Using information from Mid Term Evaluations of RDP for the Multicriteria Analysis of Agri-environmental Schemes

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Paper prepared for presentation at the XI[th] congress of the EAAE

(European Association of Agricultural Economists),

'The Future of Rural Europe in the Global Agri-Food System.', Copenhagen, Denmark in: August 23-27, 2005

USING INFORMATION FROM MID TERM EVALUATIONS OF RDP FOR THE MULTICRITERIA ANALYSIS OF AGRI-ENVIRONMENTAL SCHEMES

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Abstract

This paper discusses how environmental indicators and multicriteria methodologies can support the ex post evaluation of Agri-Environmental Schemes. The paper is based on information from the Mid term evaluation of the Rural Development Programmes and develops around an example that compares Ireland and Emilia-Romagna. The results show that the application of Agri-Environmental Schemes only partially achieves to local objectives, and the way in which the Agri-Environmental Schemes are implemented can be reasonably improved. However, the tentative analysis emphasises the scarcity of quantitative data that can be related to effectiveness, the lack of predetermined quantitatively defined target levels of objectives and the difficulty to assess the relative importance of different evaluation criteria. Clearly, the ability to properly evaluate the results depends not only on the amount of information gathered, but also on the formalisation of a clear evaluation framework at the design stage of schemes.

Keywords: Agri-environmental schemes, Mid term evaluation, Multifunctional agriculture, Indicators, Multicriteria analysis.

JEL classification: Q1 – Agriculture; Q18 - Agricultural Policy; Food Policy; Q2 - Renewable Resources and Conservation

1. Background

In spite of the emphasis given to the institutionalisation of evaluation procedures, the Agri-Environmental Schemes (AESs) proposed under regulation 2078/92 and 1257/99 still lack a consistent evaluation framework. At the beginning of the implementation of reg. 1257/99, the EU made the considerable effort to produce a set of common questions for the comparative evaluation of Rural Development Programmes (RDP), including AES, across Europe (European Commission, 2000; 2002a; 2002b). Presently, many countries/regions in Europe have produced their Mid Term Evaluations (MTEs). However, the issue now is how to interpret such information in order to:

- produce a meaningful evaluation of the AES implemented up to now, through within - country and cross - country comparison;
- support the development of future rural development regulations;
- support the definition of future AES evaluation methodologies.

This issue is particularly relevant in view of the forthcoming definition of future rural development regulations (European Commission, 2004).

Research has been active in the field of AES evaluation, by proposing a number of tools and methodologies. However, few of them may help in organising ex post information and are not suitable to be applied to practical issues often characterised by a very partial amount of information.

The objective of this paper is to test the possible contribution of environmental indicators and multicriteria methodologies in supporting the ex post evaluation of AESs. It also intends to use this experience in order to identify possible information and research needs in this field. The paper is based on information drawn from the MTE in response to the common questions set by the European Commission (see annex 1) and develops around an example in which Ireland and Emilia-Romagna are compared. The paper will proceed through the following outline:

- overview of multicriteria methodologies and AESs evaluation problems;
- methodology;
- an example;
- discussion.

2. Overview of indicators and MCA in connection to AES

2.1. Indicators and AESs evaluation problems

Simply put, evaluation is a process that aims to assess performance and thereby identify strengths and correct weaknesses. The ability to assess 'performance' implies some a priori definition of what is a poor, satisfactory, good or excellent performance level. Thus, we consider 'effectiveness' to be a measure of how well the actual performance matches the expected performance level.

These approaches also underpin the evaluation of the environmental effectiveness of AESs. Ideally, an AES will have clearly stated environmental objectives, for which there are specific, measurable environmental targets to be achieved. The aim of monitoring is to collect information on the actual environmental performance, which can then be compared with the original, expected environmental targets. The comparison of collected data with quantitative targets then forms the basis of the objective decision-making that is the purpose of an evaluation. Although monitoring involves the collection of data, evaluation uses the data to interpret the effectiveness of the scheme and make decisions on the basis of evidence. In this way, the evaluation process can:

- identify the extent to which the scheme objectives are being fulfilled, and;
- identify any changes required to bridge the gap between policy aims (environmental targets) and policy outcomes (actual environmental performance).

Thus, the evaluation process can confirm that elements of a scheme are effective and, where necessary, recommend amendments to improve effectiveness. As such, the agri-environmental evaluation is an iterative process that facilitates the flexibility required for continued improvement of agri-environmental schemes.

In practice, several issues complicate an evaluation of environmental effectiveness. For example, schemes may lack clarity about the environmental objectives; it is unclear what are the specific, measurable environmental targets to be achieved. Monitoring of environmental performance may be either absent or inadequate. Given the interdependence among the design of scheme objectives, implementation, monitoring and evaluation, an integrated approach to these three issues at the stage of initial scheme design confers many advantages; in contrast however, many monitoring programs are an 'add-on'.

