Assessing Farm Sustainability with the IDEA Method - from the Concept of Agriculture Sustainability to Case Studies on Farms

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Abstract

The IDEA method (*Indicateurs de Durabilité des Exploitations Agricoles* or Farm Sustainability Indicators) is based on research work conducted since 1998 and is one way of giving practical expression to the concept of sustainable farms. Based on 41 sustainability indicators covering the three dimensions of sustainability, this method is designed as a self-assessment tool not only for farmers but also for policy makers to support sustainable agriculture. The scientific approach is based on identifying three different scales of sustainability. The application of the IDEA method is illustrated using French case studies. Linking the IDEA method with the Farm Accounting Data Network is noted as an interesting possibility to assess the sustainability level of different farming systems. The conclusion is that there is not just one farm sustainability model, and therefore the indicators must be adapted to local farming before using the IDEA method.

Keywords: IDEA; Farm Sustainability Indicators; Sustainable agriculture; Sustainability assessment

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Introduction

The latest reform of the Common Agricultural Policy (CAP) partly expressed the EU's determination to establish sustainable development as one of the guiding principles of European policies by establishing the principle of cross compliance[6] and support for types of agriculture that favour the environment (Article 69 of CAP Regulation N°1782/2003).

The European Commission also supports the elaboration of sustainability indicators in agriculture with a view first to orientate policies towards sustainable farming and second to assess them (European Commission, 2001). Based on Francis *et al.* (1990) our starting point is that sustainable farming is based on three essential functions: producing goods and services, managing the landscape and playing a role in the rural world. These are included in the definition of a sustainable farm given by Landais (1998): *"a farm that is viable, livable, transferable and reproducible."*

The purpose of this paper is to present results of French multi-disciplinary research giving the concept of sustainability practical expression through the elaboration of the **IDEA** method (***I**ndicateurs de **D**urabilité des **E**xploitations **A**gricoles* or Farm Sustainability Indicators*)* (Vilain *et al.*, 2003). This method, designed as a self-assessment framework for farmers, provides operational content for the assessment of agricultural sustainability.

First we present the scientific method used to develop the IDEA method, moving from the concept of agricultural sustainability to a system of indicators on the scale of the farm. Second, the results of various case studies in France using results from different farms are presented and, third, a number of points regarding the construction of the method are discussed. We conclude by discussing options to use of a modified IDEA method in assessing

[6] *Council Regulation (EC) n° 1782/2003 and Commission Regulation n°796/2004*

the sustainability of agriculture on a regional scale with data from the Farm Accounting Network.

General Considerations Underlying the IDEA Method

Defining the main concepts

Indicators are, for the purposes of the **IDEA** method, *"variables that provide information on other variables that are less easily accessible. They also serve as a guide when making a decision"* (Gras *et al.*, 1989).

The IDEA indicators aim to characterise the key concepts taken from the definition of sustainable agriculture (Landais, 1998).

1. *Viability* involves, in economic terms, the efficiency of the production system and securing the sources of income of the farming production system in the face of market swings and uncertainties surrounding direct payments.

2. *Livability* focuses on analysing whether the farming activity provides a decent professional and personal life for the farmers and their families.

3. *The environmental reproducibility* of the ecosystems linked with the farms can be analysed using agri-environmental indicators in particular, which characterise the impacts of farming practices on the environment.

Properties required of the indicators

An indicator must be scientifically sound, relevant to the issue being studied, sensitive, easily accessible and comprehensible (Girardin *et al.*, 1999). In addition, indicators for sustainable development must also be:

- *systemic*: the indicators should cover the economic, environmental and social aspects of agriculture,
- *temporal and spatial*: the indicators should make it possible to monitor sustainability at all relevant temporal and spatial scales,
- *ethical*: the indicators should recognise values such as the need to conserve the natural and human heritage (Vidal and Marquer, 2002).

Stages in the indicator development

The IDEA method was developed in six main stages (Table 1) based on recommendations by Mitchell *et al.* (1995) and Girardin *et al*. (1999).

