Assessing farm sustainability.
An application with the Italian FADN sample.

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Summary

As policy makers, taxpayers and consumers are willing to know the actual contribution of farming to natural and social environment, sustainability and sustainable development arose as key issues in public debates. Sustainability is a multifaceted concept that includes environmental, economic and social objectives and policy makers need information to take effective decisions. Analysts should rank decisional units according to sustainability criteria and should offer to policy makers more and more insights on the different points of view behind the three dimensions of sustainability. Within the current FADN database sustainability indicators have been identified. In some cases estimations have been necessary and in some other cases thanks to allocation of costs (crop protection and fertilizers), to the registration of physical information (quantities of fertilizers) and to other details assembled with the Italian methodology (irrigation system, socio-demographic information) indicators have been directly derived. Starting from a multi-criteria matrix a Sustainability Farm Index (SuFI) has been calculated at farm level. The methodology has been applied to the regional FADN sample of Veneto of 2009. The current FADN database has demonstrated to be a valuable source of information to monitor the environmental and social farm assets, beside the economic one. However, additional informative modules seem necessary to integrate the current set of information in order to describe comprehensively the environmental and social aspects of agricultural holdings in the context of the assessment of sustainable development.

Keywords: Sustainability farm index, FADN, multi-criteria approach

JEL Classification codes: Q51, Q56

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1. INTRODUCTION

In the last two decades there has been an increasing interest to evaluate the farm management not only with the traditional socio-economic parameters (profit maximisation and related income indicators), but also from the environmental point of view. Policy makers, taxpayers and consumers are willing to know the actual contribution of farming to natural and social environment. The first two categories of stakeholders are interested to know to what extent environmental objectives are integrated into public intervention and to what extent agricultural activities have an active role in rural areas. Also consumers are more and more sensitive to food health and environmental protection issues and they show an increasing concern for the impacts of the most damaging farming practices. Sustainability and sustainable development arose as key issues in public debates, although a comprehensive awareness of the different dimensions and trade-offs behind these concepts has not fully reached, yet.

The concept of sustainable development was developed from the increasing knowledge about the complex interactions that exist between human activities and the natural, human and man-made environment. Among several alternative interpretations, the statement contained in the Bruntland Report of United Nation - "sustainable development means meeting the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987) - remains a milestone of the conceptualisation process. This concept has also been transferred to the primary sector and "sustainable agriculture" has become a priority in the policy arena. As stated in many documents, the long-term challenge facing agriculture is to produce sufficient food and industrial crops efficiently, profitably and safely, to meet a growing world demand without degrading natural resources and the environment (OECD, 1995).

Sustainability is a multifaceted concept that includes environmental, economic and social objectives and on this base, policy makers should be able to take decisions according to some criteria of sustainability. In particular analysts should rank decisional units according to sustainability criteria and should offer to policy makers more and more insights on the different points of view behind the three dimensions of sustainability. The strong political demand for comprehensive assessments has to be confronted with the challenges of establishing clear and scientifically-based criteria of sustainability. This is a difficult task, due to the fact that the concept of sustainability is a "social construction" where the reference points linked to ranking criteria are not easy to derive from social preferences.

Due to the close interdependence between agricultural activity and natural capital, the environmental dimension of sustainability is one of the crucial issues in the Common Agricultural Policy (CAP) reform. Increasing conflicts are arising between the economic and social objectives that have substantially characterized the past and current public intervention in the agricultural sector and the relatively new environmental dimension. The creation of an information system to monitor the evolution of farming systems under an environmental perspective is one of the first steps toward a more comprehensive analysis.

Indicators represent one of the most appropriate tools to tackle this task. As stated by the European Commission, "indicators provide the basis for assessing progress towards the long-term objective of sustainable development" (CEC, 2000). Indicators are effective and ready-to-use support tools to decision-makers. There are examples of complex systems of environmental indicators developed by the European Commission for monitoring and assessing the farming systems (EEA, 2005) and also the policy implementation process (e.g. the Common Monitoring and Evaluation Framework for monitoring and evaluation of Rural Development Programmes 2007-2013).

