The sustainability of an organic sector under transition: an empirical evaluation for Italy

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Keywords: organic, sustainability, conventionalization, bifurcation, aggregated indicator.

Abstract

The Italian organic sector since its origin has been going through a deep process of transformation. Many organic farms experienced an increase in size, an industrialization of production processes, a gradual integration within the traditional food system – such as the use of large scale retail channels and brands, coming along with a weaker defense of the original values stated by International Federation of Organic Agriculture Movements. This resulted in the so called conventionalization of organic farming that led to increasing doubts about the environmental and social sustainability of conventionalized organic farms.
The aim of this work is to contribute to this debate by comparing the sustainability of organic and conventional Italian farms. In the first part of the work we analyze the evolution of the Italian organic sector from its origins. In the second part of the work a short description, based on the Farm Accountancy Data Network (FADN) data, of the organic agricultural sector in Italy will be presented. In the last part of the work we propose a methodology to evaluate the environmental, social and economic sustainability of organic farms and apply it to the FADN data. Simple indicators for each of the three levels of sustainability –social, environmental and economic- are first calculated. They are then aggregated in a synthetic measure of sustainability. The calculated indicators can be used to compare the sustainability of organic and conventional farms, in addition they can also be used to visualise farm heterogeneity within the organic sector and to monitor the trajectory toward conventionalization. The first results show that Italian organic farms are on average more sustainable than conventional farms.

1. Introduction

Since the 90s, the European policy measures are increasingly focusing on the sustainability of the agricultural sector, disseminating a multifunctional and sustainable conception of agriculture, as well as competitive, to compound the needs of the production system with the environmental protection demand. In this politic and social context, organic farming has been establishing itself as an innovation, although more as a niche one, in the food system intended to counteract the negative environmental effects associated with the evolution (modernization / industrialization) of agriculture. In the '80s organic farming started to abandon the connotation of social movement, while formalization and professionalization occurred. Since then area under organic farming continued to expand and organic food gained increasing market shares.

While European policy authorities are attaching increasing interest in the environmental potentials of organic farming, organic food faced a crisis of trust.

The EU executive is posing growing interest in organic farming, particularly in the context of its contributes to the protection of natural resources, to biodiversity and animal welfare. The positive role of organic farming in enhancing the environmental sustainability of EU agriculture has been recently recognized in the legislative proposals for the post-2013 CAP. According to these proposals organic farms will automatically be entitled to receive the ecological component of payments while they are exempted from greening constraints.

At the same time consumers' trust was undermined mainly due to the so called conventionalization and bifurcation of organic production and distribution, that is the dilution of the original social movement components and their replacement with an industrial approach.

The aim of this work is to contribute to this debate by comparing the sustainability of organic and conventional Italian farms. In the first part of the work we briefly analyze the debate on the conventionalization. In the second part of the work a short description, based on the FADN data, of the organic agricultural sector in Italy will be presented. In the last part of the work we assess the economic, environmental and social and sustainability of Italian organic farms by making use of a hierarchy of simple and composite indicators.

2. The debate on the conventionalization and bifurcation of organic farming

Starting from the 1990s there is a wide debate on the "conventionalization" and bifurcation of organic farming. The concept of conventionalization refers mainly to the distance between the values and ethical principles of pioneer and new entrants to organic farmers. The concept of bifurcation refers to the process by which the organic sector shows a dual-structure with smaller, lifestyle-oriented producers on one side and larger, industrial-scale producers on the other side.

The main issues in the conventionalization debate are the increasing distance from the original principles of organic farming and on the growing adoption of an industrial approach with important implications in term of the environmental and social sustainability of the organic farming sector.

Some authors (Darnhofer et al, 2010) have suggested the 4 principles formulated by IFOAM -welfare, ecology, equity and precaution (IFOAM, 2005) – can be a synthetic good approximation of the original principles of organic farmers..

