Sustainability of the agri-food system: Strategies and Performances

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INTRODUCTION

The 2013 annual conference of the Italian Society of Agricultural Economics (SIDEA) has been held in the attractive scenario of the city of Lecce under the organization of three different Universities of the Apulia Region (Università degli Studi di Bari, Università degli Studi di Foggia and Università del Salento).

The scientific theme of the 50th SIDEA Conference has been "Sustainability of the agri-food system: Strategies and Performances" (*Sostenibilità del Sistema Agroalimentare: strategie e performance*). With such a topic, the SIDEA intended to cope with the challenges coming from a growing demand of food in a world where critical natural resources such as water, energy and land are becoming increasingly scarce and climate change is posing credible threats. The agri-food system and the broader bio-based economy are, in fact, human activities where the classic dimensions of sustainability (ecological, economic and social) are gaining a striking weight often showing evidence of frictions.

Despite a significant growth in food production over the past century, today one of the most important challenges facing agro-food system is how to feed an expected population of some nine billion by 2050 without penalizing rural development, environmental and social justice outcomes (IAASTD, 2009). In fact, it is clear that the dominant development models are showing obvious limits in pursuing at the same time economic, environmental and social objectives.

Environmental sustainability, that is the ability to maintain or improve the quality of natural resources, is constantly endangered. Agricultural and food systems are estimated to account for one-third of global greenhouse gas emissions, more than twice that of the transport sector (IPCC, 2007; Harvey and Pilgrim, 2010). There are widespread environmental problems linked to soil loss due to erosion, loss of soil fertility, salination and other forms of degradation, pollution from chemical residues, alteration and losses of natural landscapes. Other concerns relate to deforestation, loss of biodiversity, rates of water extraction for irrigation exceeding rates of replenishment and over-fishing.

Even the economic sustainability, thought as the ability in generating wealth and employment and to grant consumers an easy access to food, shows evident setbacks. The more the economic systems integrate, the more they bring to uneven wealth distribution along the supply chains. Furthermore, there are concrete concerns for the local economic systems to collapse under the globalized markets' competitive pressure. The consequential loss in the ability to give value to local resources would decrease the chances of creating value to local farmers. Finally, price volatility of raw materials and agricultural products and the consequent instability in farmers' incomes undermine the farmers' planning ability and shape an increasing uncertain system.

The social sustainability of the food system is its ability to ensure the welfare conditions to humans, belonging to different socioeconomic status. Agricultural activities together with the production and distribution of food have a direct impact on the quality of life by influencing its basic elements such as safety and health. As an example, the demand for food for a growing population should comply with the need for safe and healthy products obtained in production environments respectful of workers' rights. Another important aspect is the role of the food system in promoting well-being in the most deprived areas of the planet (think of the fair trade), to foster the cohesion of communities in rural areas and to meet differentiated demand in

terms of quality, broadly speaking.
In such a framework, many food production systems are no longer sustainable. Without changes, the global food system will continue to degrade the environment and can compromise the world's capacity to produce food in the future, as well as contributing to climate change and the destruction of biodiversity. Although in recent decades many innovations and technological advances are emerging, this combination of drivers still poses novel and complex challenges for global agriculture and led to a widespread and increasing demand for new organizational frameworks and productive systems designed to ensure food and energy security in ways that are environmentally and socially sustainable.
Politicians and researchers are asked to promote innovative development models able to generate revenue and employment and to improve life conditions granting the next generations the same inherited stock of resources. It is not by chance, therefore, that the importance of sustainable bio-based economy is widely highlighted in the theme of the Seventh Framework Programme "Food, Agriculture and Fisheries, and Biotechnology". In 2007-13, the EU allocated almost € 2 billion in research funding to promote (a) sustainable models for agricultural production, forestry and fisheries, (b) relationships between optimal nutrition, health and wellness, (c) sustainable processes and products for non-food use.
Given such a framework, the SIDEA intended to stimulate the debate among its members on the strategies to achieve a sustainable development in the agri-food system and on the most appropriate set of indicators to measure their effects. In particular, the Italian Agricultural Economists have been prompted to tackle the following topics:

- Topic 1: The sustainability of the agro-food system: the actual scenario and the future prospects;
- Topic 2: The evaluation of sustainability of agro-food system;
- Topic 3: The role of the agricultural policies in promoting sustainable development models.