The identification of trade-offs between the three dimensions of agricultural sustainability (competitiveness, nature protection, territorial cohesion) seems to have reached a common ground to establish effective priorities in the recent debate about "green growth". A green-growth strategy is proposed by OECD (2012) in order to ensure that enough food is provided, efficiently and sustainably, for a growing population. The role of the environmental dimension is crucial because of the need to increase output while managing scarce natural resources; to reduce the carbon intensity and adverse environmental impacts throughout the food chain; to enhance the provision of environmental services such as carbon sequestration, flood and drought control; and to conserve biodiversity. The transfer of these macro-objectives to the farm scale is one of the most challenging tasks and also one of the powerful tools to offer scientifically sound information to policy makers.

This study aims to assess the sustainability at farm level through the calculation of a composite index, using as much as possible the current Farm Accountancy Data Network (FADN) database as main source of information. FADN is the current more informative database on structural, socio-economic and management information of the farming sector. The Sustainable Farm Index (SuFI), realised as an aggregation of data from a set of environmental, economic and social indicators, allows to rank the farms in order to evaluate their potential role in the context of green-growth strategies.

1.1. A SHORT LITERATURE REVIEW

The majority of sustainability studies has been made at national or regional scale, developing analytical frameworks that comprise sets of indicators ready for intra-region and national comparisons. Katona *et al.* (2005) examine farm inputs on the basis of OECD and Eurostat data, structuring the DPSIR model, according to agri-environmental indicators of IRENA project. Sydorovych and Wossink, (2008) propose a conjoint analysis to identify economic, social, and ecological issue promoting an aggregate sustainability assessment, based on relative impact on the overall sustainability measure. The authors demonstrate how conjoint analysis could be used as a standardized tool for sustainability assessment and comparison of stakeholder perceptions on sustainability itself. Trisorio (2004) assesses the development of Italian agriculture towards sustainability suggesting a set of agri-environmental indicators taking into account social, economic and environmental dimensions of sustainability. The author proposes a possible solution to the problem of aggregation with a synthetic representation of the sustainability in agriculture. Halberg et al (2005) compare in-depth ten input-output accounting selected systems with a focus on the differences and usefulness of indicators, especially on energy, nutrient and pesticide use. The authors define some important recommendations for the use of input-output accounting systems based on indicators, suggesting that the indicators should be selected based on explicit and precise environmental objectives and with realistic demands for data and calculation efforts. Priority should been given to quantitative indicators that may show changes on a farm over time and are relatively easy to calculate, audit and understand. In particular in the indicators use system, often the expert or advisor has a responsibility to interpret the indicator values in relation to reference values. For this reason it is very important to develop well-documented reference material for benchmarking on the individual farm. Very interesting is the work of Bohringer and Jochem (2007) that review the explanatory power of various sustainability indices applied in policy practice. More precisely they provide a survey on eleven operative indices used in policy prospective to measure national sustainable development. They highlight several weaknesses in the index formation, normalization, weighting, and aggregation, which in general are associated with subjective judgments, revealing a high degree of arbitrariness. Bockstaller et al (2008) present different types of indicators developed during the last decade and review the progress of the methods used for their development. In particular they present a typology of environmental indicators and discuss their advantages and limitations. The authors show that in many cases only few data are available, especially at regional or higher levels, and due to the low quality of prediction the indicators generally has to be combined in order to improve their accuracy.