According to Padel (2008) conventionalized organic farms are characterized by large scales, the adoption of industrial intensive production processes and the choice of large-scale retailer organizations to sell this products. Darnhofer et al (2010), in their overview of the conventionalization debate, identify a list of possible indicators of the degree of conventionalization of organic farms. In most cases these indicators intend to measure the shift toward a productivistic logic oriented towards, for example, yields and profitability maximization. "Among the indicators related to crops, therefore, are indicators of intensification of the productive activity, such as a low share of legumes in the rotation, a high share of cereals in the rotation, an inadequate or unbalanced sequence of crops in rotation. Other indicators are linked to the level of biodiversity of global cropland and measure the adequate number of ponds and marshes, hedges and field margins". Regarding the indicators devoted to livestock, some refer to biodiversity (the presence of rare breeds in farm), other to the conditions for breeding and rearing (average life time, share of artificial reproduction techniques, access to pastures), other to farm management elements (characteristics of the environment and nutrition). Other indicators underlying conventionalization suggested by Darnhofer (2006) focus on an increased weight of externally purchased inputs (machinery, fertilizers, feed, chemicals), on a substitution process in the use of resources, capital instead of labor and land and also the preference towards high value crops (e.g. salads).

In addition to this, Darnhofer et al (2010) argue that the organic farm is more sustainable if it is of a mixed type, producing either crops and livestock, thus ensuring a complete nutrient cycle within the same farm. A reduction of mixed crops and livestock farms is assumed to be indicative of a growing weight of fertilizer coming from outside the farm, confirming a phenomenon of substitution of inputs. Going further, the authors find out that "concentration, de-localisation, institutionalization and input substitution certainly are occurring to a significant extent" and are also signals of a conventionalization process.

Flaten and Lien (2006), in a study on the organic dairy sector in Norway, distinguish organic farmers into 3 groups according to the time of entry into the sector. They find that the farm structures of recent entrants are more homogeneous and characterized by high concentration of land, low level of specialization in horticulture, higher yields of milk for livestock farms and higher level of treatments for diseases. In terms of approach to business, recent entrants are more pragmatic and more oriented to profitability, but also with greater concern for the environment.

Not all authors agree with the conventionalization thesis. For example Padel (2001) argue that the changes in organic farming are the normal consequences of the diffusion. A first objection to the conventionalization hypothesis is based on the fact that it presents the characteristics of the more general model of the adoption and diffusion of innovations. In particular, the author refers to the difference between early and later adopters , not only in attitudes and goals, with later adopters likely more profit oriented, but also in farm size and in professional background. Moreover, the author underline that early converted farmers have been exposed to organic ideas and experiences for a much longer time and probably in greater intensity than those who converted more recently, thus it is difficult to establish differences in attitudes and values. For example, in defense of the new entrants, a study on the decision to convert to organic farming in Germany (Best, 2006) shows that farmers recently converted are characterized by very high concern about the environmental sustainability of agriculture and the search for less productivist practices. Actually data does not allow to adequately capture the heterogeneity of organic farms or the complexity of the change dynamics (Darnhofer et al, 2010).

Finally, Rosin and Campbell (2008) point out that conventionalization is always associated with a negative meaning of the dynamic of development that obscures the diversity of agricultural practices. As for bifurcation, they argue that it can be applied in several ways within the debate, such as that between pure organic and pragmatic organic, small scale and large scale production, "old guard" of producers and new entrants and so on. It is not correct addressing the attention only to the dichotomy traditional vs. conventionalized organic, as organic farms are developing multiple paths with different nuances that "compete" with the organic production, from fair productions to green production to eco-labels (food miles, carbon footprint), up to local production and certification of origin.

3. A short description of the organic sector in Italy in 2003-2007 according to FADN

The Italian FADN survey annually collects information on a sample of about 15000 professional farms.

The FADN farms can be further divided in conventional (not organic), partially and fully converted to organic farming. The FADN sample partially varies from year to year, so that the differences in the number of organic farms are not exclusively due to developments in the sector, but also to the evolution of the sample over time.

Over the period under study, organic farms are 3% of the sample. Approximately half of organic farms is partially converted to organic techniques, in other words the farms use the organic techniques only on a portion of the production.

The number of Italian fully converted organic farms (Table 2.1) shows an upward trend until 2005, it then started to decrease so that in year 2007 there were again less than 10,000 fully converted farms. For partially organic farms the trend is more fluctuating over time.

Organic farms, both fully and partially converted, use more land (Utilized Agricultural Area – UAA) as well as more Annual Working Units (AWU) then conventional farms.

