WHAT MAKES ENVIRONMENTAL EVALUATION DIFFERENT? FROM CONTROLLING NON-LINEAR VARIABLES TO REACHING THE BUTTERFLY EFFECT

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Abstract
Environmental policies and programmes deal with multiple variables and specificities that transform them into complex systems, needing thorough analyses and tailored evaluation approaches. The maze of causes and effects that individualize environmental policies consequently affect the evaluation process in practice. What are the causes that make the measurement of environmental policies effectiveness difficult? To how many challenges the evaluation practice needs to respond when dealing with environmental programmes?
Neglecting the complexity of environmental field, questioning data availability and accuracy, working under a narrow geographical and temporal policy focus, confronting a deficient level of understanding of the evaluation scope, not having the right instruments to prevent misleading conclusions, represent just a few potential barriers for environmental evaluators that will be analysed in this paper. It becomes very clear that, especially under the role of the evaluation practice given by the post-2020 programming horizon, environmental evaluation needs to adjust its toolkit in order to be able to analyse complex policy systems, to fundament specific and applicable recommendations and, in

the end, to aspire to generate any type of change and improvement in the environmental policy implementation.

Keywords
Adapted evaluation models, environmental evaluation, evaluating complex systems

1. INTRODUCTION

This paper is based on the preliminary results of the PhD research endeavour conducted by the author, designed at the intersection of two fields, environmental policy and evaluation theory, in search of identifying the best methods and instruments necessary to accurately evaluate complex interventions. This paper is aiming to emphasize the key role and impact that the practice of evaluation weighs in formulating and implementing complex policies and programmes as environmental interventions. Based on the analysis of the challenges imposed by the sensitive field of evaluation, the author wants to emphasize the impact that tailored evaluation methods that take into account the specificities of environmental policies may have on field. This paper is written at the intersection of two EU programming periods, when the future of EU policies and priorities are in full negotiation process. Because the evaluation practice tends to have a diminished role in 2021-2027 (based on the analysis carried out by the author of the first drafts of the EU Funds Common Provisions Regulation published in May 2018 by the European Commission), this paper is aiming to raise awareness among the evaluation community for maintaining the positive trend that the last two programming periods meant for the practice and use of evaluation, in particular for complex policies that require adapted evaluation approaches.
The methodological apparatus used by the author is based on desk research of evaluation theoreticians, analyses of public reports on the state of environment, meta-evaluation of environmental programmes with available ex-ante, mid-term

and ex-post reports and applicable in Romania (ex. Sectorial Operational Programme Environment) and analyses of EU Regulations that are defining the role of evaluation for European policies, approved or in full negotiation process.
Evaluation practice owns a high degree of universality, being generally applicable to all decision-making processes, rather than acting as a singular science, equidistant from the contexts and variables of environments where it takes place. Evaluation is critical as recurrent or ad-hoc practice applied to any category or social group, decision-making or executive body of organisations placed at certain moments in the middle of public interventions. As Evert Vedung says, evaluation rests on a very simple idea (Vedung 2010, 264):

"Traditionally, public activities gained acceptance through proper procedures and strong economic investments, combined with beautiful rhetoric seasoned with reference to noble principles, the best of intentions and decent goals. Rarely was the public sector legitimized by reference to achieved results. Yet proponents of evaluation argue this is no longer sufficient. What count are actual achievements."

"The ability to see ourselves as others see us" (Stern 2008, 253), as process of being assisted during decision-making through external feedback, has become an increasing necessity nowadays. The reflexive tools that evaluation is providing are helping policymakers to anticipate obstacles and to deal with situations that they have not foreseen. Citizens, groups and professional organisations face many difficulties in assessing their positions in any field, and evaluation, whether it is institutionalized or not, has the capacity to respond to these needs**.**
On the other hand, environmental policies endorse the idea of joint responsibility for creating a global framework for environmental sustainability. The avalanche of socioeconomic crises, directly or consequentially affecting the environment, has increased the need for anticipation and mitigation of natural and technological events with destructive potential over the past decades.
Evaluating environmental programmes is an indisputably meaningful effort at European level, as a tool for progress monitoring, legitimizing the initiation, continuation or change of the way that strategies are implemented, designed to

participate in the achievement of the common environmental objectives. But the complex field of environmental quality, diversity of species, ecosystem sustainability, ecology, or energy efficiency, is plagued by numerous methodological barriers and uncertainties in practice, such as risks in understanding the relation between causes and the effects that define them or having difficulties in quantifying, measuring, or attributing achieved results.