Some studies have tried to downscale the analysis at farm level, considering as a scale more appropriate di evaluate economic and ecological interrelations. Giardin *et al.* (2000) develop an evaluation method, called AGRO*ECO, to evaluate the potential impacts of arable farming systems on the environment. They apply the multi-criteria methods to generate agro-ecological indicators (AEI), developing tools that could help decision-makers to make rational decisions concerning environmental criteria. Among them, the work of Pacini *et al.* (2003) is relevant because they developed an environmental accounting method based on site-specific environmental indicators and environmental externalities generated by farming cycles were measured at farm level. Considering the studies using FADN database, Andersen *et al.* (2007) developed a set of farm management indicators using information on the intensity of farming at EU level member States (EU-15). They considered bi-dimensional farming typology based on land use and intensity in order to evaluate the environmental performance of farms. Another contribution comes from Van Passel *et al.* (2007), that implemented an empirical model to measure farm sustainability using FADN dataset of a group of dairy farms in Flanders during the period 1995-2001. The authors applied the concept developed in Figge and Hahn (2004), of "sustainable value added" to measure the sustainable efficiency in Flemish dairy farms system. The sustainable value added approach is inspired by the "strong" sustainability principle, and measures whether a farm creates extra-value while ensuring that every environmental and social impact is in total constant (Figge and Hahn, 2004). Van Passel *et al.* (2007) found that farms with a high sustainable efficiency also have a high productivity, suggesting that the sustainable efficiency indicator can be a useful indicator to incorporate economic and environmental aspects. Another interesting approach is presented by Reig-Martínez *et al.* (2011), which built up a composite indicator at farm level to assess social, economic, environmental issues. The approach followed combines Data Envelopment Analysis and Multi-Criteria Decision Making methods. A practical methodology for evaluating the sustainability of farms by means of composite indicators has been proposed by Gómez-Limón and Sanchez-Fernandez (2010), showing the advantages and disadvantages of the various methods used to construct composite sustainability indicators and emphasising farm heterogeneity within a single agricultural system with respect to sustainability as well as to analyse the structural and decision-oriented variables that influence it.

Recently, many efforts have been made to define a scale of reference to assess sustainability. In response to the need for monitoring and assessing sustainability at farm level, a common methodology for assessing the environmental impact of European Agri-Environment Schemes (AES) was developed. The so called Agri-Environmental Footprint Index (AFI) is a farm-level, customizable index that aggregates measurements of agri-environmental indicators. This index has several advantages as it is based on common framework for the design and evaluation of policy that can be customized to locally relevant agri-environmental issues and circumstances. The AFI structure is flexible, and can respond to diverse local needs. Its processing is interactive, and entails the engagement of farmers and other relevant stakeholders in a transparent decision-making process that can ensure acceptance of the outcome (Purvis *et al*., 2009). The AFI algorithm implies a step-wise process that incorporates multi-criteria analysis (Mortimer *et al.*, 2008). Preferably, AFI values are calculated for each farm in a representative sample of a category of farms; thus, the approach enables tracking of temporal changes and/or comparisons between groups of farms that participate in an AES and those that do not. Another study, comes from Westbury *et al.* (2011), applies the AFI methodology in combination with data collected in the Farm Business Survey (the FADN survey in England). They tested whether the AFI methodology could be extended for the routine surveillance of environmental performance of farming systems using established data sources. They indeed demonstrated that the methodology can be potentially widely applied to similar data sources across the EU-27.

2. METHODOLOGY

The Sustainable Farm Index (SuFI) has been developed as a variant of AFI approach methodology (Mortimer *et al.*, 2008) in order to propose a composite index including not only the environmental dimension, but also the economic and social ones. The calculation of the index is a step-wise process, adapted here to the peculiarities of the FADN dataset.

Firstly, the context of the analysis was established, namely all farm types (FT) of the Veneto region FADN sample for the accounting year 2009. The regional agriculture is mainly oriented to intensive arable crops, viticulture and cattle, therefore farms were classified to build groups that could better show how sustainability may change in different rural areas. Eight groups were identified, using the 4 digit type of farming classification. The first five groups are mainly devoted to crop production: 1) intensive arable crops, 2) other herbaceous crops (including permanent grassland), 3) grapevine, 4) permanent crops, 5) mixed crops. In the other three groups the presence of livestock is more marked: 6) cattle farms (with bovines), 7) other livestock and 8) mixed farming.