Tab. 2.1 Conventional, partially and totally organic farms, land and labour (2003-2007)

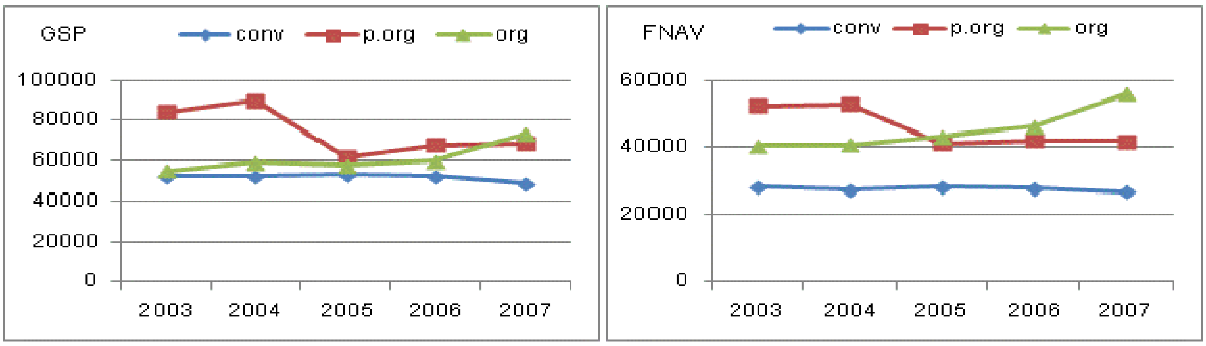
	Farms			UAA (ha)			AWU		
year	conven.	part. org	org.	conven.	part. org	organic	conven.	part. org	organic
2003	662703	10275	8250	16.05	32.97	28.64	1.33	1.72	1.51
2004	654643	7877	9210	14.28	37.67	21.85	1.33	2.63	1.73
2005	680016	11867	12916	13.55	29.82	25.52	1.37	1.78	1.55
2006	671144	9661	12791	14.86	35.15	35.45	1.37	1.87	1.53
2007	731156	8801	9755	12.86	35.73	27.83	1.35	1.92	1.92

Source: our calculations based on FADN data

Regarding production systems, in 2003 partially or totally organic farms are concentrated in permanent crops, as indeed happens even in the conventional sector. In 2007, the situation is stable for organic (and also conventional) farms, while the distribution for partially organic farms moves towards mixed crops.

Graphs 2.1 shows the real average values of the gross product (GSP) and of the Farm Net Added Value (FNAV). The difference between the GP and the FNAV series measures the expenses for intermediate inputs and depreciation of durable goods. The FNAV measure instead the remuneration of factors (land, labor and capital) including profits. It is interesting to note that fully converted farms the cost of intermediate consumption and depreciation are lower than the other two groups, this also implies that a greater share of production can be used to offset land, capital and labor. The positive trend of GSP and FNAV in fully organic farms unlike the other two business groups, shows constantly-increasing economic performance.

Graph 2.1 GP, FNAV in conventional, partially and fully organic farms (2003-2007).



Source: our calculations based on FADN data

4. Assessing the sustainability of the organic sector through economic, social and environmental indicators: an application to the Italian FADN data.

The economic results presented in the previous section showed how organic farms have succeeded to counter the negative trend that is affecting the rest of the Italian agricultural sector and to ensure themselves increasing levels of income.

These results provide a first indication of the economic sustainability of organic farms, while the debate around the conventionalization, synthesized in the first paragraphs of this work, has raised some doubts about the environmental and social sustainability of organic farms.

In order to produce clear evidences about the sustainability of conventional, partially and totally organic farms we propose to exploit the micro-data collected by the FADN survey and to calculate statistic indicators economic, environmental and social sustainability.

4.1 Methodology

The objective of the methodology described in the following paragraphs is to measure the sustainability of Italian farms in view of comparing the levels observed in Italian conventional and organic farms. The proposed methodology Is based on Perali et al. (2005) and on Gómez-Limón and Sanchez-Fernandez (2010) and extends it to take into account the social sustainability of farms.

We first calculate three sets of simple statistical indicators of economic, social and environmental sustainability . Then, the three sets of simple indicators described above are used to compute three composite indices of economic, social and economic sustainability. First, for each set of simple indicators we normalize each simple indicators, that is we performs a linear transformation on the original data values so that they fit the range [0,1]. We apply the so called min-max normalization,

(Indicator value - min) / (max - min)

where the minimum and maximum refer to the minimum and maximum value taken by the indicator.

