

## Adapting a European Sustainability Model to a local context in semi-arid areas of Lebanon

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**Abstract:** *There is a need to transcribe the concept of agricultural sustainability in small farms into a conceptual model based on clearly identified sustainability objectives for easy assessment. For this purpose, a French agriculture sustainability assessment model (IDEA) was modified to fit the Lebanese agriculture context. IDEA is structured around several objectives grouped together to form three sustainability scales: agro-ecological, socio-territorial and economic scale which in turn are translated into measurable indicators. Based on this model, various components of a farming system are assigned by numerical scores that are then weighted and aggregated to give the farm a score for each of the three scales of sustainability. To fit the Lebanese model, indicators related to the average farm size, conservation of genetic heritage, organic matter management, fertilization, contribution to employment, available income per worker in relation to natural legal minimum wage and operating capital had to be modified. The modified model was initially tested on three farms and then a full survey was carried out for one year over 34 farmers. The modified IDEA model proved to be a useful assessment tool to guide farmers and development agents in assessing agriculture sustainability of small farms in semi arid areas. It showed high sensitivity within the Lebanese context unveiling differences between and within farming systems and identifying levels of intervention to improve sustainability.*

**Keywords:** *Agricultural sustainability, assessment, IDEA model, Lebanon*

### Introduction

The consequences of population increase, globalization, and environmental degradation in the past two decades affected agriculture and raised concern about the sustainability of agricultural systems (Salvatore, 2004). In Lebanon, agriculture, once a prominent activity, now contributes to less than 10% to the gross national product. Over the past 50 years, the Lebanese agricultural sector has witnessed a major shift from a low-input, extensive farming system aimed at staples and some fruit production to an intensive, land-limited and horticulture-based system limited by major structural and environmental constraints. A significant effort is required to improve agricultural sustainability in Lebanon (Hamadeh et al., 2007). A variety of methods have been proposed for the evaluation of the environmental impacts of farms as sustainability measurement (Von Wiren-Lehr, 2001; Halberg *et al.*, 2005; Pacini *et al.*, 2002). One model is the French IDEA (Indicateur de durabilité des exploitations agricoles) sustainability assessment model that was developed by a joint working group between the Directorate General for Teaching and Research (DGER) in the French Ministry of Agriculture and Fisheries and the "Bergerie Nationale" (National Sheep Husbandry Centre) in Rambouillet (Zham *et al.*, 2004). The paper describes the application of the IDEA model to assess the sustainability of the Lebanese farms in the semi arid Bekaa region.

## Materials and methods

### Sustainability Assessment Model: IDEA

In order to determine the sustainability of the agricultural systems in the Bekaa plain, the IDEA model was used following minor modifications in indicators. IDEA is structured around 16 objectives (Table 1) grouped together to form three sustainability scales: agro-ecological, socio-territorial, and economic scale. Each of these three scales is subdivided into three or four components (making a total of 10 components): diversity, organization of space, farming practices, quality of the products and land, employment and services, ethics and human developments, economic viability, independence, transferability and efficiency. The components are in turn made up of a total 41 indicators. A single objective can contribute to the improvement of several components of sustainability and indicators are intended to translate these objectives into measurable criteria.

**Table 1:** The sixteen objectives of the IDEA model.

Consistency	Local development
Careful management of non-renewable natural resources	Quality of life
Preservation and management of biodiversity	Product quality
Soils preservation	Adaptability
Preservation and management of water	Ethics
Citizenship or socially aware practices	Employment
Atmosphere preservation	Landscapes preservation
Human development	Animal well-being

Based on the IDEA model, various components of a farming system are assigned by numerical scores that are then weighted and aggregated to give the farm a score for each of the three scales of sustainability (Zahm *et al.* 2006). The calculation method is based on a point system with an upper limit. The three sustainability scales are of equal weight and range from 0 to 100 points. All farm information is translated into sustainability units thus determining the score allocated to each indicator.