The second step includes the specification of an assessment criteria matrix (ACM). The ACM is based on the three dimensions of sustainability (environmental, economic and social) and two relevant management domains, namely Farm Management (FM) and Regional Contest (RC) (Table 1). The core issue of this phase has dealt with the involvement of stakeholders (farmer unions, public servants, experts from extension services, ecologist and agricultural economists), which shared their viewpoints on several issues concerning farming sector during a recent regional Conference on agriculture and rural development (Regione del Veneto, 2011). According to stakeholders' opinions a selection of of sustainability indicators on topics such as water management, preservation of natural resources, landscape and human capital, etc. has been identified.

Once the main structure of ACM was agreed, specific indicators available from the FADN database have been used to fill in each cell of the matrix. Altogether the ACM used in this study is made of 26 measurable indicators, some of which are monetary-valued, while others being social and environmental then were measured on a Likert-scale (1 to 5 or so). In some cases indicators were derived by estimation and approximations. In fact the FADN is a data source mainly based on monetary values, therefore the level of detail can be a limiting factor. In the Italian FADN survey complementary information have been collected for years, as in the case of the physical quantity of agricultural inputs, which is not mandatory at EU level in the FADN survey. For example, as confirmed by the DireDate project (EUROSTAT, 2011), energy consumption can be indirectly estimated from expenditure data in FADN *via* energy prices. The data needed to calculate energy unit costs and estimate energy consumption are available with annual updates. In some cases the process of synthesis of the indicators has required more complex analysis. For example in the case of fertilizer, where information on quantities and prices were missing, the standard cropping system has been identified through agronomic indices reported in the technical handbook and with the help of an empirical investigation on market price the quantities of fertilise for each farm has been defined.

Table 1 – Assessment Criteria Matrix used for the calculation of SuFI of FADN sample

	Environmental dimension	**Economic dimension**	**Social dimension**
Farm management (FM)	Nitrogen content Phosphorus content Irrigation area Irrigation system Pesticide expenditure	Economic Return to labour Economic Return to land Utilized Agricultural Area Expenditure for service to thirds Expenditure for energy	Family labour Farmer age Farmer gender Farmer education
Regional Context (RC)	Land use limitations Livestock Unit Organic farming Grassland Agri-Environmental Schemes	Altitude Other Gainful Activities Distance from inhabited centre	Altitude Distance from inhabited centre Networking Labour supply

Environmental dimension – According to the recommendations from Diredate Project (EUROSTAT, 2011), to assess farm intensification nitrogen and phosphorus content and pesticide expenditure were taken into consideration. Besides considering the irrigated UAA, the irrigation systems were distinguished according to low and high water consumption, respectively sprinkler and surface-flooding system.

To tackle to environmental dimension in terms of integration within the RC, four indicators were taken into account: i) land use limitations constraint if the farms were labelled as belonging to Natura 2000 areas or other protected areas; ii) participation to agri-environmental schemes (AES); iii) organic farming practices, iv) the intensification of livestock was considered relevant because potentially strong pollutant for the surrounding territory.

Economic dimension – Agricultural holdings were grouped taking into account the return to labour and land, considered as Net Value Added (NVA). Analysing the distribution of the amounts of NVA/AWU, NVA/ha, income from Other Gainful Activities (OGA), expenditure on energy and contract work farms were grouped into classes according to the variability of the indicators mentioned. Similarly farm dimensions in terms of cultivated area (UAA) were grouped.