Once the normalized indicators have been calculated, we sum them up to obtain a composite indices.

Each of the 3 Composite Index distributions has then been divided into five categories based on quintiles (from 1- lowest - to 5 -highest sustainability).

Finally, these three composite indices are normalized and summed up to obtain a global sustainability index. It is important to note that the values taken by the global and partial composite indices of sustainability must be interpreted with caution since they offer only a partial assessment of a very complex phenomenon under analysis.

The pros and cons of composite indicators for assessing the sustainability were analyzed by Saisana and Tarantola (2002). Among the pros they included the ability to synthesize a complex and multi-functional as the sustainability of farms; easier to interpret than a synthetic indicator to a set of simple indicators; possibility of comparisons between companies and over time. Among the major disadvantages is the chance that, due to limited knowledge or misinterpretation of the analyzed phenomena, the calculated indicators give a description far from reality and misleading.

Finally, it is worth remembering that a system of weights could be applied to the indicators when calculating the aggregate index of sustainability. The assignment of weights is a very delicate moment that could affect the final value obtained arbitrarily. For this reason here we preferred not to make use of weighting and proceed directly to the sum.

4.2 The simple indicators of environmental sustainability, economic and social development in FADN

In this paragraph we present the results obtained by application of the methodology described to the FADN data.

Overall, the FADN survey is extremely rich in information, although it should be noted that the survey was designed to monitor the economic performance of farms, therefore, information relating to environmental and social performance of the farms are not recorded, hence many of the sustainability indicators suggested by the literature so far cannot be calculated. Nevertheless we can use the data to build three set of indicators to approximate the environmental and social performance of farms. While we recognize the limits resulting from the use of these proxies, we proceeded to the identification of all variables potentially exploitable for the construction of environmental and social indicators in order to test their ability to approximate the phenomena under analysis and also to highlight any weaknesses and suggest possible future additions to the investigation which will allow wider coverage of the two phenomena mentioned above.

The list of simple indicators of sustainability calculated from the FADN data and we are going to illustrate in the following sections is shown in Table 3.1.1.

Table 3.1 Indicators of sustainability

Environmental sustainability indicators	**Economic sustainability indicators**
Nitrogen load	Dependency from purchased inputs (GSP/IC)
Pesticides use (CP)	Land productivity (FNAV/UAA)
Livestock/crops genetic diversity(BC, BA)	Labor productivity (FNAV/AWU)
Greenhouse gas emissions (GHG) from livestock	**Social sustainability indicators**
Fertilizers use (CF)	Farm labor intensity (AWU/UAA)
Energy use (direct) (UDEN)	Presence of young's in the farm management
Livestock density (CB)	Presence of women in the farm management
Set aside	Risk of abandonment of agricultural activity
	Stability of work force

4.3 The environmental indicators

In relationship to environmental sustainability a first set of environmental indicators detect potential environmental stressors (Bassanino *et al.* 2011; Marinari *et al*. 2010; OECD 2001), while no information is available about the real environmental impact of agricultural practices. In particular we have tried to quantify the pressure arising from the use of agrochemicals, GHG emissions from livestock and from the use of energy, and the pressure on biodiversity.

Nitrogen load: it is the ratio between the amount of nitrogen released, thanks to organic and synthetic fertilizers, and the fertilized area. N(kg)/ha per year

Pesticides use (PC): it is the ratio between the amount of plant protection products distributed and the fertilized area. Pesticides kg/ha per year

Livestock/crops genetic diversity (LB, CB): it is ratio between the number of cultivated species or livestock raised and the area. N°/ha

Ghg emission from livestock: it is the ratio between emissions of carbon dioxide and methane from manure and utilized agricultural area. g/ha

Fertilizers use (FC): it is the ratio between the amount of fertilizers distributed, thanks to organic and synthetic fertilizers, and the fertilized area. N(kg)/ha per year

Energy use (direct) (DENU): it is the ratio between the amount of energy consumed and the utilized agricultural area. GJ/ha

Livestock density (LD): it is the ratio between the fodder area and the number of cattle units.
Set aside: it is the ratio between idled and the utilized agricultural area (UAA)

4.4 The economic indicators

The indicators of economic sustainability measure land and labor productivity of the farm, and the dependence of the farm from purchased inputs.