Any attempt to assess the performance of AESs at a European scale is also complicated by the diversity of agri-environmental objectives across Member States, and even among different regions within a Member State.

2.2 Multicriteria methodologies and AESs evaluation problems

Multicriteria analysis (MCA) includes a number of tools that have in common the feature to evaluate alternatives on the basis of multiple criteria. A number of multicriteria methodologies have been developed over time (Saaty, 1980; 2000; Zeleny, 1982; Roy, 1985; Maystre et al. 1994). A classification and overview may be found in Guitouni and Martel (1997).

The multicriteria approach has been used during the '80s and '90s on a variety of issues, including environmental impact assessment, policy assessment and project evaluation. For its characteristics, multicriteria is particularly suitable to support participatory decision making, as it allows the comparison of alternatives on the basis of the relevant evaluation criteria, their relevance and their effects on the final results.

Generally speaking, multicriteria analysis works through the following steps:

1. setting the problem;
2. identification of alternatives;
3. identification of evaluation criteria;
4. data collection and measurement of evaluation criteria;
5. measurement of "environmental" quality functions;
6. weighting;
7. aggregation and computation of evaluation parameters;
8. sensitivity analysis;
9. data interpretation and analysis.

A theoretical analysis of the application of MCA techniques to agriculture and its relations with environmental issues is presented in Rehman and Romero (1993). A review of such literature is provided by Hayashi (2000).

AESs, and multifunctionality issues in general, appear particularly suitable for the use of multicriteria analysis, as policy performance may be measured through a number of indicators and criteria. The EU has provided a list of criteria and indicators for the evaluation of AESs. Common indicators have been widely discussed and possibly complemented with locally defined criteria. Nevertheless most of them appear insufficient to quantify the real impact, as they are mostly uptake indicators. Also, no real aggregation procedure is devised to achieve an overall picture of the policy performance, allow comparison and estimate trade offs among objectives.

Multicriteria methodologies allow a comparison of AESs and an assessment of their ability to respond to social needs and expectation, possibly confronting different schemes or different environmental factors. The results can support revision of policy design during the policy cycle and can negotiate the implementation of local needs into policy design in a participatory way.

MCA techniques may be used both for ex post or ex ante evaluation of AESs. These two options entail rather different approaches and issues, especially where data requirements are concerned. Ex post evaluation, may imply a number of problems, as long as data are often given and there are no alternative simulated options for comparison. Alternatively, MCA may be used to compare the implementation of policies in different geographical areas in order to understand their relative effects and possibly to identify factors of success in one case compared to the other.

Despite its potential suitability and the fact that current data collection in AES is structured as a grid of indicators (apparently an ideal starting point for an MCA), MCA is still rarely used for practical purposes in the field of AESs. This may be due to the general complexity of the methodologies adopted. In addition, the way an MCA is carried out may imply difficulties. To this end, three key issues are the definition and measurement of evaluation criteria, the choice of the aggregation procedure and the quantification of weights (if required).

3.The methodology

3.1 Overview

The methodology adopted in this paper is based on the use of MCA as a tool for ex post evaluation of the application of AESs, through comparison of policy performance in different study areas. The basic information required is drawn from RDP MTE. The choice to avoid to use additional information (except for weights) has been made purposefully, in order to work as much as possible in the same information conditions of the evaluator/policy maker. In a first step, the information included in the MTE has been translated into effectiveness indicators. Secondly, MCA has been applied to indicators derived from the first step, through weighting and aggregation.

3.2. From MTE information to effectiveness indicators

Despite the definition of a common set of evaluation questions to be answered in the mid-term reviews of the RDPs (see section 2), the approaches towards evaluating the measures of the RDPs vary widely among the member states. The MTE reports differ considerably in the type of information they contain and the level of detail they provide. This adds to the aforementioned difficulties in assessing the comparative effectiveness of agri-environmental schemes among EU member states (see Section 2.1).

Given the limitations of the information compiled in the MTEs, the environmental effectiveness of AESs was estimated by assessing whether the agri-environmental measures in an area achieved the most important medium-level environmental objectives. The medium-level objectives were derived by re-wording the list of criteria as a framework to answer the common evaluation questions (European Commission, 2000). We judged the relevance of these objectives in both Ireland and Emila Romagna.

In general, as discussed in Section 2.1, the effectiveness of a measure[4] depends on a number of factors:

- is the measure capable of achieving the stated objective i.e. is there a causal link between the management practice and the achievement of the environmental objective?
- has the measure been implemented properly by institutions and participating farmers?
- for each measure, what minimum participation rate is required to achieve the named objective (desired participation rate), and how does this compare with the actual participation rate?
- what proportion of participants agree to implement the measure, but do not (compliance)?

