

Framework for a Diagnosis of the Sustainability of Agriculture, from the Plot up to the Regional Level

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Abstract

This paper presents a framework for a diagnosis of the sustainability of agriculture, from the plot up to the regional level. This framework is structured by 4 questions, 3 levels and 2 kinds of viewpoints. The case of a french small region producing field vegetables is analysed. This leads to the idea that to take diversity into accounts is heuristic for the search of sustainable solutions.

Problem and objectives

In 1987 G.H. Brundtland defined the sustainable development as: « ...*Humanity has the ability to make development sustainable - to ensure that it meets the needs of the present without compromising the ability of future generations to meet their needs.* »

In 1991, the FAO pointed it as: « ...environmentally non-degrading, technically appropriate, economically viable and socially acceptable ... ». Agriculture has a great share to take in that development: food security relies on it; it is part of economic activities; it uses land and natural resources.

Operational methods are needed. The first step is to identify in what and for which reasons such or such agriculture is or is not sustainable. Several conceptual approaches have been proposed (see for instance Kruseman, G., et al.'s (1993) analyse). Efforts are made to define components/criteria/indicators in order to account for the different « parts » of sustainability. Others elaborate more global frameworks. In our mind, lists of criteria might be useful, but not at once and not alone. Even if exhaustivity could be achieved, it would not give decision rules. Hierarchies have to be done, according to local contexts, and time. In the problematic cases, the question will be to get closer and closer a sustainable state, step by step. This leads to considerations of time and space scales. The objectives that might be assigned to agriculture are highly linked with these two scales.

Methods: a model for a diagnosis of the sustainability of agriculture

For years we have been developing a methodology to account for agriculture in a region, facing various problems (CAPILLON, A., 1993). We studied many cases in France, in order to perform and apply this methodology. To answer the question « are they sustainable ? », we came to formulate a global framework. The necessary qualities required for a sustainable agriculture are described in 4 points. The diagnosis must then be organised in order to answer **4** questions. Each of them is examined at **3** levels - plot, farm, and region -, according **2** types of viewpoints.

Two types of viewpoints

Farmers are basic actors in the production process; they might have to change their farming practices; they might bear contradictions between production and respect of the environment. We pay therefore a special attention to their position, by distinguishing their viewpoint(s) from the other actors' ones.

The **human society** having viewpoints on agriculture may include para-agricultural sectors, policies and administration, activities directly in competition for space or resources use, general trends of opinions or traditions of the society. The weight of this different parts varies according to cases.

Four questions to be answered

Question 1 : Does the local agriculture fulfil the **objectives** assigned to it by producers on one side, by food industry, by consumers, by states policies concerning food security or markets' shares, on the other side? This leads to carry out analysis of yields - per ha, per farm, per region, (per nation) - and also analysis of the quality of production: respect of norms on the products, quality of service (towards industry or consumers), and quality of life for the farmers.

Question 2 : Is the production process **reproducible**? Do the results and consequences of its running allow it to function again? To answer this requires at least 3 appraisals to be led on the following subjects: conservation of soil fertility and other natural resources needed in the process, (in quantity and quality); labour productivity; financial analysis (farming accounts, cash flow analysis, goods and financing means accounts).

Question 3 : Do the cropping or farming systems have **resilience**, that is to say the ability to adjust to changes of their context, to be flexible? Can a crop be easily replaced by an other one according to soils quality, equipment and labour availability? Can new crops, new technics be integrated? Is it possible to lower operational or structural costs?

Question 4 : Does the agriculture **respect the environment**, either natural resources or other ecological preoccupations - particular biotopes, flora and fauna biodiversity, landscapes - or others human activities existing in the same space or using the same resources?

Three levels

The **plot level** deals with cultivated fields, grasslands, and also with cattle units. The production technics involved are elementary.

At the **farm level** emerges the notion and role of management, and the economic appraisals. Here are described the linkage between family and farm. We also point that the decision rules to locate crops on this or that soil belong to that level.

The **region level** represents a geographical space and a human society, having decision centers and fixed laws regarding land and resources use. At this level, the part of agriculture in activities and various interests can be examined. The dimensions of the relevant regional units vary a lot according to the countries. The analysis of cropping systems location at this level, allows to identify the most sensitive zones, and then to formulate, hierarchy and locate the actions needed to improve the situation (CAPILLON, A., 1992). The linkage between levels have to be precise. A situation might be judged sustainable at one level but not at an other one; the solutions suitable at one level might be forbidden because of the conditions existing at supra or infra level.