Despite the evolution of environmental policy as a result of a gradually increasing awareness of the field, development trends of environmental indicators are mixed and interdependent. Although the effectiveness of environmental policy is considerable, the measures applied to address environmental issues are constantly confronting determining factors that cannot be neglected, such as public health or the conservation of biodiversity; this indicates a real difficulty in addressing long-term systemic environmental challenges, complex interactions of environmental variables and their causal relationship, to which modern environmental policies promise to find answers and solutions.

The evolution of global trends does not encourage European environmental policies to develop separately and independently, so that the global economic, demographic and technological progress, ecosystem degradation and climate change are binding aspects to be taken into account for ensuring the flexibility and adaptability of the European policy. The European Environment Agency identifies a series of such global trends, among which we can list: population growth, urbanization of society, technological evolution, economic growth, rebalancing economic poles, global resource development, increased ecosystem pressures, increased global warming, environment pollution and a strong dissonance in global governance. (AEM 2015, 37)

At the same time, there is a growing demand for global food, energy and water security, favouring transnational land acquisitions, especially in developing countries. Europe's food and energy stock depends both on the efficiency of consumption or on the resilience of ecosystems, as well as on the variables of global megatrends that do not depend directly on European action. Environmental policy is the element of continuity through which EU Member

States aim to respond to environmental challenges in the context of multiple variables existing at both European and global level.

The environmental evaluation practice has developed distinct levels of awareness across the world and the breaches that interrupt its uniformity are directly proportional with the different trends in economic development and with the evaluation culture within the implementation of public policies. The complexity of the environmental field makes evaluation processes difficult in any kind of society, no matter the geographical position or readiness to take real action. Evaluating environmental policies and programmes with standardized modelling and methods validated for other fields risk leading to a decreased quality and use of evaluation results.

Because environmental action is wider than the limits of the field itself, affecting public health, socioeconomic development for generations, environmental policies can be associated with the principles of chaos theory or non-linear dynamics that affect complex systems, theorized by Michael Patton. By correlating the theory of non-linear dynamics with the environmental evaluation system, the hypothesis is that better environmental evaluation is able to produce unexpected long-term and irreversible effects at policy level, being able to generate the so-called butterfly effect in what concerns the impact of environmental policies (Patton 2008, 370).

2. THE INTERDEPENDENT VARIABLES AND CHALLENGES FACED BY ENVIRONMENTAL EVALUATION

European environment policy is based on precaution, prevention and rectifying deviance at source, by applying the 'polluter pays' principles and following the strands of sustainable development. Sustainable development strategy is based on the intention of dealing with global environmental problems by means of a solid cooperation designed to achieve a common goal that combines the life quality and the welfare of present and future generations under a three-dimensional approach: environmental protection, economic development and

social justice. The European countries' motivation for these three goals has gradually evolved since The Single European Act (1987), which provided a legal framework for an environmental policy based on sustainability of environmental protection measures, to a stronger commitment and acknowledgement of environmental issues nowadays, developed under common policies, sustainable development strategies, supported by EU environmental legislation and tools designed to help the implementation in Member States.

Even if the European Community has later taken into account environmental priorities, European legislation over the years has played a vital role in improving the overall quality of the environment, by actively supporting the protection of habitats and species, improving air and water quality and designing waste management strategies. The European environmental policy has significantly contributed to reducing pressures on the sector, while the collective action of Member State and partner governments grew a common framework of cooperation through international agreements, legislation, environmental quality standards, public policies, decision-making transparency measures and environmental financing instruments.