The plenary session of the first day of work was chaired by prof. Giovanni Cicia from the Università degli Studi di Napoli "Federico II". It saw the participation of two prominent invited speakers: prof. Ray Huffaker, University of Florida, speaking on the theme "Pursuit of Green Food Production" and prof. Francesco Di Iacovo, Università degli Studi di Pisa, which presented a communication about "Agriculture and social sustainability".
In his speech prof. Huffaker, starting from 2012 Global Food Policy Report issued by the International Food Policy Research Institute (IFPRI), discussed the main concerns regarding the agricultural water use. He highlighted that while the pursuit of a "green economy" in food production is a worthy goal, it cannot be achieved with market policies drawn from a fictional perfectly-competitive baseline that ignores externalities are prevalent worldwide and that they would not persist if this baseline were realistic. These externalities persist because of high transaction costs that governments and international commissions have failed to correct. He concluded affirming that in most instances government corrective measures are corruptible by rent-seeking activities of powerful groups representing only a fraction of resource users.
The presentation of Prof. Di Iacovo analyzed the state of the art with respect to the themes of inequality and how to interpret the process of exclusion, poverty and well-being of people and geographical areas. He investi-

gated the theme of social sustainability, discussing its definition and application, examining the reasons of the persistence of poor social sustainability condition in the current social and economic context with reference to agriculture and rural environment.
The chairman of the second plenary session was prof. Alberto Manelli, director of the National Institute of Agricultural Economics (INEA). Two keynote speakers were invited: prof. Massimiliano Mazzanti from Università degli Studi di Ferrara and prof. Antonio Seccia from Università degli Studi di Bari.
Prof. Massimiliano Mazzanti, discussed whether a smooth process towards sustainability is possible, or if the transition towards a sustainable economy requires some radical changes and shifts along the way. He pointed out that market and policy shocks are the best way to generate radical forms of change but also radical behavioral changes are needed. The key issue is that shocks of a market or policy nature are not effective in all framework but it depends by the accumulated relevant stock of 'institutional, social and technological capital'. The build up of intangible forms of capital is the precondition in which shocks can modify more adaptable and flexible systems towards sustainable societies, through the emergence of technological and behavioral innovations. He concludes that we must define and construct the necessary social, institutional and technological pre-conditions to favor the positive effect of policies within ecological-economic systems.
Prof. Antonio Seccia, presented a comprehensive literature review on sustainability of logistics processes in the food supply chains. He discussed the evolution and the new challenges that logistic has to face in the future to improve sustainability. Finally, he pointed out that despite many emerging innovative strategies adopted by retail sector and its key role in the food supply chains, the literature is still lacking in formalized studies about sustainability in food retail sector. In a new perspective, retailers should consider sustainability as a business objective because it allows to develop competencies that give rise to competitive advantages improving the company reputation and, consequently, the store loyalty.
The two days of the conference have been dedicated to the presentation of 25 short papers accepted after a blind review process. Papers were divided into 6 parallel sessions. In the first day of work, scientific sessions covered different subjects such as "Consumer Preferences and sustainability in the food chain", "Environmental sustainability in agricultural and food production", "The measurement of sustainability in the food system". These sessions were chaired, respectively, by prof. A. Banterle, University of Milan, prof. G. Marotta, University of Sannio, and prof. L. Casini, University of Florence.
In the first parallel session the following papers were presented:

- *Sustainable food choices: from motivations to purchases, from food to the lifestyle* (Maria Bonaventura Forleo, Angela Di Nocera – Università degli Studi del Molise);
- *"Ready to eat" and fresh products demand through scanner data* (Antonio Baselice, Antonio Stasi, Francesco Diotallevi, Andrea Marchini, Gianluca Nardone - Università degli Studi di Foggia, Università degli Studi di Perugia);
- *Exploring factors effecting willingness-to-pay for sustainable wine through hypothetical and non-hypothetical experimental auctions* (Eugenio Pomarici, Riccardo Vecchio - Università degli Studi di Napoli "Federico II);

- *Wines from Lazio Region: an Evaluation from Three Major Italian Wine Guides* (Luca Cacchiarelli, Anna Carbone, Tiziana Laureti, Alessandro Sorrentino - Università degli Studi della Tuscia).

