tariffs.

2.3. The content of agri-environmental measures and the mechanism of use

Agri-environmental measures, which exceed eco-conditionality (environmental standards), are defined by the Good Agricultural and Environmental Conditions (GAEC) and are considered, therefore, voluntary steps in the direction of organic farming conversion, subject to the Measure 214 "Agri-environmental payments" subsumed to Axis II "Improving the environment and the rural areas", which is a strategic goal of the rural development program. The agri-environmental measures represent compensation payments for environmental services provided by agricultural land users from the eligible regions. The agricultural land users voluntarily assume certain technical and productive restrictions and/or efforts to render farming practices compatible with the environment conservation. The amount of compensation payments is differentiated by packages / versions of the 214 measure, the amount being between € 101 and € 393 / ha.
Beyond a series of difficulties regarding the zoning eligibility appeared due to insufficient empirical data and research, there is the problem of differentiation of compensatory payments, taking into account the qualitative characteristics of the agricultural land; its quality class express its technical productive potential, so, the loss of income, as a result of Measure 214 implementation, differs from one user to another of farmland. A broader framework for understanding the content and mechanism of the measure 214 could be provided by the next vector model of land management (fig. 2).
Of course, the mechanism for the implementation of Measure 214 should include the possibility of assessing its impact on the performance of the rural socio-ecological systems. Regardless of the options for the system adopted in this regard, it is necessary to structure it according to the DPSIR model, in which:.

- Control factors (D): changing land use, the structure of cultivated area, livestock systems, the intensification, the specialization, etc.

- Pressure factors (P): chemicals consumption, water consumption, energy consumption, etc.
- Environmental status (S): the risk of polluting the land (its vulnerability), soil nutrient balance, genetic diversity, etc.
- Environmental impact (I): the change of the quality and structure of environment as a whole, the quality of environment components, evolution of pollutants, landscape evolution, etc.
- Policymakers' response (R): expenses regarding the human resources, renewable energy, integrated pest and disease control, the greening of technologies and the reduction of the work volume per hectare, etc.

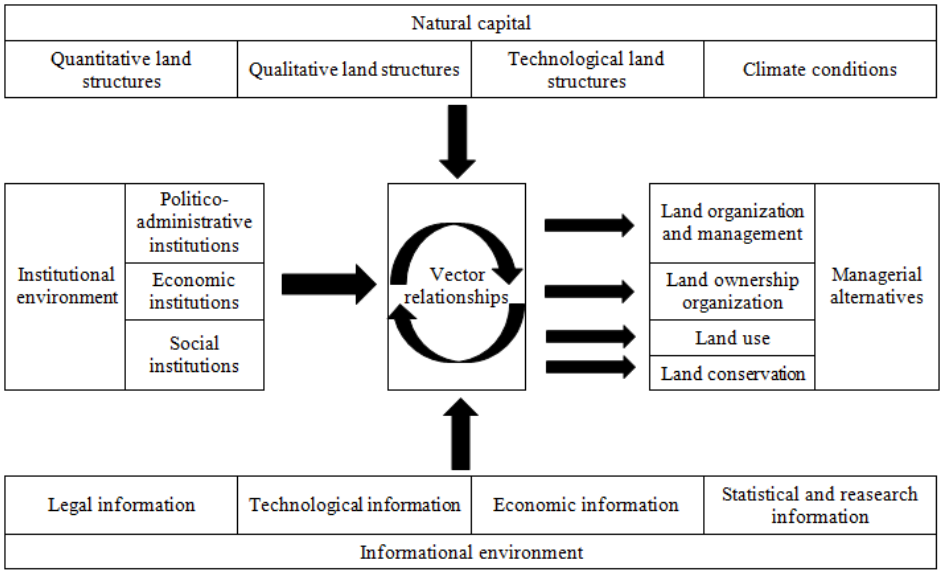

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Fig. 2 The vector model of agricultural land management

Such indicators should allow assessment of the impact of agri-environmental measures, mainly in the form:

- the net impact on the environment
- the net impact on the income of the agricultural land users
- the impact on the agricultural supply (and, thus, their prices).