Social dimension – In terms of farm management Family Labour Unit has been considered a crucial indicator for the social dimension, considering that the presence of family-based farms is important for the vitality of rural areas. Similarly to Westbury et al. (2008), the demographic characteristic of the farmer were taken into account. Farmer age was grouped in four groups: under 35 years old, between 34-45, between 45 and 60, over 60 years old. Farmer education was based on levels of qualification: none, school only; secondary only; university degree. To tackle to social dimension in terms of social integration within the RC, the distance of the holding from the inhabited centre was grouped into 4 categories (under 5 km, between 5 and 10, between 10 and 15, above 15 kilometres). Furthermore the concept of labour supply was introduced. It was calculated as the difference between total labour involved at the farm level and the family labour, representing a proxy for the potential and real need for labour additional to the family one.

When including the altitude area where the farm are located (distinguished in mountain, hill and plain), it imply that farmer on the mountain area suffer of natural constraints to reach places and people. The degree of networking was measured by the subscriptions to associations according to number of subscriptions, with in a score variable between one and four. Farms were grouped accordingly. The social dimension took into consideration the human (labour, skills and knowledge) capital and equal opportunities, the natural capital (land, water) was considered within the environmental dimension. However, the current FADN database has not allowed going into further details at this stage. Further exploitation of information assembled is feasible and forthcoming.

Table 2 shows a summary descriptive analysis of the variables (continuous and categorical) used in the assessment exercise.

Table 2 – Values of the indicators in Veneto FADN sample

Indicator	Number	Data type	Units	Min	max	Mean	Stand. deviation
Agri-Environmental Scheme	853	class	binary	0	1	-	-
Altitude	853	class	coded	1	3	-	-
Contract work	853	variable	euro/hectare	0	28.580	170	1.077
Energy expenditure	853	variable	euro/hectare	0	132.113	1.493	7.636
Family labour	853	variable	hour/hectare	0	16.720	531	1.298
Farmer age	853	class	coded	1	4	3	1
Farmer education	853	class	coded	1	4	2	1
Farmer gender	853	variable	binary	0	1	-	-
Grassland area in UAA	178	variable	%	1	100	49	0
Irrigation area in UAA	852	variable	%	0	100	50	0,43
Irrigation system high insensitivity	852	variable	%	0	100	8	0,25
Irrigation system low insensitivity	852	variable	%	0	100	42	0,42
Labour unit	853	variable	labour unit/hectare	0	15	0	1
Labour supply	853	variable	hour/hectare	0	27.203	141	1.172
Land use limitations	853	class	binary	0	1	-	-
Livestock unit (LU)	853	variable	LU/hectares	0	326	3	20
Networking degree	853	class	coded	0	5	3	1
Nitrogen balance	806	variable	quintal/hectare	0	1.275	3	45
Organic farm	853	class	binary	1	2	-	-
Other gainful activities	853	class	euro	1	5	-	-
Pesticide expenditure	807	variable	euro/hectare	0	20.383	368	1.061
Phosphorous balance	806	variable	quintal/hectare	0	1.275	3	45
Return to labour	853	variable	euro/labour unit	-29.625	561.534	38.664	50.140
Return to land	853	variable	euro/hectare	-5.059	435.115	8.962	29.724
Town distance	853	class	kilometres	0	4	1	0
UAA class	853	class	hectares	1	6	2	1

Source: our elaboration on Veneto FADN dataset, 2009.

After the identification of indicators, the normalization of indicator scales allowed to sum up different indicators. Indicator values were converted into scores according to the relationships between indicators values and level of sustainability. Relationships can be linear, non linear, and scaling can be categorical or binary (Mortimer *et al.*, 2008). For each indicator scores are on a 0-to-10 scale. Before to aggregate the normalised indicators, a weight was assigned to each cell of the matrix. The two management domains, FM and RC, were considered equally important in achieving the three sustainability dimensions. Therefore a weight of 0.5 was assigned respectively.

Within the three dimensions, each indicator was associated with different weights according to how much stakeholders have evaluated the importance of each indicator to sustainability dimensions. According to AFI methodology while calculating the index the same indicator in the matrix may validly be used in more than one dimension[1]. Overall, a weight was assigned according to relative importance of each criterion.