Results and discussion: Case study of a small region specialised in the production of sand carrots in Normandie in France. Identification of the non-sustainability causes - study led in 1992 (CAPILLON, A., et al., 1992).

Short description and material

The studied zone lies near the sea. It includes 250 farmers, out of which 180 (70 %) grow carrots using a total of 4 000 ha. The best soils for carrots are sandy soils, located behind dunes. Their water reserve is small. The water table, close to the surface, is over-used for irrigation. Sandy soils cover 35 % of the 4 000 ha. Carrots are sold in the best category under a trade-label. The farmers used to make a good earning out of it, but sell price are going down. The other soils are loams and silty-clay soils, with a deeper water table used for drinkable water. Carrots are grown without irrigation, and sold at lower price in lower categories. We surveyed 46 farms and described farm practises upon 160 plots. We analysed soils, climate and water conditions, as well as the organisation of the agro-food chain concerning carrot production.

Diagnosis at the plot level

In sandy soils, carrot cultivation is now highly concentrated, intensive and mechanised. The frequency in time on the same plot is very high: one crop each two years, or two crops in three years. Leek is cultivated in between. Nematodes rates became so high that without treatment carrot is impossible to grow. The weak point is the nematicide available: its remanence puts its use into debate. In the lack of any efficient and non-remanent molecule, this product is temporarily authorised. Each year the question of its forbidding rises again. A « soft » solution would be to lower the carrot frequency up to one crop each 5 or 6 years. But then, two problems arise, visible at the two other levels. On an other hand, the over-use of water dries up certain drills when others become salty, causing major problems for cultivation in certain areas. In the other soils, rotations are long, with carrot each 6 years; nematodes are

rare, treatment is not necessary and not applied. For this category of carrot, the cropping systems are sustainable.

Diagnosis at the farm level

Farming systems are highly specialised: 3 types gather 72 % of the 180 producers. All of them grow carrot on **two/third** of their area, and leek on the last third. Structures are small (mainly 5-10 ha or 10-20 ha). Carrot production being highly mechanised, most of farms have no salaried labour or only on a casual basis. Leek requires more labour; the family workforce limits its extension. These systems use **82 %** of the **sandy soils**, 40 % of the loams and only 13 % of the heavy clay soils. Their flexibility is weak. The issue is to find alternative crops, having the same high level of profitability (because structures are very small), highly mechanised, and growing in sandy soils, preferably without irrigation. The challenge is severe. It requires a strong organisation at the regional level.

Five other systems types combine dairy farming and carrot cropping. Even considered as important, carrot is not the main production for them. They use 87 % of clay soils, 60 % of loams and 18 % of sandy soils. Fodder crops enter in rotation with carrot, except in sandy soils. Farmhouses and stables are inland, rather far from sandy soils. These farm types have good basis for sustainability: milk quotas give them security; carrot plays a second and not prime role; the most part of their cropping systems (outside sandy soils) are sustainable. However, they do not represent a solution for the sandy area problems.

Diagnosis at the regional level

Sandy soils are overloaded with carrot. To lower carrot frequency means here to lower the whole production, and then loose market's shares. The specialised farmers produce the most part of it and are numerous. For economical and social reasons the region cannot have them fail. Under the European demands, the trade-labels definition becomes more and more strict. This reflects the increasing requirements of the human society regarding the quality of products as well as modes of production. Cropping and farming systems are concerned, with expectations such as less chemical residues in food, higher quality standards in food industry, less pollution, more preservation of resources and biodiversity, better animal welfare.

Facing an increasing competition coming from France and other countries, sand carrot growers will have to « clean » their practices, especially pesticides and water use. As we saw it, this means at short/mean term a diversification of the production, for 72 % of the farmers. It needs a strong collective and co-ordinated effort between producers, co-operatives, wholesalers, extension services and technical institutes to find and develop suitable productions.

Conclusions

This rapid review on one case illustrated the interest to formulate a framework for a diagnosis of sustainability as we did it. The national level could fruitfully be analysed, but it was out of our subject.

Diversity is our last but not least point to discuss here. In France as well as in many countries, diversity exists at all levels: practises, farm structures, cropping and animal breeding systems, farming systems, regions. It is very important to describe diversity, to account for it and to take it into accounts. We believe that innovations also come from farmers. Loss is great when data are improperly reduced to their means. The analysis of the diversity of cropping and farming systems is heuristic for the elaboration of sustainable solutions.

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