The works presented in the second parallel session were:

- *Economic and environmental sustainability assessment of Clementine crops scenarios in Calabria* (Alfio Strano, Giacomo Falcone, Anna Irene De Luca, Giovanni Gulisano - Università degli Studi Mediterranea di Reggio Calabria);
- *Sustainability and typical products. The case of the Water Footprint of "PDO Umbria" olive oil* (Laura Rocchi, Luisa Paolotti, Antonio Boggia - Università degli Studi di Perugia);
- *Life cycle assessment (LCA) of conventional and organic milk production* (Nadia Palmieri, Maria Bonaventura Forleo, Nicola Zurlo, Elisabetta Salimei - Università degli Studi del Molise);
- *Wild Plants As Resource For Productive And Economic Purposes: Do Reasons Exist To Develop New Supply Chains?* (Alfonso Silvio Zarbà, Giuseppe Di Vita, Valeria Allegra - Università degli Studi di Catania).

In the third parallel session the following papers were presented:

- *The evolution of Life Cycle Assessment (LCA): some guidelines for future research in the wine sector* (Graziella Benedetto, Gian Luigi Corinto, Benedetto Rugani, Ian Vázquez-Rowe, Enrico Benetto - Università degli Studi di Macerata, Università degli Studi di Sassari, Public Research Centre Henri Tudor);
- *The use of environmental, economic and social indicators as decision support for the advancement of farms towards sustainability* (Anna Gaviglio, Mattia Bertocchi, Simone Silvestri, Alberto Pirani - Università degli Studi di Milano);
- *New methodological frontiers for sustainability assessment: a multidimensional vulnerability framework for the agrofood system* (Paolo Prosperi, Thomas Allen, Martine Padilla, Iuri Peri – Università degli Studi di Catania, Mediterranean Agronomic Institute of Montpellier);
- *Assessing food security: economic issues in Southern Mediterranean Countries* (Luca Camanzi, Laura Solaroli, Giulio Malorgio - Università di Bologna);
- *How to include sustainability criteria in decision making for the food sector? A methodological proposal* (Clara Cicatiello, Silvio Franco, Barbara Pancino - Università degli Studi della Tuscia).

The second day of the conference started with the session on "Consumer Preferences and sustainability in the food chain" chaired by prof. G. Malorgio, University of Bologna. "Social Sustainability in agricultural food production" was the topic of the session chaired by prof. G. Martino, University of Perugia. The final session, chaired by prof. A. Casieri, University of Bari, explored the theme "Public Policy and sustainability of rural areas"
In the first of these sessions the following papers were presented:

- *Market strategies in the beef sector: a discrete choice experiment for the segmentation of consumer preferences* (Gabriele Scozzafava, Leonardo Casini - Università degli Studi di Firenze);
- *Consumer propensity for organic wine: a field study using a discrete choice- experiment in Friuli Venezia Giulia* (Stefania

Troiano, Tiziano Tempesta, Francesco Marangon - Università degli Studi di Padova, Università degli Studi di Udine);
- *Consumer preferences for pasta with multiple quality attributes: a choice experiment with a real-life setting approach* (Carla Cavallo, Teresa Del Giudice, Francesco Caracciolo, Rossella Di Monaco - Università degli Studi di Napoli "Federico II);
- *Consumer behaviour between convenience and environmental sustainability: the case of 'Canestrato di Moliterno' cheese* (Vittoria Pilone, Caterina De Lucia, Miriam Spalatro, Piermichele La Sala, Francesco Contò - Università degli Studi di Foggia).

In the second session the papers presented were:
- *Social Embeddedness in Farmers Decision Making* (Giuseppina Migliore, Luigi Cembalo, Francesco Caracciolo, Alessia Lombardi, Giorgio Schifani - Università degli Studi di Napoli "Federico II", Università degli Studi di Palermo);
- *Assessing social relationships within Local Action Groups: a worthwhile tool for measuring LAGs' effectiveness - Experiences from two Sicilian LEADER LAGs* (Gioacchino Pappalardo, Doris Marquardt, Biagio Pecorino - Università degli Studi di Catania, Institute for Regional Development and Location Management - European Academy of Bozen);
- *Social sustainability and development of wine production: the case of Umbrian wines* (Francesco Zecca - Università degli Studi di Roma "La Sapienza");
- *Agri-food supply chain and sustainability: towards a measurement tool for socially responsible products* (Maurizio Canavari, Roberta Spadoni, Concetta Nazzaro, Giuseppe Marotta and Alessio Ishizaka - Università di Bologna, University of Portsmouth, Università degli Studi del Sannio).