The fifth step consisted in the SuFI calculation, thus summing up scores by weights at each level within the hierarchical SuFI structure. The general index can score between 0 and 10.

The last step consisted in the sensitivity analysis to allow comparisons of farms by considering different scenarios. In this study four scenarios were defined. The first one, called "indifferent scenario", assigns equal importance to the three dimensions of sustainability and to the two domains (FM and RC). The other three scenarios - leaving unchanged the weights of the two domains - differ from one another because of the relative importance placed on the three dimensions accordingly (e.g. 80% to the most important one while the other two dimensions share the remaining 20%). The choice of a very high weight for one of the three dimensions allows to rank the different groups considering a specific point of view (or scenario as we called it) and the subsequent comparison among the different scenarios should make clear what groups maintain a high rank in presence of different scenarios.

3. RESULTS FROM SENSITIVITY ANALYSIS

The above-described method was applied to the regional FADN database of Veneto, an Italian north-eastern region, accounting for 853 agricultural holdings in 2009.

The mean SuFI score shows low variability under the indifferent scenario, as it varies from 5,8 and 4,8, although the index itself could vary between 0 and 10. Nevertheless, differences in the mean values are statistically significant ($F_{7,845} = 47{,}6$ $P < 0{,}01$), as well as in the other scenarios (table 3). The mean score of SuFI is lower under the environmental scenario than under the indifferent one, whereas is higher under the economic one. This result can be linked to what is represented in table 4 which suggest that by stressing on the environmental dimension of sustainability, in spite of the economic dimension, farms perform poorly. Furthermore given the variables used, stressing on the social dimension does not lead to easily-explicable differences (mean Sufi 5,5) even though statistically significant.

According to farm types, farms with bovine livestock show higher sustainability (mean value of 5,8 under the indifferent scenario), due to the high presence of grassland areas, which are typically extensive. Viticulture and Other crops are less sustainable than others, due to the very intensive use of chemical inputs. This reappears also under the environmental scenario, where Intensive arable crops, Other crops, Viticulture

[1] For example, the distance of the farm from inhabited centers is a useful indicator to describe both social and economic dimension of regional networking. In fact proximity to town centers may help social contact, but also enhance contact to the economic marketplace. However, such indicator has been assigned a different weight (relative importance) within the two dimensions. Similarly altitude was used in the two dimensions with different importance to sustainability.

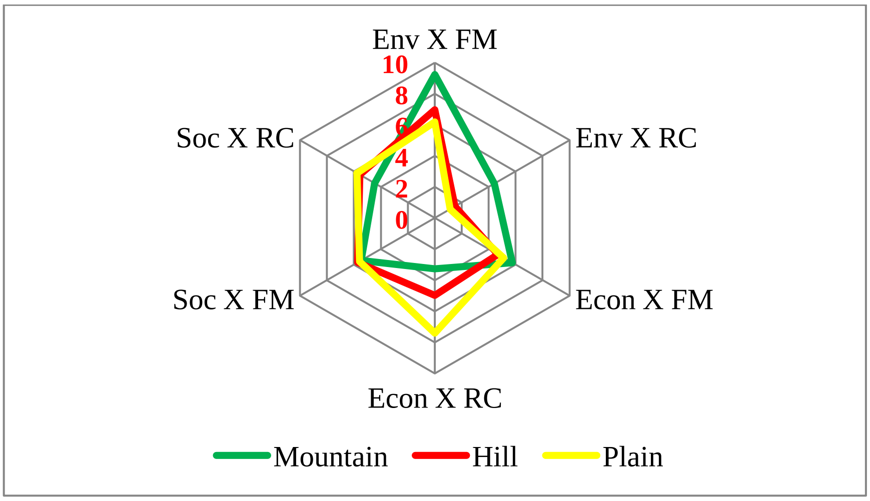
and Permanent crops show low sustainability. Those farms were expected to be low performing under the environmental scenario and conversely highly performing under the economic scenario.