For each of the three sustainability scales the score consists of the cumulative number of basic sustainability units (or points) awarded to the different indicators in that scale in question and the higher the score, the more sustainable the farm is considered on that particular scale. Each component has a ceiling value (generally 33 points) thus allowing for a large number of possible combinations leading to the same degree of sustainability. When it comes to the global score aggregating the 3 scales, according to Vilain *et al.* (2003), the lowest value of the three scales is considered as the final farm sustainability score.

The sensitivity of the IDEA method is such that it can detect differences in sustainability between production systems as well as within the same production system. This sensitivity endows the method with the ability to reveal differences between farms either on the level of the three scales or their components, or for a particular indicator (Zahm *et al.* 2006).

### Adaptation of IDEA Indicators to the Lebanese Context

The original model was designed to assess French farms where the average size is 42 ha, and therefore, it was modified in order to fit the Lebanese context, where the average farm size is 1.27 ha (MOA/LEDO, 2001) and where 75% of farmers cultivated less than one hectare and (MOA 2007). Accordingly, seven indicators, related to farm size or surface reliance and agricultural income in addition to certain agricultural practices, were modified, as follows:

- In the agro-ecological scale: Enhancement and conservation of genetic heritage, Dimensions of field, Organic matter management and Fertilization
- In the socio-territorial scale: Contribution to employment
- In the economic scale: Available income in relation to national legal minimum wage and Economic transferability.

These indicators were initially tested on 6 farms and used in this study to assess the sustainability of selected organic and conventional farms in the Bekaa valley.

### Data collection

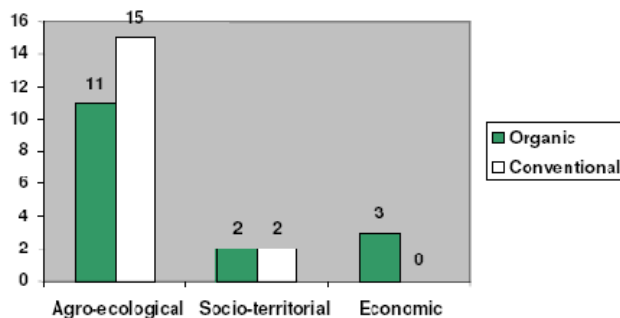
Data for the assessment was gathered through a field questionnaire that was devised to include parameters of the assessment method and related questions. Thirty four farms were selected, of which 17 were certified organic farms. The remaining 17 farms were conventional and were chosen based on key criteria, namely: proximity to selected organic farms and similarity in size of useful agriculture surface (UAS) and in cultures. The data collected through the questionnaire and the modifications made to the model were initially tested for this mission on three farms.

## Results and Discussion

### Applicability of the IDEA model to the Lebanese Context

#### *System variation*

The IDEA model was able to differentiate dimension score contributing to sustainability. The limiting contributor in both systems (organic and conventional) was the agro-ecological one (Fig.1) with 76% of the studied farms having a deficit in such dimension.



**Figure1.** Limiting sustainability values contributors to the sustainability scores for organic and conventional farms.

#### *Components variation*

Variation between sustainability components were also dissected by the IDEA model showing differences within and across production systems. As shown in Fig.2, all the components of agro-ecological (diversity, farming practices and organization of space) and socio-territorial (quality of land and products, employment and services, and ethics and human development) scales contributed to the better sustainability of the organic system versus the conventional one. No significant difference was revealed under the economic scales (economic viability, independence, transferability, efficiency).