A precursory inspection of the MTEs generally revealed an inadequate level of information on many of these points. Most MTEs did, however, quote evidence, or offer an assessment, of the ability of the management prescriptions to achieve stated objectives.

[4] A measure is the prescribed management practice that is expected to achieve the objective. Note that one objective may be achieved through several measures.

MTEs generally gave information on 1) the area actually covered by a measure (the actual participation rate) 2) the area to which the measure is applicable, or 3) participation rates expected by policy makers. For the purposes of this study, either of points 2 or 3 is used to indicate the participation rates required to achieve an objective. (Both these approaches assume that the policy-makers are both correctly affected by the environmental issue to be addressed, and propose appropriate target participation rates.)

In a first step, the 'performance' and the 'actual participation relative to desired participation' of measures are summarised by applying a decision-making framework, which is described in the following paragraphs. At the same time, however, the major gaps of information are identified and strategies (outside the existing MTE reports) to fill them developed.

The decision making process begins with the list of most important objectives for each geographical area. The agri-environmental measures that contribute to achieving each relevant objective are then identified. The evidence quoted in the relevant MTE is used to rate the performance of each measure, or group of measures, as low, medium or high. Although subjective, these decisions are strongly guided by the information and judgement that is stated or implied in the MTE. However, if quantitative information is available, a standard approach is used across countries. A reduction of substance usage due to an agri-environmental measure, for example, is set in relation to the 'normal' usage, and reduced usage of 0% – 10% is rated low, reductions of > 10% – 25% and of > 25% are rated medium and high, respectively.

A similar process is followed when estimating the actual participation relative to desired participation. The actual participation in a measure is rated low when it amounts to 0 – 40% of the desired participation, medium if it comes to > 40% - 70% and high if it reaches > 70% of the desired participation.

The 'performance' and 'participation' ratings are then transposed into numeric values, and the product of the two ratings serves as an approximate estimate of the effectiveness of a measure, or a group of measures, in achieving the stated objective.

3.3. From effectiveness indicators to aggregated ranking parameters

The MCA is applied using the hierarchical aggregation framework illustrated in figure 1.

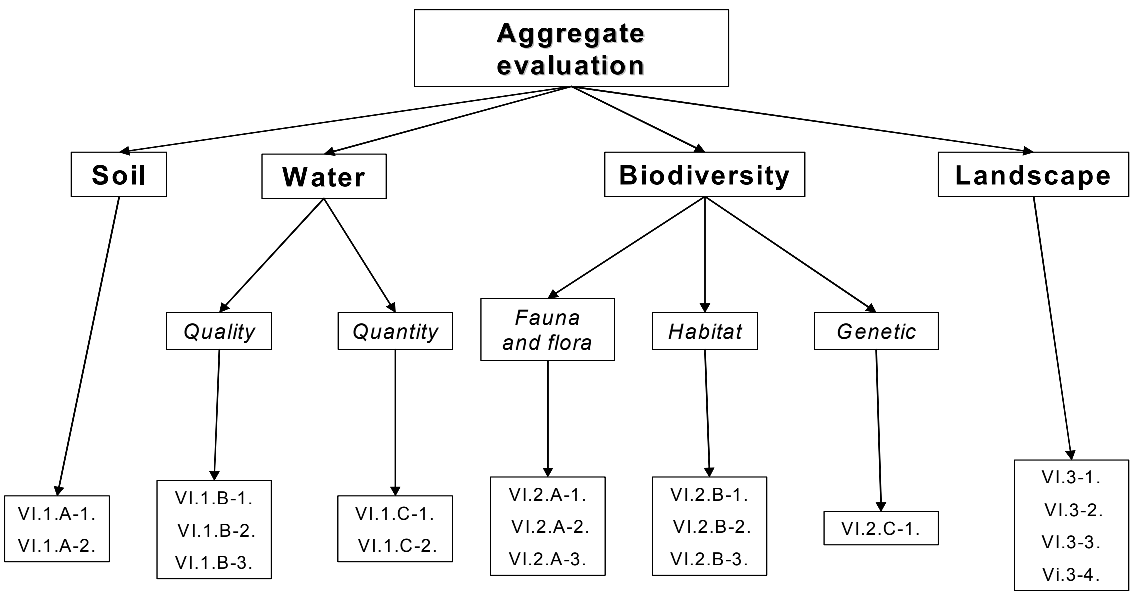

Figure 1. Hierarchical relations between factors and indicators.

All indicators used were available from MTE among the common questions proposed by the EU and quantified in the previous step. Cleaning for possible overlapping may be a relevant issue, but it involves basically only VI.1.B-3, and has been left for future developments. Effectiveness has been taken as the value of environmental quality function without further considering thresholds or other non-linearities.