Table 3 - Mean scores of SuFi according to Farm Type and scenarios

	Indifferent scenario	Environmental scenario	Economic scenario	Social scenario
Intensive arable crops	4,8	3,6	5,6	5,2
Other crops	5,0	3,9	5,9	5,3
Viticulture	4,9	4,1	5,1	5,6
Permanent crops	5,1	3,5	5,8	5,9
Mixed crops	4,8	3,7	5,4	5,4
Bovine	5,8	5,8	5,9	5,6
Other livestock	5,4	4,7	5,8	5,7
Mixed farms	5,4	4,9	5,8	5,5
Total	**5,2**	**4,3**	**5,7**	**5,5**
F $_{(7,845)}$	47,6	85,0	10,4	11,3
p-value	<1%	<1%	<1%	<1%

Examining the constituent components of the index (under the indifferent scenario) shows that farms on mountain areas scored highly in environmental dimension as a whole (both FM and RC), whereas for dimensions relating to the interaction between socio-economic issues and regional contest farms on the plain are scored highly (figure 1).

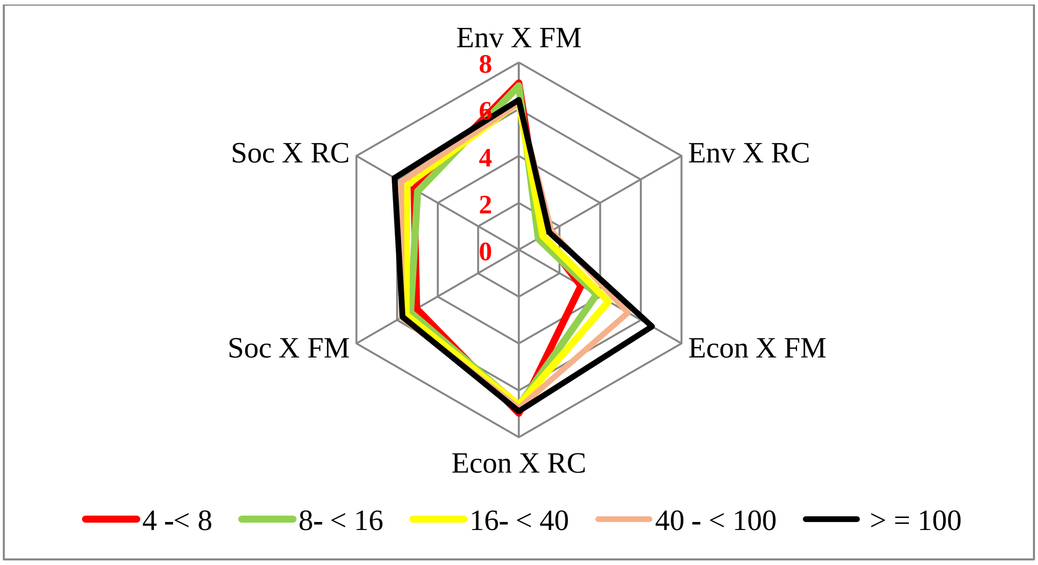
Figure 1 - Mean scores of components of SuFI under indifferent scenario, according to altitude



Source: own elaboration on Veneto FADN dataset, 2009.

The components of the index (under the indifferent scenario) show that large farms (above 100 ESU) scored highly in almost all dimensions and domains, especially relating to the interaction between economic dimension and farm management (figure 2). The only exception is represented by small farms (below 8 ESU) that scored highly in environmental dimension relating to Farm Management. Analysing the interaction of economic dimension and RC, interesting results can be observed, due to the fact that farms that are extreme in size (both very small and very large ones) score highly.

Figure 2 - Mean scores of components of SuFI under indifferent scenario, according ESU



Source: own elaboration on Veneto FADN dataset, 2009.