The Brundtland Report 'Our common future' raised awareness on the importance of environmental protection and defined sustainable development as the action designed to support the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland 1987, 14).

This is why environmental policies are exceeding the limits of their field, influencing public health, economic development and social responsibility. From economic perspective, a sustainable system must be able to produce goods and services uninterruptedly in order to maintain a controllable level of external debts and to avoid balancing the sectoral extremes that affect industrial and agricultural production. On the other hand, in the light of environmental protectionism, a sustainable system must maintain stable resources while avoiding the over-exploitation of non-renewables. Conservation of biodiversity, atmospheric stability and other ecosystem functions should become a significant point of interest without becoming a source of profit. Also, from a social

perspective, a fair distribution is needed to ensure proportionality of social services (including health and education), gender equality and fairness, political participation and credibility.

One of the main pillars of environmental policy is the promotion of sustainable global development, which involves reconciling environmental protection with economic development and minimizing the costs of reducing environmental damage caused by human consumption. Despite the non-linear dynamics that are under the responsibility of environmental policy, it needs to be unitary integrated in order to be able to deliver comprehensive analyses and quantifiable results. From this perspective, environmental policies and programmes can easily become imprecise and subjectively interpreted.

With all the efforts made during the recent decades within the environment policy, Europe is still facing stringent challenges: economic human activities that emphasize the degradation of natural capital and public health, such as agriculture, fisheries, urban expansion, transport, globalization, economic growth and demography or the inability of national governments to deal with environmental issues.

Evaluation means, above all, a process of understanding how and why a policy or programme works. Understanding an intervention involves analysing the identified needs, the measures involved, the implementation, the short-medium-long-term results of the changes brought to the initially identified needs and how the intervention can be improved in line with social changes. Making these steps for environmental interventions involves expanding the research horizon by placing them in the geographic, temporal and economic context of the country / region of implementation and by being open to understand the set of environmental factors that positively or negatively influence the objectives of the intervention.

Understanding environmental programmes with all their anticipated or unforeseeable aspects in rigid terms may cause unintended negligence of effects that could have been predicted by a multifaceted and thorough analysis; for example, focusing on the achievement of the greenhouse gas reduction target in the implementation of environmental programmes in any beneficiary state, without taking into account national specificities in programme implementation,

the baseline values of emissions, the accuracy level of data or the contribution of other independent factors to the real level of emissions, the risk to distort the evaluation results is very high.
In the following sections, some difficulties and constraints involved by assessing environmental programmes will be analysed. Without claiming to present an exhaustive list of the challenges faced by the evaluation practice for this type of intervention, I will try to include the most prominent challenges that arise in environmental evaluation.

2.1. How ethical is the Cost-Benefit Principle for environmental evaluation?

The practice of assessing environmental interventions is sometimes reduced to the principle of cost-effectiveness, which is not necessarily wrong, but it raises many ethical and methodological issues. For example, the Japanese government has set the dioxins emissions standard starting from a cost-effectiveness analysis based on calculating the cost per life-year saved by reducing the dioxin emissions of municipal solid waste incinerators (Crabb Leroy 2008, 126).
Economists respond to critics by pointing out that environmental programmes involve the use of insufficient resources, and for their assessment it becomes reasonable to compare the value of the benefits of certain programmes with how much has been invested for their appliance. The technical difficulties of such a comparison intervene when the evaluator starts to analyse the implementation and impact of the programme, because he needs to know how the changes have been made and what were their actual and attributed effects. Only after understanding these aspects, the evaluator can assess if the changes have been made in a cost-effective manner, without ignoring potential different scenarios, including the intervention's possibility of non-existence.
Another practice that is commonly used in economic analyses is estimating costs of externalities of investments (ex. the impact on public health) through monetizing human lives. These estimations, despite their pragmatic use, are raising multiple ethical questions among the general public. For example, the Value of Statistical Life (VSL) estimates an individual's life according to the level