Aggregation is based on a hierarchical weighted sum, where the score is generally given by:

$$u(a_i) = \sum_{i=1}^{k} v_j a_{ij} \tag{1}$$

where

$u(a_i)$ = utility of the i^{th} alternative (study area/case of application);

v_j = weight of the j^{th} criterion;

a_{ij} = utility value of the i^{th} alternative for the j^{th} criterion.

The main problem with this method is the high level of trade off between the criteria (completely compensatory). An additional problem is the fact that information is not available for all indicators. In a first option, this problem has been solved by re-calculating weights attributing zero to non available indicators and redistributing the weights within available indicators in proportion to the original weight. In a second option, the methodology has been adjusted by using the original weights, as follows:

$$u(a_i) = \sum_{i=1}^{k} v_j a_{ij} \delta_j \tag{2}$$

where:

δ_j = 0 if the indicator is not available, 1 if the indicator is available.

Weights are defined according to an evaluation of the relevance of each indicator given by authors on the basis of information drawn from RDP and MTE. One unusual issue is that weights are different in one case (area) with respect to the other. A weight has been assigned to all indicators considered relevant.

In order to deal more directly with the lack of information on many indicators, the comparison between the two study areas has been further improved using a non-compensatory concordance index for the first stage of aggregation (from effectiveness score to sub factor). The score is based on the comparison across alternatives (areas) for each indicator and attributed using the following rules:

$s_{ii'j} = 1$ if $a_{ij} \geq a_{i'j}$;

$s_{ii'j} = 0{,}5$ if the value of the indicator is missing for i;

$s_{ii'j} =$ effectiveness score/max effectiveness score if the value of the indicator is missing for i';

4.An example

4.1 The case study

An explorative case study is illustrated. The case study compares Ireland and Emilia Romagna (Italy). The choice of the two areas at this stage of the research was mostly determined by data availability. However, the two areas also reflect very different environmental conditions and very different strategies for policy implementation.

4.2 Effectiveness indicators

Effectiveness indicators and related scores for Ireland show average to good results in terms of contribution to environmental improvement and rather good results in terms of participation related to target (table 1).

Table 1. Effectiveness indicators (Ireland).

Indicator	MTE evidence of performance of measures			Actual participation / desired participation			Final Score	
	Description	Qualitative rating	Numeric value	Description	Qualitative rating	Numeric value	Product	Overall
VI.1.A-1	no info							
VI.1.A-2	no info							
VI.1.B-1	24 % reduction of P usage	Medium	4	78%	high	6	24	
	Significant improvement in waste storage	High	6	78%	high	6	36	30
	no info							
VI.1.B-2	no reliable evidence							
VI.1.B-3	no reliable evidence							
VI.1.C-1	no info							
VI.1.C-2	no info							
VI.2.A-1	Little reliable evidence	Medium	4	78%	high	6	24	24
VI.2.A-2	no info							
VI.2.A-3	Little reliable evidence	Low	2	78%	high	6	12	12
VI.2.B-1	Little reliable evidence	Medium	4	78%	high	6	24	24
VI.2.B-2		High	6	78%	high	6	36	36
VI.2.B-3	No info							
VI.2.C-1		High	6	substantial decrease	low	2	12	12
VI.3-1	no info							
VI.3-2	no info							
VI.3-3	no info							
VI.3-4	6 504 features identified, 2 128 new.	High	6	78%	high	6	36	36

The outcome may be to a good extent attributed to a relatively high uniformity of the territory involved and of the measures proposed as well as the relatively simple structure of measures. Also, target levels of objectives were relatively easy found and likely adequate to financial budget.

The case of Emilia Romagna is more complex, due to the higher variety of measures and environmental issues addressed (table 2).

Table 2.Effectiveness indicators (Emilia Romagna).