In the last parallel session the following papers were presented:
- *Sustainable development in rural areas: a comparison on governance among some European experiences* (Daniela Toccaceli - Università degli Studi di Firenze);
- The sustainability of rural diversification into tourism: a study in the Italian regions of the «convergence» objective (Angelo Belliggiano, Stefano De Rubertis, Pierfrancesco Fighera - Università degli Studi del Molise, Università del Salento, Ministero dell'Ambiente)
- Urban Systems, Urbanization dynamics and land use in Lombardy region: evidence from a spatial analysis (Gianni Guastella, Stefano Pareglio - Università Cattolica del Sacro Cuore).
- *Networking practices involving local small firms: a case of rural innovation in Friuli Venezia Giulia* (Italy) (Ivana Bassi, Nadia Carestiato, Lucia Piani - Università degli Studi di Udine)

The conference was held under the patronage of the Ministry of Agricultural, Food and Forestry Policies, the Apulia Region (Assessorato alle risorse agroalimentari), the Municipality of Lecce. We also acknowledge the support of University of Foggia, University of Bari – Aldo Moro, National Institute of Agricultural Economics (INEA), Dare Puglia, Chamber of Commerce of Lecce, Province of Lecce and Foundation Caripuglia. A special thanks to the members of the Organizing Committee whose precious contribution ensured the success of the Conference.

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PLENARY SESSIONS

Pursuit of Green Food Production

Ray Huffaker (University of Florida)

The 2012 Global Food Policy Report issued by the International Food Policy Research Institute (IFPRI) calls for a "green economy" in agriculture that "improves human well-being and social equality while significantly reducing environmental risks and ecological scarcities." The report calls for markets to "provide the right signals (e.g., prices that reflect the scarcity value of natural resources) and establish and enforce secure property rights [in natural resources]." The report identifies water scarcity as factor limiting food production in both developing and developed countries. Since agriculture is the world's largest water user (responsible for about 80 percent of all fresh water withdrawals), the report emphasizes the need for "economic incentives for improving water conservation in agriculture...". In particular, agricultural water use efficiency must improve to "proactively support sustainability goals."

The pursuit of a "green economy" in food production is a worthy goal. Ecological resources are indispensable inputs to agriculture, and their degradation threatens food production and the supply of fresh water – indispensable inputs to human life. However, in expecting markets to "provide the right signals", the report fails to account for persistent externalities that render markets chronically inefficient and ineffective in protecting ecosystem resources. The IFPRI report falls into the trap of establishing the artificial world of perfectly competitive resource markets as a real-world benchmark. Perfect competition is a theoretical construct in which resource uses engage in private negotiations at zero transaction costs leading to agreements that maximize wealth regardless of how property rights are initially assigned. Prices provide the "right signals" because price-distorting externalities cannot persist – they are immediately negotiated away. This is the popular Coase theorem, which we will refer to as Coase I.

Ironically, Coase did not intend for Coase I to explain how the world actually works (Fox 2007). Rather, in 'The Problem of Social Cost', Coase studied perfect competition as a stepping stone to his more realistic analysis of an economy with transaction costs (Coase 1960). He developed what some have called the "second Coase theorem" (Coase II) for the case of transaction costs: "In a world with positive transaction costs, judicial activism or legislative action has the potential to increase efficiency by reallocating property to higher valued uses when transaction costs prevent this occurring through voluntary exchange" (Coase 1960). He warned of risks associated with involving the government in allocating resources; in particular, the potential for government to be captured by special-interest groups.