of economic development or other factors related to the analysis of the economic profiles of individuals. Other similar indicators are Value of Life Years or Quality-Adjusted Life-Years, varying according to the same criteria.
For example, for economic evaluation carried out in transport and health sectors, the use of VSL and QALY indicators is very commonly used to support cost-benefit analyses (VSL official values from 23 countries gathered for SafetyNet 2009, project funded by the European Commission, QALY thresholds used in comparisons in cost-benefit analyses by official institutions in Sweden Influensan A(H1N1) 2009 project). The conclusions of the analysis carried out by Andreas Nilsson (2014) about the use of monetary value of human life in different sectors, show that beyond the moral difficulty arising in valuating human life, datasets based on these indicators deal with serious difficulties of estimation and use in practice. (Nilsson 2014, 30)

"*It is increasingly common to include estimates of value of statistical life in analyses of proposed policies that affect people's mortality risks. While VSL estimates have often been derived using methods that, for example, compare wage differences between risky and non-risky jobs, such methods may be inappropriate to assess the value of different environmental, health and transport risks affecting the general population.*" (OECD 2019).

2.2 Neglecting the complexity of the environmental field

In order to simplify the understanding and monitoring level of public interventions, policy makers tend to measure them through a variety of quantitative simplified indicators, even in the environmental field. The validity of simplified indicators can only be considered after having a good level of understanding of the field, after formulating an effective and responsive policy and, in particular, after implementation followed by a quantifiable success. Analysing a classic example of environmental intervention, such as a set of measures taken to improve air quality in urban areas, it is easily to observe that the sources are systemically attributed only to several variables such as carbon

dioxide emissions from transports, urban heating systems efficiency or proximity to industrial polluters. The consequence of this approach is the instinctive attribution to certain variables of the analysed theme, without taking into account the full context of causes that contribute to those specific figures (for example, the positioning of the measurement system may favour the data to be analysed and lead to questionable results). Ignoring the complexity of environmental issues creates a system of standardized solutions that neglect alternative causes and effects, that can arise, develop and risk to affect the most vulnerable groups of the society in terms of safety and public health. For example, the conclusions of the mid-term evaluation team of the Romanian Sectorial Operational Programme Environment showed that the attribution of the results obtained by the intervention for several indicators faced certain obstacles, like the need for financial support for further major investments in technical equipment that are measuring the real impact of the actions taken, or the descriptive formulation of indicators that are not linked to data available from measurement systems for air quality. (SOP Environment Mid-term evaluation report 2013, 31)

Analysing environmental problems by using only standardized indicators jeopardizes the legitimacy of the policy outcomes, as well as the full attribution of the results. We cannot measure the efficiency and effectiveness of air pollution mitigation measures only by referring to maximum allowable carbon dioxide emissions over a given time horizon and in a given area, without taking into account all the elements that could affect the analysed area (proximity to alternative sources of pollution, weather conditions, testing of the degree of attribution of field results, analysis of the regional quality of the environment and of the variables existing around the area concerned).

2.3 Data availability and accuracy

Data availability is a general problem faced by all the relevant actors in public policies, especially in the environmental field. At global level and especially at European level, during the last two decades, has developed a constant concern

for all kinds of data collection and reporting, in the purpose of using them as input for a more coherent formulation of public policies. In particular, international environmental organisations cooperate and make systematic efforts to collect and report relevant and useful datasets in order to try to have an accurate radiography of the state of the environment. However, there are still areas where the lack of coherence or validity of data is still a major problem, which directly affects the effectiveness and relevance of environmental policies. For example, according to the report of European Environment Agency on environmental measures, the non-compliance of the Member States obligation to report in individual items of legislation 'may give rise to resentment on the part of Member States, and so far, it has not guaranteed the quality of the information provided.' (EEA 2001, 29)

Apart from the lack of interest for providing data sets on the quality of the environment state in a transparent, easily accessible and responsible manner for all interested citizens, their processing is also affected by the fear of control and punishment that exists in societies where the evaluation culture is weak.