Table 1 : IDEA method development stages and main features

Stages	Main features of the IDEA method
1. Transcribing the concept of farm sustainability into clear objectives	Conceptual model based on 16 objectives grouped into 3 scales and 10 components
2. Moving from the objectives to indicators measuring achievement	Matrix combining the 16 target objectives with the 41 indicators used to characterise them
3. Setting out initial hypotheses and choices for indicator construction	- It is possible to quantify sustainability with a numerical score given for each indicator. - Maximum scores are set for each indicator in order to set an upper limit on the total number of sustainability units. - The scale score is the cumulative number of basic sustainability units for the different indicators in the scale after weighting and aggregating the individual indicator scores within each component. - The lowest score of the three scales is the final sustainability value.
4. Determining the calculation method rules (with thresholds and choosing standards)	- A points system with an upper limit for each indicator - A final sustainability score for each of the three scales with an equal weight between the 3 scales - A ceiling value of 33 points for each component - Each scale goes from 0 to 100 - The higher the score, the more sustainable the farm.
5. Developing the indicators	A detailed sheet per indicator for the calculation with justifications of choices and explanations
6. Testing the method	More than 1,500 farms already tested in France since 2000 to 2007

The first stage specifies the conceptual hypotheses. The IDEA method is structured around 16 objectives grouped together to form three sustainability scales. Each of these three scales is subdivided into three or four components (making a total of 10 components) which in turn are made up of a total of 41 indicators (Figure 1).

In the second stage, we recommend building a matrix (Figure 1) to check whether all the objectives are represented in a balanced manner by the 41 indicators.

Figure 1: IDEA indicator /objective matrix

				16 objectives															
		Component	Indicator number	Coherence	Biodiversity	Soil preservation	Water preservation	Atmosphere	Food quality	Ethics	Local development	Landscape preservation	Citizenship	Management of non-renewable resources	Human development	Quality of life	Adaptability	Employment	Animal well-being
3 scales, 10 components and 41 indicators	Agro-ecological scale	Diversity	A1	X	X	X						X							
			A2	X	X	X						X							
			A3		X							X							
			A4	X	X														
			A5	X	X														
		Organisation of space	A6	X	X	X						X							
			A7	X	X	X	X					X							
			A8	X		X					X	X		X					
			A9	X	X	X	X					X							X
			A10	X	X							X	X						
			A11	X		X	X									X			
			A12	X	X	X	X		X			X							
		Farming practices	A13	X			X	X	X					X					
			A14				X	X						X		X			
			A15	X	X	X	X	X	X							X			X
			A16						X	X						X			X
			A17		X	X	X							X					
			A18			X	X							X		X			
			A19	X				X						X					
	Socio-territorial scale	Quality of the products and land	B1						X		X		X		X				X
			B2	X						X		X			X	X			
			B3									X	X	X		X			
			B4	X						X		X	X			X			
			B5	X						X	X		X		X				
		Employment and services	B6	X							X								
			B7								X		X						
			B8							X	X		X					X	
			B9								X		X		X	X			
			B10								X					X		X	
		Ethics and human development	B11	X						X				X	X				
			B12	X							X				X	X			
			B13	X												X		X	
			B14												X	X			
			B15													X			
	Economic scale	Economic viability	C1	X							X					X	X		
			C2	X													X		
			C3	X												X	X		
			C4	X													X		
			C5	X							X		X			X	X	X	
		Efficiency	C6	X			X							X					

The principle of coherence is central in the IDEA method. We make a distinction here between technical coherence and coherence in terms of "citizenship". *Technical coherence* refers to a set of farming practices which, working together, amplify each other and produce effects that are greater than the sum of individual effects. For example, coherent cropping plans, rotations and operational sequences make it possible to combine profitability and protection of the environment. *Coherence in terms of citizenship* concerns farmers not only in their function as agronomists and managers but also on the personal level as citizens living and working in relation to other expectations of society. Thus it refers to socio-economic behaviour that enhances sustainable agricultural and rural development.

The Three Scales of the IDEA Method

The agroecological sustainability scale

The agroecological scale (Table 2) consists of three components (diversity of production, organisation of space and farming practices) and 19 indicators. Each of the components has the same weight with 33 or 34 points out of the total score of 100.