Dependency from purchased inputs: it is the ratio between gross output and intermediate consumption (GSP/IC*)*, the higher the ratio the lower the dependency.

Land productivity: it is the ratio between *Farm Net added value and utilized agricultural area:* high values signal efficiency.

Labor productivity: it is the ratio between *Farm Net added value and Total Annual Work Units*: high values signal efficiency.

4.5 Social Indicators

Social sustainability refers to the ability of the farm business to provide a level of standard of living that is high -in terms of safety, health, education, etc.- and evenly distributed overall and by gender. The most important aspects of social sustainability in farms are related to the aging of the farm labor, stability of the employment, poverty and social exclusion of farm workers.

The indicators of social sustainability that can be built using the information contained in the FADN farm level are presented below.

Percentage of women among farm holders and managers [1]: the higher the index value, the more likely is the permanency of female population in rural areas.

Presence of young people (under 40 years old) among farm holders and managers: the higher the index value, the more likely is the permanency of young population in rural areas.
Farm labor intensity (AWU/ UAA): it is the ratio of labor to land.

Farm employment stability (temporary labor unit/AWU): it indicates the percentage of temporary to total work required on farm. The higher the index value, the lower the vitality of the area in terms of population permanently living in rural areas. This indicator has been included in the aggregation of the indices by inverting the numerator and the denominator.

Risk of abandonment of farming (G. Sanchez Fernandez, 2009). It is assumed that the decision to quit farming depends on two main factors: the age of the farmer and the profitability of the farm business. This indicator has range 0-1. It takes value 0 if the farm holder is aged less than 55 years, and the FNAV is greater than the median of the unitary farm family labor income, hence when the farm business is "attractive" in economic terms. The abandonment indicator takes value 1 if the holder is aged 70 or over and the FNAV is lower than half the median unitary farm family labor income, i.e. the farm business is “not attractive” in economic terms.

4.6 The sustainability in the FADN farms

The simple statistical indicators described above have been then calculated by using the FADN dataset over the period 2003-7. They have then been used to calculate the composite indicators described in paragraph 3.2. The mean values of the calculated composite indicators of economic, environmental and social sustainability are reported by conventional, partially and fully converted organic farms.

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[1] Farm holders are the legal or physical persons taking benefit of the agricultural activity whereas managers are the persons who take the everyday decisions.#

Tab 3.2 Sustainability indicators results

	economic			environmental		
year	conven.	part. org	fully organic	conven.	part. org	fully organic
2003	2.984	3.293	3.850	3.000	3.119	2.839
2004	2.981	3.576	3.792	2.992	3.334	3.143
2005	2.973	3.571	3.896	2.994	3.317	2.923
2006	2.975	3.575	3.825	3.003	3.007	2.795
2007	2.983	3.204	4.011	2.999	2.939	2.998
Total	2.979	3.447	3.875	2.998	3.147	2.931
	social			global		
year	conven.	part. org	fully organic	conven.	part. org	fully organic
2003	2.999	2.739	3.283	2.998	2.834	3.310
2004	3.010	2.584	2.617	3.006	2.610	2.873
2005	2.999	2.874	3.135	2.998	2.934	3.141
2006	2.998	3.004	3.117	2.996	3.028	3.165
2007	2.998	3.200	2.956	2.996	3.160	2.995
Total	3.001	2.883	3.030	2.999	2.920	3.100

Source: our calculations based on FADN data

Partially organic farms show the highest degree of environmental sustainability. However, it is worth noting that this composite indicator must be treated with caution given that the information contained in the FADN does not capture all the dimensions of the environmental sustainability of farms. A first attempt to exploit the information on the use of chemicals and natural resources and energy, recorded only for a small subsample of farms, provided clear evidences of greater environmental sustainability of organic over conventional farms.

Problems are recorded even with the social sustainability index. The classification of the three group of farms changes over time. On average fully organic farms record levels of sustainability slightly higher than conventional and partially converted farms.

The values of the composite indicator of economic sustainability, unlike the two previous ones, show that organic farms record better economic performance than conventional farms.