2.4. Impact Assessment Algorithm

The three impact categories mentioned not only reveals some diversity but, also, their potentially contradictory evolution. Thus, for determining the net impact of the agri-environmental measures on the performance of the rural socio-ecological systems when considering, also, its relation with sustainable development, this paper proposes the following aggregation algorithm, exemplified for the "environment" impact field:

I) The choice of parameters for each area of impact: Annual share of the surface with pastures and hay in total area under fodder production; the ratio between the agricultural land expressed in conventional units (equivalent I class) and the one expressed in physical

units; species diversity (no. species at 1000 individuals); the ratio between the maximum concentration and the admissible one of pesticides in water.

II) Determining comparable size: the empirical relationship between the parameter values and the evolution of the environmental quality; marking the parameter values on the horizontal axis in ascending order; marking the size scale of environmental quality and choosing the regression function (Fig. 3).

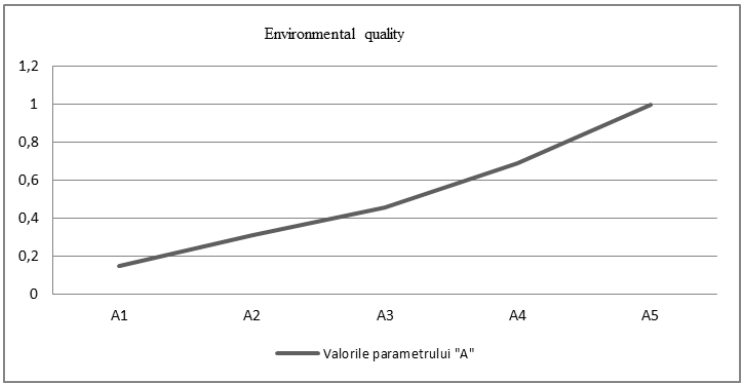

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Fig. 3 Environmental quality

Let the parameter "A" have the following values: $a_1 = 2,\ a_2 = 4,\ a_3 = 6,\ a_4 = 9,\ a_5 = 13$, for which it is determined:

- the value of a quality unit (V_u) ranging between [0,1]

$$V_u = \frac{a_i}{max\ a_i}, \text{ resulting:}$$

$$a_{1c} = 0.15,\ a_{2c} = 0.31,\ a_{3c} = 0.46,\ a_{4c} = 0.69,\ a_{5c} = 1.$$

- the transformation of the quality units in value scale units (U_{VS})

$$U_{VS} = V_u[\max(a)\text{-}\min(a)], \text{ resulting:}$$

$$a_{1s} = 1.7,\ a_{2s} = 3.4,\ a_{3s} = 5.1,\ a_{4s} = 7.7,\ a_{5s} = 11.$$

If after aplying agri-environmental measures the values of the parameter "A" are changing from A_4 to A_2, the imapct (I) would be:

$$I_A = a_{4s} - a_{2s} = 7.7 - 3.4 = 4.3\ \ U_{VS}.$$

III) The parameters weight in according to the importance coefficients. For this, depending on the considered set of parameters, it is established and distributed a number of importance units. The reporting (the comparison) is based on the size relationship established in consultation with a group of specialists. Therefore, if we consider the environmental quality parameters set {A, B, C}, the net impact of the measure 214 (I_{nm}) would be:

$$I_{nm} = I_A * c_i + I_B * c_i + I_C * c_i$$

By making the same calculation for the other two categories of impact, it could be determined the total net impact of Measure 214 on the rural social-ecological system considered in this paper.

Conclusions

1. Effective designing and operationalizing of agri-environmental measures involve reviewing a series of concepts, such as: environment, efficiency, intensification of agricultural production.
2. Agri-environmental measures, as instrument of environmental policy in agriculture, should be integrated into the development policy of the rural socio - ecological systems.
3. Differentiating the application of agri-environmental measures should consider, on one hand, the agro - productive potential of eligible areas and, on the other hand, the importance of these areas in conserving the carrying capacity of the environment.
4. Agri-environmental measure should contribute to applying satisfactory solution regarding the ratio between small, medium and large agricultural holdings.
5. Finally, the ecologic impact assessment of the agri–environmental measure is required, as the premise of improving their design and implementation.

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