Indicator	MTE evidence of performance of measures			Actual participation / desired participation			Final Score	
	Description	Qualitative rating	Numeric value	Description	Qualitative rating	Numeric value	Product	Overall
VI.1.A-1	Increase in minimum or no tillage	High	6	58 894 ha,no targets	low	2	12	12
	Increase in cover crops							
	Increase in organic matter of soil							
	Increase of land use with low potential for erosion.	High	6	9 412 ha, no targets	low	2	12	
VI.1.A-2	Reduced usage of plant protection products.	High	6	66 309 ha, no targets	medium	4	24	24
	Reduced usage of chemical and organic fertilisers.							
VI.1.B-1	Reduced usage of chemical fertilisers: 31% average reduction of N usage, 62% average reduction of P usage.	High	6	32492 ha, no targets	low	2	12	12
	Significant reduction in usage of plant protection products.	High						
	Reduced usage of chemical fertiliser: 93% average reduction of N usage, 39% average reduction of P usage.	High	6	26402 ha, no targets	low	2	12	
	Significant reduction in usage of plant protection products.	High						
	Reduced usage of chemical fertilisers.	High	6	7415 ha, no targets	low	2	12	
	Reduced usage of plant protection products.							
	Reduced usage of organic fertiliser.							
	Increased areas of low input crops.							
	Reduced usage of plant protection products.							
VI.1.B-2	Increase of areas with land cover to impede contaminant losses to water.	High	6	8536 ha, no targets	low	2	12	10
	Increase of areas with features to impede contaminant losses to water.	Medium	4	61839 ha, no targets.	low	2	8	
VI.1.B-3	No info							
VI.1.C-1	Increase of areas with reduced irrigation	medium	4	12645 ha, no targets.	low	4	16	13
	Increase of non-irrigated area.	high	5	686 ha, no targets.	low	2	10	
VI.1.C-2	No info							
VI.2.A-1	Reduced usage of plant protection products.	High	6	53303 ha, no targets.	low	2	12	12
	Reduced usage of fertilisers.							
	Avoidance of inputs during critical periods.							
VI.2.A-2	Increase of areas with crop patterns benefiting flora and fauna.	medium	4	53303 ha, no targets.	low	2	8	8
VI.2.A-3	Field work showing benefit of measures for birds.	high	2	28900 ha, no targets.	low	2	4	4
VI.2.B-1	No info							
VI.2.B-2	No info							
VI.2.B-3	No info							
VI.2.C-1	No info							
VI.3-1	No info							
VI.3-2	No info							
VI.3-3	No info							
VI.3-4	No info							

The contribution to environmental improvement may be generally considered as good. However, no clear target was set from the very beginning, which makes it difficult to evaluate ex post.. Target levels have been estimated as the amount of land that could have been potentially addressed by each measure. However, this could be an over estimate of the target, as it could be excessively optimistic with respect to the budget available and the compatibility among objectives. In fact , the results from Emilia Romagna are probably negatively affected by a lower budget with respect to the size of the environmental issues expected to be dealt with.

4.3 Multicriteria analysis

In the first stage, MCA has been carried out by excluding the weights for missing indicators. Results for Ireland are reported in table 3.

Table 3. MCA –Weights omitted for missing indicators (Ireland).

		A) Aggregation by sub-factor				**B) Aggregation by factor**				**C) Overall score**		
Indicator	**Score**	**Weight**	**Weight r corrected**	**Sub-Factor**	**Score**	**Weight r**	**Weight corrected**	**Factor**	**Score**	**Weight**	**Weight corrected**	**Final Score**
VI.1.A-1		1,00	0,00	Soil	0,0	1,00	1,00	Soil	0,0	0,10	0,00	**26,6**
VI.1.A-2		0,00	0,00									
VI.1.B-1	30	0,38	1,00	Water quality	30,0	1,00	1,00	Water	30,0	0,26	0,29	
VI.1.B-2		0,25	0,00									
VI.1.B-3		0,38	0,00									
VI.1.C-1		0,00	0,00	Water quantity	0,0	0,00	0,00					
VI.1.C-2		0,00	0,00									
VI.2.A-1	24	0,43	0,50	Biodiversity (flora and fauna)	18,0	0,35	0,35	Biodiversity	20,4	0,44	0,49	
VI.2.A-2		0,14	0,00									
VI.2.A-3	12	0,43	0,50									
VI.2.B-1	24	0,43	0,50	Biodiversity (habitat)	30,0	0,35	0,35					
VI.2.B-2	36	0,43	0,50									
VI.2.B-3		0,14	0,00									
VI.2.C-1	12	1,00	1,00	Biodiversity (genetic diversity)	12,0	0,30	0,30					
VI.3-1		0,25	0,00	Landscape	36,0	1,00	1,00	Landscape	36,0	0,20	0,22	
VI.3-2		0,00	0,00									
VI.3-3		0,50	0,00									
VI.3-4	36	0,25	1,00									

Ireland showed a lower number of indicators, but a relatively good correspondence between the weights assigned to indicators and the availability of information on that indicator. In the intermediate level, however, the results are better for landscape and water, while a highest weight is attributed to biodiversity, which is the one mostly affecting the final result.

The first relevant issue for Emilia Romagna is the number of potentially relevant indicators that have not been quantified at this stage, with respect to the more distributed relevance (weights) of environmental issues (table 4).

Table 4. MCA – Weights omitted for missing indicators (Emilia Romagna).