The objectives of the agroecological scale refer to the agronomic principles of integrated agriculture (Viaux, 1999). This scale analyses the propensity of the technical system to make efficient use of the environment at the lowest possible ecological cost. The indicators illustrate the capability of farms to be more or less autonomous in their use of non-renewable energy and materials and to generate more or less pollution through their farming activities.

Table 2 – The 19 indicators in the agroecological sustainability scale

3 components	19 indicators	Maximum values for each	
		indicator	component
Diversity	Diversity of annual or temporary crops	13	Maximum total of 33 sustainability units
	Diversity of perennial crops	13	
	Diversity of associated vegetation	5	
	Animal diversity	13	
	Enhancement and conservation of genetic heritage	6	
Organization of space	Cropping patterns	10	Maximum total of 33 sustainability units
	Dimension of fields	6	
	Organic matter management	6	
	Ecological buffer zones	12	
	Measures to protect the natural heritage	4	
	Stocking rate	5	
	Fodder area management	3	
Farming practices	Fertilization	10	Maximum total of 34 sustainability units
	Effluent processing	10	
	Pesticides and veterinary products	10	
	Animal well-being	3	
	Soil resource protection	5	
	Water resource protection	4	
	Energy dependence	8	
	Grand total	**100**	**100**

Diversity of production considers the complementarities and natural regulation processes allowed by farming ecosystems. It is covered by five indicators measuring the diversity of species or crops. However, the conditions are that the diversified production system is designed to make the best possible use of the natural assets of the area and limit any damage to the environment. These aspects are dealt with by the indicators of the organisation of space and farming practices.

The socio-territorial sustainability scale

The socio-territorial scale (table 3) characterises the integration of the farm within its landscape and in society. It seeks to assess the quality of life of the farmer and the weight of the market and non-market services rendered to the landscape and to society. In this respect, it allows us to look into issues that go beyond the farm itself. In practice, this scale combines and weights practices and behaviour that are essentially qualitative (architectural quality of buildings, landscape quality of surroundings). Certain indicators, such as labour intensity or quality of life, are determined on the basis of the farmers' declarations. Some indicators concern the family and not the farm itself in the strictest sense, because experience shows the importance of the family-farm link in the sustainability of agricultural systems.

Table 3 – The 16 indicators in the socio-territorial sustainability scale

3 components	16 indicators	Maximum values for each	
		indicator	**component**
Quality of the products and land	Quality of foodstuffs produced	12	Maximum total of 33 sustainability units
	Enhancement of buildings and landscape heritage	7	
	Processing of non-organic waste	6	
	Accessibility of space	4	
	Social involvement	9	
Organisation of space	Short trade	5	Maximum total of 33 sustainability units
	Services, multi-activities	5	
	Contribution to employment	11	
	Collective work	9	
	Probable farm sustainability	3	
Ethics and human development	Contribution to world food balance	10	Maximum total of 34 sustainability units
	Training	7	
	Labour intensity	7	
	Quality of life	6	
	Isolation	3	
	Reception, hygiene and safety	6	
	Grand total	**100**	**100**

The economic sustainability scale

Economic viability (table 4) is essential for farming systems in the short and medium term, but it must be placed in perspective by three other criteria:

- Economic independence guarantees the medium-term future of the farms by making it possible for production systems to have the capacity to invest and to adapt more easily to reductions in public subsidies;

- Transferability analyses the long-term ability to carry on from one generation to the next. In cases of succession, the amount of capital required to run and take over can end up leading to the farm being broken up;
- Production process efficiency assesses autonomy. It means the capacity of the production systems to make optimum use of their own resources as inputs.