Three levels of sustainability were identified, that are Low with SuFI score < 5; Medium 5-6; High with SuFi > 6 (table 4). The distribution in terms of number of holdings, UAA and NVA were analysed. Attention can be drawn to 12% of farms that are highly sustainable, accounting for only 20% of the regional UAA and 35% of regional NVA. In terms of NVA low sustainable farms under the economic scenario, accounting for 68% of the regional NVA, correspond to 77% of NVA under the economic scenario.

Table 4 - Distribution of farms, Utilized Agricultural Area and Net Value Added according to classes of SuFI

Classes of SuFI	Indifferent scenario	Environmental scenario	Economic scenario	Social scenario
		Number of farms		
Low	44%	77%	22%	28%
Medium	44%	12%	40%	45%
High	12%	11%	38%	27%
Total	100%	100%	100%	100%
		Utilised Agricultural Area		
Low	24%	72%	9%	29%
Medium	56%	14%	23%	40%
High	20%	14%	68%	32%
Total	100%	100%	100%	100%
		Net Value Added		
Low	15%	68%	4%	12%
Medium	48%	18%	19%	38%
High	36%	14%	77%	50%
Total	100%	100%	100%	100%

4. Conclusions

The FADN database has proved to be a valuable source of information in providing data necessary for the quantification of a sustainable index and for monitoring farms with it, confirming a former analysis made by Mari (2005). It should be kept in mind that FADN cannot represent the only source of information, since it was established for other purposes, as confirmed by DireDate project as well. Nevertheless, thanks to data assembling of quantities of inputs and cost allocations, the estimation of nitrogen and phosphorus consumption was possible at farm and crop levels. The registration of commercial name of fertilizers allows to cross check the information on the input with the crop and as consequence fairly precise estimations could be run. Unlike other studies, the irrigation system was taken into consideration and distinguished among the amount of water consumed.

Some weak issues shall be mentioned, particularly because some variables have been chosen as *proxy* due to lack of information as such. In terms of assumptions made, age (young farmers) and family labour (high AWU) were considered as positive to social sustainability. Some could argue that employing family labour does not necessarily affect the social dimension of sustainability. However there was either nor other way to integrate the current FADN data set at this stage, nor to integrate the database with other *ad hoc* data collections. With this data limitation, approximation is needed, some areas for improvements were identified and will be of next implementation in the Italian FADN. For instance, the forthcoming geo-referencing of FADN database will allow to overcome limitations of proxy, such as the estimation of the distance of holding from inhabited centres and other territorial classifications.

The EU FADN Committee Working Group proposed to collect data on quantities of each of N, P and K ingredients of mineral fertilisers used on farms in the annual FADN survey. The purpose is to study farm income and a business analysis of agricultural holdings in relation to quantities of used NPK, what links farm incomes with the environmental aspect of farming. The fertilisers' use can have effect on such environmental features as soil and water pollution, eutrophication and contamination, soil acidity, GHG emissions, and biodiversity, while the Common Agricultural Policy is increasingly relying on the environmental sustainability. Starting from the accounting year 2011 the Italian FADN survey is going to anticipate what will be mandatory with the new regulation for the farm return (Reg. 385/2012) from the 2014. In the next surveys the physical quantities of NPK will be collected, enhancing reliability in the calculation of the SuFI index.

The CAP has been increasingly adapted for integrating environmental concerns and to better serve sustainability purposes. This is done by ensuring a sustainable way of farming through avoiding environmentally harmful agricultural activity and providing incentives for environmentally beneficial public goods and services. Also the territorial cohesion is another issue at stake in the CAP reform process. The social dimension could be included in the matrix thanks to information assembled on farmers and their household composition. In next examinations other details can be exploited, such as the number of members in farmer's family and degree of involvement in running the farm (hours worked per family member). From the economic point of view information on farmer household income can be used a proxy for farms wealth.

It seems remarkable that some informative modules are to be necessary in the future annual surveys, in order to describe comprehensively environmental and social aspects of agricultural holdings. All the coming efforts with this respect are more and more envisaged in farm evaluation with respect to sustainable development at national and international level.

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