Indicator	Score	A) Aggregation by sub-factor				B) Aggregation by factor				C) Overall score		
		Weight	Weight r corrected	Sub-Factor	Score	Weight r	Weight corrected	Factor	Score	Weight	Weight corrected	Final Score
VI.1.A-1	12	0,50	0,50	Soil	18,0	1,00	1,00	Soil	18,0	0,30	0,35	13,1
VI.1.A-2	24	0,50	0,50									
VI.1.B-1	12	0,43	0,75	Water quality	11,5	0,54	0,54	Water	12,2	0,32	0,38	
VI.1.B-2	10	0,14	0,25									
VI.1.B-3		0,43	0,00									
VI.1.C-1	13	0,50	1,00	Water quantity	13,0	0,46	0,46					
VI.1.C-2		0,50	0,00									
VI.2.A-1	12	0,33	0,33	Biodiversity (flora and fauna)	8,0	0,21	1,00	Biodiversity	8,0	0,23	0,27	
VI.2.A-2	8	0,33	0,33									
VI.2.A-3	4	0,33	0,33									
VI.2.B-1		0,20	0,00	Biodiversity (habitat)	0,0	0,36	0,00					
VI.2.B-2		0,40	0,00									
VI.2.B-3		0,40	0,00									
VI.2.C-1		1,00	0,00	Biodiversity (genetic diversity)	0,0	0,43	0,00					
VI.3-1		0,25	0,00	Landscape	0,0	1,00	1,00	Landscape	0,0	0,15	0,00	
VI.3-2		0,25	0,00									
VI.3-3		0,25	0,00									
VI.3-4		0,25	0,00									

The analysis offers the image of a very different policy profile, as Emilia Romagna is more oriented towards soil and water conservation than Ireland. Also, due to the low level of effectiveness attributed to most of the indicators, Emilia Romagna scores a very low result overall.

Taking information deficits into account changes the result significantly. While the overall judgement on the comparison between the two areas does not change, the role of different (groups of) indicators changes significantly. For example biodiversity becomes the best scoring indicator for Ireland, while landscape falls in the last place (table 5).

Table 5. MCA – Weights for missing indicators (Ireland).

Indicator	Score	A) Aggregation by sub-factor			B) Aggregation by factor			C) Overall score	
		Weight	Sub-Factor	Score	Weight	Factor	Score	Weight	Final Score
VI.1.A-1		1,00	Soil	0,0	1,00	Soil	0,0	0,10	12,7
VI.1.A-2		0,00							
VI.1.B-1	30	0,38	Water quality	11,3	1,00	Water	11,3	0,26	
VI.1.B-2		0,25							
VI.1.B-3		0,38							
VI.1.C-1		0,00	Water quantity	0,0	0,00				
VI.1.C-2		0,00							
VI.2.A-1	24	0,43	Biodiversity (flora and fauna)	15,5	0,35	Biodiversity	18,0	0,44	
VI.2.A-2		0,14							
VI.2.A-3	12	0,43							
VI.2.B-1	24	0,43	Biodiversity (habitat)	25,8	0,35				
VI.2.B-2	36	0,43							
VI.2.B-3		0,14							
VI.2.C-1	12	1,00	Biodiversity (genetic diversity)	12,0	0,30				
VI.3-1		0,25	Landscape	9,0	1,00	Landscape	9,0	0,20	
VI.3-2		0,00							
VI.3-3		0,50							
VI.3-4	36	0,25							

The same happens in Emilia Romagna when the result for soil is strengthened with respect to water and biodiversity (table 6).

Table 6. MCA – Weights for missing indicators (Emilia Romagna).

Indicator	Score	A) Aggregation by sub-factor: Weight	Sub-Factor	Score	B) Aggregation by factor: Weight	Factor	Score	C) Overall score: Weight	Final Score
VI.1.A-1	12	0,50	Soil	18,0	1,00	Soil	18,0	0,30	
VI.1.A-2	24	0,50							
VI.1.B-1	12	0,43	Water quality	6,6	0,54	Water	6,5	0,32	
VI.1.B-2	10	0,14							
VI.1.B-3		0,43							
VI.1.C-1	13	0,50	Water quantity	6,5	0,46				
VI.1.C-2		0,50							
VI.2.A-1	12	0,33	Biodiversity (flora and fauna)	8,0	0,21	Biodiversity	1,7	0,23	
VI.2.A-2	8	0,33							
VI.2.A-3	4	0,33							**7,86**
VI.2.B-1		0,20	Biodiversity (habitat)	0,0	0,36				
VI.2.B-2		0,40							
VI.2.B-3		0,40							
VI.2.C-1		1,00	Biodiversity (genetic diversity)	0,0	0,43				
VI.3-1		0,25	Landscape	0,0	1,00	Landscape	0,0	0,15	
VI.3-2		0,25							
VI.3-3		0,25							
VI.3-4		0,25							

When comparing the two study areas, the result appears again rather straightforward, as Ireland is better than Emilia Romagna at all levels of aggregation and for all indicators. However, this is to a good extent the result of the lack of information for many indicators, that would have complemented and possibly changed the results.

Some deeper attempt to understand the possible relevance of additional indicators is given in table 7 and 8, using the concordance index for the first step of aggregation, with some rough estimate of the role of missing indicators in the comparison across study areas.

Table 7. Concordance score for first level indicators.