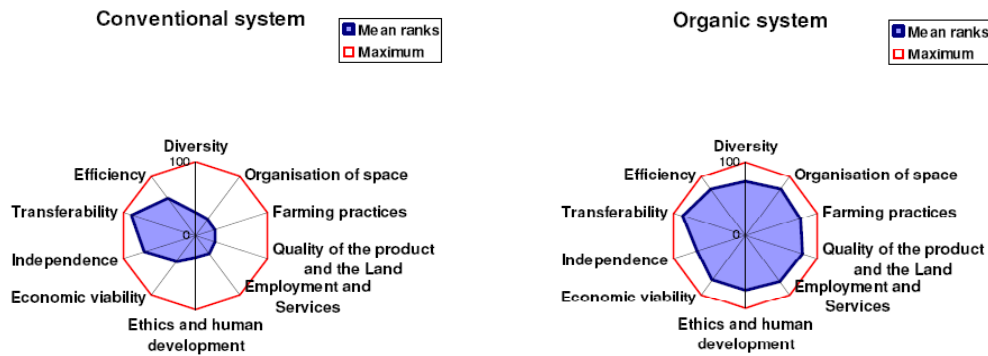


Figure 2. Mean ranks polygons of the studied components for the 17 tested farms under organic and conventional systems.

*Production system*

The modified IDEA model revealed high variability in sustainability scores within a production system in agreement with Viaux (2003) who recorded the sensitivity of the IDEA model in a whole population of tested farms.

When comparing farms that scored the highest and lowest sustainability score, IDEA enabled us to identify the major differences or activities that contributed to the variation of sustainability such as crop and animal diversity, energy and fertilizer dependence and others.

*Sustainability dimensions*

The IDEA model exposed differences on the level of studied scales. Figure 3 represents the three sustainability dimensions of two studied organic farms. As can be seen, the sustainability scores can differ greatly according to the scale: in the first farm, the economic factor is the limiting one, while in the second farm it is the agro-ecological dimension. This comes in agreement to the findings of Zahm et al. (2006) about the practical difference between farms regarding studied dimensions.

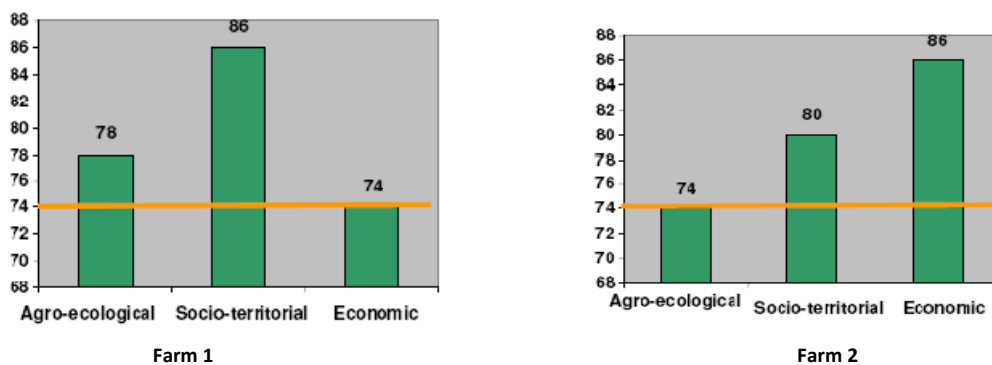


Figure 3. Sustainability dimensions (Agro-ecological, Socio-territorial, and economic) of 2 different organic farms.

*Sustainability components*

It was shown that in some farms having the same sustainability scores related to the same dimension, the IDEA model revealed a sufficient sensitivity regarding the components of that dimension. This was also noted by Viaux (2003) reporting that no two farms resemble each others in the IDEA model.

**Farmers Self Assessment**

The modified model proved to be user-friendly for farmers as a yearly self assessment process. As a start, the farmers needed to be trained on the significance of each sustainability indicator and its

calculation methods. In addition, regular recording of practices was essential for indicators accuracy and especially the economic ones.

## Conclusion

The modified IDEA model proved to be a useful assessment tool to guide farmers and development agents in assessing agriculture sustainability of small farms in semi arid areas. It showed high sensitivity within the Lebanese context unveiling differences at the farm level between and within farming systems and identifying levels of intervention to improve sustainability. The model provided a simple but complete diagnosis that can serve as a decision support tool towards improving the sustainability of agricultural production systems in Lebanon.

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