Table 4 – The 6 indicators in the economic sustainability scale

4 components	**6 indicators**	**Maximum values for each**	
		indicator	**component**
Economic viability	Available income per worker compared with the national legal minimum wage	20	30 units
	Economic specialization rate	10	
Independence	Financial autonomy	15	25 units
	Reliance on direct subsidies from CAP and indirect economic impact of milk and sugar quotas	10	
Transferability	Total assets minus lands value by non salaried worker unit	20	20 units
Efficiency	Operating expenses as a proportion of total production value	25	25 units
Total		**100**	

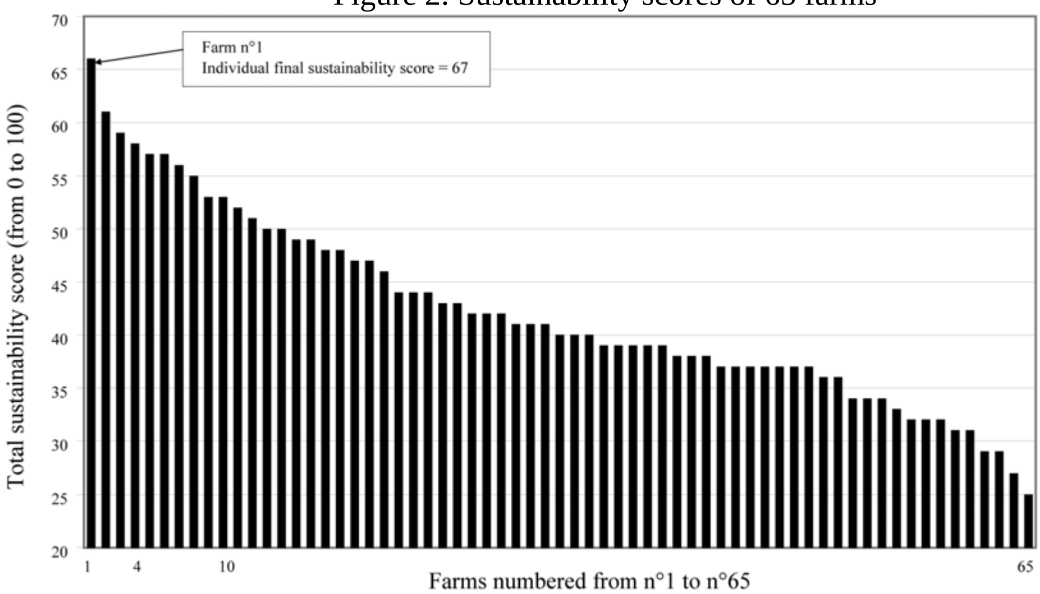
Results of French Case Studies

More than 1,500 farm assessments have been carried out since 1996. Tests have shown that the method can be implemented by a farmer supported by an advisory officer. Moreover, most of the values of the indicators can be calculated during half a day of work once the necessary documents have been compiled.

Here we present results from 65 case studies of French farms, representing various cropping systems surveyed in 3 different arable crop zones (Indre et Loire, Charente Maritime and Loiret regions of France). Of these farms 18 had a livestock unit. The IDEA method revealed highly variable sustainability scores over the population tested as a whole (Figure 2). In this sample, the sustainability scores varied from 25 to 67.

On the basis of these studies (Viaux, 2003) and many others, we have concluded that the IDEA method can be used for comparisons between farms which share the type of production and similar local contexts (soil and climate).