Indicator	Effectiveness score		Weight in sub-factor		Unweighted comparison scores		Weighted comparison scores	
	IR	**ER**	**IR**	**ER**	**IR.ER**	**ER.IR**	**IR**	**ER**
VI.1.A-1		12	1,00	0,50	0,50	0,33	0,50	0,17
VI.1.A-2		24	0,00	0,50	0,50	0,67	0,00	0,33
VI.1.B-1	30	12	0,38	0,43	1,00	0,00	0,38	0,00
VI.1.B-2		10	0,25	0,14	0,50	0,28	0,12	0,04
VI.1.B-3			0,38	0,43	1,00	1,00	0,38	0,43
VI.1.C-1		13	0,00	0,50	0,50	0,36	0,00	0,18
VI.1.C-2			0,00	0,50	1,00	1,00	0,00	0,50
VI.2.A-1	24	12	0,43	0,33	1,00	0,00	0,43	0,00
VI.2.A-2		8	0,14	0,33	0,50	0,22	0,07	0,07
VI.2.A-3	12	4	0,43	0,33	1,00	0,00	0,43	0,00
VI.2.B-1	24		0,43	0,20	0,67	0,50	0,29	0,10
VI.2.B-2	36		0,43	0,40	1,00	0,50	0,43	0,20
VI.2.B-3			0,14	0,40	1,00	1,00	0,14	0,40
VI.2.C-1	12		1,00	1,00	0,33	0,50	0,33	0,50
VI.3-1			0,25	0,25	1,00	1,00	0,25	0,25
VI.3-2			0,00	0,25	1,00	1,00	0,00	0,25
VI.3-3			0,50	0,25	1,00	1,00	0,50	0,25
VI.3-4	36		0,25	0,25	1,00	0,50	0,25	0,13

IR = Ireland; ER = Emilia-Romagna.

Table 8. Hierarchical weighted sum on concordance scores.

A) Aggregation by sub-Factor					B) Aggregation by factor					C) Overall score	
	Score		Weight			Score		Weight		Score	
Sub-Factor	IR	ER	IR	ER	Factor	IR	ER	IR	ER	IR	ER
Soil	0,5	0,5	1,00	1,00	Soil	0,5	0,5	0,10	0,30	**0,8**	**0,6**
Water quality	0,9	0,5	1,00	0,54	Water	0,9	0,6	0,26	0,32		
Water quantity	0,0	0,7	0,00	0,46							
Biodiversity (flora and fauna)	0,9	0,1	0,35	0,21	Biodiversity	0,7	0,5	0,44	0,23		
Biodiversity (habitat)	0,9	0,7	0,35	0,36							
Biodiversity (genetic diversity)	0,3	0,5	0,30	0,43							
Landscape	1,0	0,9	1,00	1,00	Landscape	1,0	0,9	0,20	0,15		

IR = Ireland; ER = Emilia-Romagna.

In this comparative assessment, while the final scores are not so different, the evaluation of the results across environmental factors within each case change considerably (see for example the increase in relevance of landscape) in both areas. This assessment could be made more interesting if more than one case study was available, with possible differentiated ranking of performance according to different indicators. However this emphasises the need to use (with caution) comparative information, in order to put local performance in a wider perspective.

5. Discussion

The results advise two main themes: the content of AESs results and the evaluation of the methodology adopted here.

The application of AESs only achieved partially local objectives and the way in which the AESs are implemented can be reasonably improved, as far as effectiveness is concerned.

However, the evaluation is strongly affected by the scarcity of quantitative data on actual effectiveness. In addition, these conclusions of the evaluation methods are quite tentative, due to the lack of predetermined quantitatively defined target levels of objectives and the difficulty to assess the relative importance of different (numerous) criteria. Also, the number and variety of indicators makes it sometimes difficult to sum up the results and to come up with consistent reasoning in terms of overall policy performance and trade offs among objectives. Clearly, the ability to properly evaluate the results depends not only on the collection of a large amount of information, but also on the formalisation of a consistent evaluation framework at the design stage of the schemes.

The effectiveness indicators and MCA methodology applied in this paper, however simplified, allow an insight into the difficulties and issues arising in the evaluation process. Many limitations to MCA come from the comments above. How reliable is the information contained in MTEs? Do (or can) the authors check out the quality of the information they are using? This has an impact on the outcome of the MCA because the input information is processed second hand info from MTEs. In addition, what are the limitations of assuming that the policy makers are correct in the targets they set and in the areas of applicability they set for measures?

Nevertheless , the aggregation of multiple criteria and the comparison across regions is perceived as a need by EU policy makers in order to provide overall evaluations of complex schemes, in place of the wide number of indicators used for the institutional evaluation of AESs. However the choice of indicators, the possible intermediate aggregation and the mathematical complexities of the methodology might lead to losing part of the relevant information for policy makers.