2.4 Level and focus of the analysis

Evaluating environmental policy depends on certain key factors - timing, spatial dimension and level of analysis. Environmental programmes' timeframes are often very broad, in what concerns making the effects visible. The attribution of environmental interventions' results should be considered within a reasonable timeframe and within the socio-political and economic context specific to the analysed period. Also, having the right geographical focus is essential for assessing environmental policies and programmes, because, depending on their specificity, intervention target different territories and are embedded in local, national and regional development strategies. For example, if the accuracy of data pertaining to a specific environmental factor in a certain geographical perimeter is questioned, the assessment of the whole region will be distorted. Evaluation is responsible to find the appropriate methods to match the level of

administrative capacity in the analysed territories, to maintain realistic concluding.
A great example the time gap in measuring the real impact of environmental policies is offered by the decision taken through the Treaty of Vienna (1985) and Montreal Protocol (1987) to protect the ozone layer: even after a 90% reduction has been observed, it will take more than 50 years to register a full recovery of the ozone layer, according to the International Meteorological Organization. (Crabb, Leroy 2008, 58)

2.5 The role of evaluators in influencing environmental policies and programmes

The conclusions of evaluation reports are not every time a part of the decision-making process and integrating them might depend on the agenda of decision-makers. In this respect, both decision-makers and evaluators need to identify a common level of understanding and approaching the evaluation process. The positioning of the two sides should be at the intersection between engagement and detachment, both in the formulation of policy analyses and in the interpretation of the conclusions and recommendations of the evaluation reports. In the recent years, Romania has been subject to infringement procedures applied by the European Commission on the environmental policy for noncompliance with European Directives for recycling, air quality, wildlife habitats and waste management. Evaluation reports for environmental interventions applicable in Romania have launched constant recommendations for harmonising national legislation with the common European regulations, fact that confirms the vulnerable position of the (environmental) evaluation in decision making processes.
Evaluation reports are subject to non-neutral interpretations of stakeholders or of the existing socio-political context and can fail to positively present their results, by submitting arguments that do not fully support the decision that should be considered by the policy makers. And sometimes evaluation organizations secure their legitimacy by acting in full compliance with the

expectations of applicants, in some cases even conflicting with the purpose of the evaluation, developing contradictory relations between the evaluation process and the applicant's overall vision about evaluation. (Kunseler, Vasileiadou 2016, 452).

3. CONCLUSIONS

The field of environment in particular needs to break the barriers between the complexity of the factors that determine its evolution and the target groups to whom the interventions are addressed. An evaluation which is comprehensive and accessible to all the recipients of the assessed intervention can weigh very much in the process of improving the awareness of the policy's importance and real impact.

The use of evaluations' results is a sensitive point of the field and, to be applicable in practice, it is necessary to achieve three critical criteria; Firstly, there must be a general understanding of the evaluation results. Secondly, evaluations must be proceeded in a timely, valid, substantiated manner and elaborated in an understandable form that can be forwarded to decision-makers and to the general public as well. Results and conclusions must also be substantial and based in their development on sound ethical rules. (Uusikyla, Virtanen 2000, 52)

Complex policies need an elaborated set of measures when it comes to any type of assessment. An evaluation model tailored to a complex policy should provide a 360-degree view of the field, taking into account both the optics of the decision-makers and the direct beneficiaries of the projects. Such an evaluation model should take into account all the shortcomings of the research field and be prepared with various tools to prevent distorted conclusions.

Especially in the current European context, Member States need to be involved in the evaluation process in order to learn to strategically use the European resources and to embrace the practice of evaluation at all governance levels. In particular for policies with a high degree of complexity, such as environmental policy, choosing the right models and methods for evaluation is directly

proportional with guiding the real impact of the policies and interventions and equally with the implementation of national, regional or European environmental strategies

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