Figure 2: Sustainability scores of 65 farms

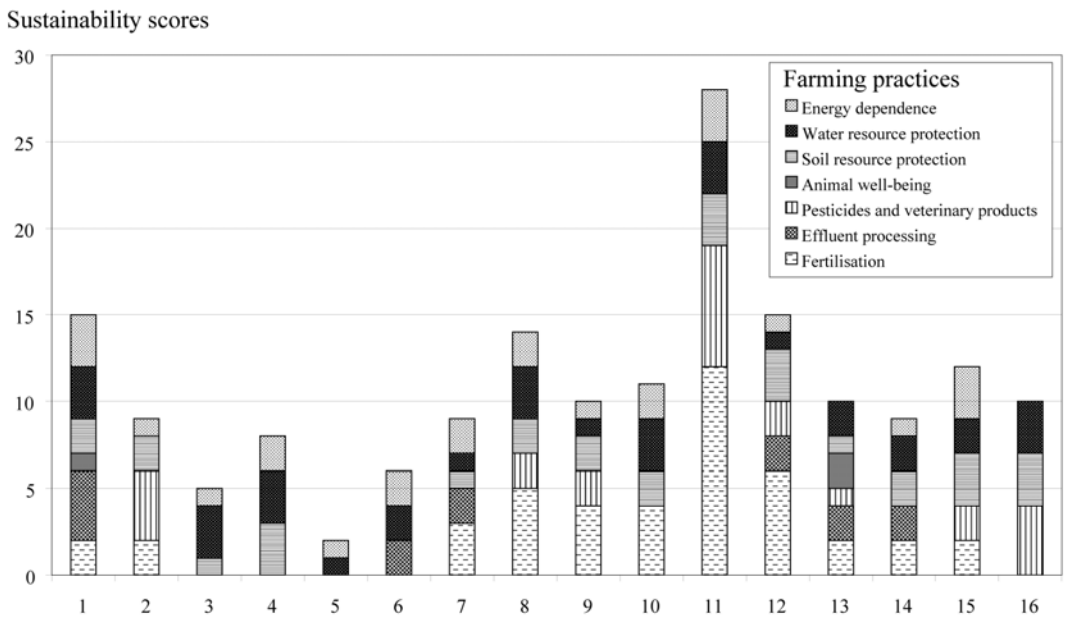


Each farm has its own profile that can be viewed with a radar chart (Figure 3). The IDEA method gives a fairly precise reflection of differences in the situation and management of the farms, and is able to highlight large differences in sustainability between farms in the same small farming region with the same basic production system.

Figure 3: sustainability assessment of 2 farms compared with a group of farmers

The farming practices of the group display considerable variation (see Figure 4). This can appear surprising for farmers who have the same sources of information and work in the same soil and climate conditions. These differences between farming practices make it possible to identify one or several farms that are of interest in terms of sustainability and to get the farmers to discuss their own results among themselves with a view to getting them to work towards greater sustainability.

Figure 4: Variability in farming practices between 16 arable farms within the same small farming region



Discussion

Aggregation of scores

On the basis of the concept of sustainability (Hansen, 1996), we applied the rule of key constraints and used the lowest value of the three scales as the final numerical sustainability value. Using an all-inclusive single score based on a combination of the three scales would have no real meaning as it would allow compensation across the three scales.

Within the three scales we added together the values of the different indicators, despite the fact that this approach implies compensation between criteria. Thus favourable practices will offset practices with a harmful effect on another component. This does have a real meaning within the same scale. For example, low animal diversity can indeed be partially compensated for by greater diversity of annual and permanent crops.

Choice of scoring scales and weighting

Any scoring system requires the construction of a value scale and of interpretations in order to put the scores in context characterising the level of sustainability (Mitchell *et al.,* 1995; Cornelissen *et al.,* 2001; Bockstaller and Girardin, 2003).

In the IDEA method the scales and interpretations were developed by a multidisciplinary group of French experts comprising about thirty people. The result is based on a consensus starting out with the macro-issues (the scales), then moving down to the level of the components and finally to the indicators themselves. The maximum score awarded to each indicator is defined not with the aim of establishing an absolute optimal value, but rather practices, behaviour or levels of results that do not give rise to fundamental problems concerning the notion of sustainability. Once tests had been conducted, the scoring scales were calibrated to achieve the greatest possible discrimination between farms.

Validation of the indicators

An indicator is validated if it is scientifically sound and if it meets the objectives for which it was created. In the first case, it is a question of “design” validation, notably through peer review. In the second case, the indicator is validated if it acquires use value for decision-making (Bockstaller and Girardin, 2003).

Given their multi-criteria character, many of the IDEA indicators cannot be validated by comparing them with field data. However, the values of IDEA indicators have been compared with the values of other indicators. Thus pesticide pollution pressure and the energy dependence indicators were compared with the "I-PHY" indicator (Van der Werf and Zimmer, 1998) and with the results of the more complete energy indicator developed by Pervanchon *et al.* (2002). For other indicators, experts were asked to give their views on the calculated values and scores.