Even when final aggregation and scores are achieved, a key issue is the understanding of the contribution of different variables to the overall results. In particular, it is necessary to distinguish between the environmental variables (such as location, territorial features, etc.), the economic context in relation to local production and the institutional factors. While improved evaluation systems increase the ability to understand the results of AESs, the cost/effectiveness of such evaluation systems for policy purposes may also be considered.

Some improvements of the present work are straightforward. First of all, the parameters adopted may be made more robust through the involvement of experts or policy makers. Secondly, in order to develop a full evaluation, effectiveness should be complemented through the relation with the total possible effects admissible in each area. Additionally, some cost-effectiveness evaluation could be carried out, by comparing scores with policy costs.

The evaluation work on present AESs is going on. Hopefully, the final evaluation will provide a more complete and clear set of information to build on. However, given the costs and complexity of such issue, it is likely that there will be the need for methodologies even better suited to deal with limited and unclear information. This may well be taken as stimulating research challenge for the future.

Acknowledgements

TEAGASC wrote sections 2.1, 3.2, 4.2 and elaborated the effectiveness indicators; DEIAGRA wrote sections 2.2 (A. Samoggia), 3.1 and 3.3 (D. Viaggi), 4.1 and 4.3 (F. Bartolini) and carried out the multicriteria analysis. The paper presents intermediate results obtained within the EU project SSPE-CT-2003-502070 “Integrated tools to design and implement Agro Environmental Schemes” (ITAES). It does not necessary reflect the view of the European Union and in no way anticipates the Commission’s future policy in this area.. The authors want to thank the anonymous referees for their useful suggestions.

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Annex 1 – List of common questions

INDICATOR
VI.1.A. To what extent have natural resources been protected in terms of soil quality, as influenced by agri-environmental measures?
VI.1.A-1. Soil erosion has been reduced
VI.1.A-2. Chemical contamination of soils has been prevented or reduced
VI.1.A-3. The protected soil gives raise to further benefits at farm or societal level
VI.1.B. To what extent have natural resources been protected in terms of the quality of ground and surface water, as influenced by agri-environmental measures?
VI.1.B-1. Reduction of agricultural inputs potentially contaminating water
VI.1.B-2. The transport mechanisms (from field surface or root zone to aquifers) for chemicals have been impeded (leaching, run-off, erosion)
VI.1.B-3. Improved quality of surface water and/or groundwater
VI.1.B-4. Water protection gives rise to further benefits at farm or societal level
VI.1.C. To what extent have natural resources been protected (or enhanced) in terms of the quantity of water resources, as influenced by agri-environmental measures?
VI.1.C-1. The utilisation (abstraction) of water for irrigation has been reduced or increase avoided
VI.1.C-2. Water resources protected in terms of quantity
VI.1.C-3. Protected water resources give raise to further benefits (farm or rural level, environment, other economic sectors)
VI.2.A. To what extent has biodiversity (species diversity) been maintained or enhanced thanks to agri-environmental measures through the protection of flora and fauna on farmland?
VI.2.A-1. Reduction of agricultural inputs (or avoided increase) benefiting flora and fauna has been achieved
VI.2.A-2. Crop patterns [types of crops (including associated livestock), crop rotation, cover during critical periods, expanse of fields] benefiting flora and fauna have been maintained or reintroduced
VI.2.A-3. Species in need of protection have been successfully targeted by the supported actions
VI.2.B. To what extent has biodiversity been maintained or enhanced thanks to agri-environmental measures through the conservation of high nature-value farmland habitats, protection or enhancement of environmental infrastructure or the protection of wetland or aquatic habitats adjacent to agricultural land (habitat diversity)
VI.2.B-1. "High nature-value habitats" on farmed land have been conserved
VI.2.B-2. Ecological infrastructure, including field boundaries (hedges…) or non-cultivated patches of farmland with habitat function have been protected or enhanced
VI.2.B-3. Valuable wetland (often uncultivated) or aquatic habitats have been protected from leaching, run-off or sediments originating from adjacent farmland
VI.2.C. To what extent has biodiversity (genetic diversity) been maintained or enhanced thanks to agri-environmental measures through the safeguarding of endangered animal breeds or plant varieties?
VI.2.C-1. Endangered breeds/varieties are conserved
VI.3. To what extent have landscapes been maintained or enhanced by agri-environmental measures?
VI.3-1. The perceptive/cognitive (visual, etc) coherence between the farmland and the natural/biophysical characteristics of the zone has been maintained or enhanced
VI.3-2. The perceptive/cognitive (visual, etc) differentiation (homogeneity/diversity) of farmland has been maintained or enhanced
VI.3-3. The cultural identity of farmland has been maintained or enhanced
VI.3-4. The protection/improvement of landscape structures and functions relating to farmland results in societal benefits/values (amenity values)