Overall organic farm record show higher levels of global sustainability, the average indicator of global sustainability detects increased sustainability of totally organic farms than conventional, partly biological. It should be noted, however, that the ordering of these three types of companies is not stable during the period considered. It should be noted that the indicators so far provide limited coverage especially of social and environmental aspects. To overcome these problems in the future could be groped to expand the coverage of the phenomena observed, for example trying to exploit the quantitative information available for a subsample. Also might be interesting to consider a system of weights that would rebalance the role played by simple indicators in the calculation of global sustainability.

5. Conclusions

Since the pioneering experiences in the '60 Italian organic farming has developed from a market niche to a professional industry more and more integrated in the agri-food system. Organic farms have followed different development paths. Some farms are still anchored to the original values and ethical principles of pioneer, while other farmers and new entrants are adopting an industrial approach, with important implications in term of the environmental and social sustainability of the organic farming sector.

Even in the absence of detailed information on the different dimensions of sustainability under analysis, the calculated global sustainability indicator has confirmed farms fully converted to organic farming are more sustainable than conventional and partly converted farms. This result is largely determined by economic sustainability.

In future we intend to further refine the set of sustainability indicator and to extend it, in addition we intend to use the sustainability indicators to study the development paths followed by Italian organic farms and to test if the bifurcation hypothesis can apply to the Italian case.

References

Bassanino M., Sacco D., Zavattaro L., Grignaniet C. (2011). Nutrient balance as a sustainability indicator of different agro-environments in Italy, Ecological Indicators 11 (2011), pp. 715–723

Blanc J., Darnhofer I., Bellon S. (2009). Summary of discussion, Working Group 2.6, Conventionalisation? Organic farming bites back , XXIII Congress of the European Society for Rural Sociology, Vaasa, Finland, 17-21 August 2009

Darnhofer I (2006). Organic farming between professionalization and conventionalisation – The need for a more discerning view of farmer practices, www.orgprints.org

Darnhofer I, Lindenthal T., Bartel-Kratochvil R., Zollitsch W. (2010). Conventionalisation of organic farming practices: from structural criteria towards an assessment based on organic principles. A review, Agron. Sustain. Dev. 30(2010) 67-81

Flaten O., Lien G. (2006). Organic diary farming in Norway in relation to the “conventionalization” debate, European Joint Organic Congress –May 30-31 2006, Odense, http:orgprints.org

Gómez-Limón J.A., Sanchez-Fernandez G. (2010). Empirical evaluation of agricultural sustainability using composite indicators, Ecological Economics, 69 (2010) 1062–107

Hall A., Mogyorody v. (2001). Organic farmers in Ontario: An examination of the conventionalisation argument, Sociol. Rural. 44, 301-316.

IFOAM (2005). Principles of organic agriculture. http://www.ifoam.org

Marinari S., Lagomarsino A., Moscatelli M.C., Di Tizio A., Campiglia E. (2010). Soil carbon and nitrogen mineralization kinetics in organic and conventional three-year cropping systems, Soil & Tillage Research 109 (2010), pp 161–168.

OECD (2001). Environmental indicators for agriculture. Towards a sustainable development, Paris.

Padel S. (2001). Conversion to organic farming: a typical example of the diffusion of an innovation, Sociologia Ruralis, Vol. 41, 49-61.

Padel S. (2008). Values of organic producers converting at different times: results of a focus group study in five European countries, Int. J. Agricoltural Resources, Governance and Ecology, Vol. 7, Nos. 1/2.

Perali F., Salvioni C., Veronesi M. (2005). Bilancio ambientale delle imprese agricole italiane: stima dell’inquinamento effettivo in ISMEA Agricoltura e ruralità l’indagine socioeconomica dell’ISMEA sull’agricoltura italiana. Franco Angeli, Milano.

Rosin C., Campbell H., (2009). Beyond bifurcation: Examining the conventions of organic agriculture in New Zealand, Journal of Rural Studies 25 (2009) 35–47

Sanchez Fernandez G. (2009)., Analisis de la sostenibilidad agraria mediante indicadores sinteticos: aplication empirica para sistema agrarios de Castilla y Leon, Tesis doctoral, Universidad Politecnica de Madrid, Junio 2009

Saisana, M., Tarantola, S. (2002). State-of-the-art Report on Current Methodologies and Practies for Composite Indicator Development. Ispra (VA): Institute for the Protection and Security of the Citizen