Regarding the economic scale, the small number of indicators is explained by an intentional choice to limit the analysis to indicators expressing primarily the economic conditions necessary for the medium and long-term survival of the farms. The indicator that seems to give the best overall picture of economic sustainability is the production process efficiency indicator, which shows the capacity of the farm to develop its own production autonomy. The ratio between the value of total inputs and the gross production value (excluding subsidies) displays the ability of the production system to generate production value from its own resources without excessive reliance on agrochemical or fodder inputs. This relative autonomy requires the introduction of more sustainable practices for the surrounding environment and guarantees economic sustainability in the long term.

Some of the issues dealt with by the indicators in the socio-territorial scale can only be analysed through qualitative factors. Quantifiable or observable items can nevertheless be combined with qualitative elements, as long as they have a meaning on the territorial scale. In this respect, the proposed self-evaluation approach is a pragmatic way of assessing complex phenomena, and has its place in awareness-raising.

Certain difficulties relating to scoring and weighting were attenuated by conducting tests. These tests also provided an opportunity to check that the method allowed fruitful exchanges with the farmer or between farmers, thus leading to the experimental validation of its use value.

Tests on farms and feedback have shown that the IDEA method indicators have difficulty measuring the agroecological sustainability of specialised farms in horticulture or market gardening. The specific nature of their farming practices is currently not taken into account sufficiently by the indicators of the method.

The socio-territorial scale

Results and user tests show that the 16 indicators do not constitute a final, exhaustive list of the social and territorial dimension of agriculture. There are no IDEA indicators for territorial functions (services rendered to landscape and society) or for the social dimension of farming operations (quality of work, hygiene and safety). The lack of simple and pertinent indicators capable of assessing these complex notions has led us exclude them for the moment. This socio-territorial scale will necessarily evolve over time. There are, for example, questions of a more comprehensive approach to the family as a collective group, the employment created locally by farming activities, hygiene and safety at work and issues of food safety.

Interest of discussion with farmer groups

Different combinations of basic sustainability units t can result in the same score, thus indicating that farms with radically differing patterns or practices can be equally sustainable. Individual monitoring over time is needed to analyse how each producer can progress towards her/his own sustainability.

Prospects for use and research

Today, the IDEA method could usefully contribute to the implementation of the new mandatory advisory system (Article 13 of CAP Regulation n°1872/2003). Many Member States are looking for new practical tools to support this new advisory system. Moreover, Article 69 allows Member States to keep up to 10% of the amount of first pillar aid to support types of agriculture that favour the environment (but are not defined in the Regulation at the moment). The IDEA method could contribute to implementing this new public policy system by characterising the types of agriculture likely to benefit from additional subsidies.

The IDEA method has recently been tested in order to evaluate its ability to assess the level of sustainability of French farming by major production systems and by region. This work is based on the transposition or adaptation of the sustainability indicators in the IDEA method to analyse not the sustainability of individual farms, but the sustainability of the principal French types of farming. It combines the set of indicators of the IDEA method with information from two additional databases, the Farm Accounting Data Network (FADN) and the farming census (Cadilhon et al., 2006). This preliminary work could be extended to other European countries where the FADN exists (all 15 EU countries before the most recent enlargement) by adapting the indicators to country specific conditions.

Conclusion

The IDEA method seeks to give practical content to the notion of sustainability and has been tested for 7 years. The method is capable of observing differences in sustainability between production systems. Indeed, even though certain principles are common to all sustainable farming systems, there is *not just one single farm sustainability model.* The proposed system of indicators does not claim to be final or to establish a model of sustainability that must never be changed.

An extension of the IDEA method to other Member States or types of agriculture could be possible as long as the following points are considered:

- The need to adapt the method to local context and specific agriculture. It would be unrealistic to believe that a single method could cover all different types of production (from the Mediterranean to boreal climates). The indicators will have to be adapted to local contexts while continuing to comply with the key principles regarding their scientific construction;
- The need to add specific points to take better account of the links between the particular issues of a landscape and its farms;
- The need to adapt the method to the specific aspects of the farms in certain new EU member States.

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[7] ARVALIS is a technical institute founded mainly by French farmer, wholly dedicated to applied research on cereals, forage, potatoes and pulses: from cropping techniques to end-uses of products and from choice of species to farming systems