Coase II provides a more productive point of departure for understanding real-world barriers to achieving a green economy. It identifies the key role of transaction costs in explaining market failure to correct for persistent externalities preventing efficient resource allocation. It recognizes that governmental corrective action may increase allocative efficiency, but that government action may fail for systematic reasons. We apply Coase II to consider the persistence of two water-related externalities that threaten the supply of water and water-related ecological resources worldwide: dams and improved on-farm irrigation technologies.

Fish Externalities from Dams

Dams create several important benefits including hydroelectric power, flood control, and stored water for irrigation, industrial, and municipal use. However, dams also prevent the free flow of rivers at the expense of migra-

tory fish populations and fishing economies. How do transaction costs contribute to the persistence of fishing externalities from dams? Consider the case of the Columbia and Snake Rivers in the U.S. Pacific Northwest. Since the late 19th century, the construction of eighteen hydroelectric dams transformed the rivers from free-flowing to a series of backed-up slack water pools that obstruct salmon populations from migrating to the ocean and returning to river tributaries to spawn. Despite attempts to make dams more 'fish-friendly', wild salmon stocks have been decimated to the extent that thirteen salmon and steelhead species are listed as threatened or endangered under the federal Endangered Species Act (ESA). Wild stocks have been largely replaced by hatchery fish lacking the genetic diversity that would protect them from devastation by a single disease. This substantially increases the risk of commercial fishing.
Voluntary negotiations between dam owners, stored-water users, and commercial fishermen is prevented because regional water law does not grant private water rights to keep water in rivers–and thus to protect migratory fish habitat. Governmental restrictions against allocating property rights to an important group of resource users is the ultimate transaction cost preventing market negotiations from efficiently allocating water among competing users. Negative externalities perpetrated on some groups by others persist. Regional government protects instream flows by setting targets and holding some water rights in 'trust' that leave water in the river. However, as Coase predicted, government has failed to adequately protect migratory salmon habitat due to successful rent-seeking activities by irrigators to increase the priority of their diversionary rights and to weaken enforcement of instream flow targets.

The identical situation exists in the current construction of the Xayaburi hydroelectric dam and eight more planned constructions on the Mekong River in Laos (The Economist 2013). Environmentalists warn that the constructions will block the only channel for fish migration, promote extinction of endangered Mekong giant catfish and several other species, and irreparably damage local fishing economies and those of neighboring Cambodia and Vietnam. Although these countries are fellow members of the Mekong River Commission, whose purpose is to coordinate Mekong River management, they do not have the right to block Laos' unilateral decision. Again, competing water uses lack the property rights to engage in market negotiations, and the available international agreement is powerless to assign these rights. Fishing externalities will persist with no corrective mechanism in sight.

Stream-flow Externalities from Improved On-farm Irrigation Technology

Policy-makers look to irrigated agriculture as a fruitful source of water savings because the sector withdraws the largest amount of freshwater, and on-farm irrigation efficiency (i.e, the fraction of withdrawn water consumed by crops) is low worldwide with national averages ranging from 25-50% (Brown 2006). Agricultural water conservation programs worldwide seek to lower agricultural withdrawals required for crop production by encouraging farmers to increase on-farm irrigation efficiencies (Allen et al. 1997). The expectation is that reduced withdrawals conserve water by leaving it instream. Contrary to expectation, improved irrigation technology has not only failed to conserve water, but has further depleted scarce water supplies in real-world practice. Recent examples include the failure of increased irri-

gation efficiency to check declining aquifer levels in the North China Plain (Kendy et al. 2003), and the so-called 'invisible drought' in the lower Snake River Plain aquifer (Idaho USA) linked to increased irrigation efficiency in the upper Plain (Johnson et al., 1999).

The divergence between policy design and practice is due to a technological externality concealed in on-farm irrigation efficiency improvements. The externality is illustrated in the following hypothetical:

"A traveler withdraws $100 from a non interest accruing bank account for cash to spend on a trip. She spends $60 on her trip and redeposits the unspent $40. Can she save money by reducing the withdrawal from $100 to $75 if she continues to spend $60 on her trip?" (Huffaker 2010)

The traveler does not save money by reducing her pre-trip withdrawal. Her bank account is reduced by the $60 she spends on her trip. The key is that she redeposits the unspent $40. Under these circumstances, the only way that she saves money on the trip is to spend less than $60. If the hypothetical is changed so that she no longer redeposits unspent money (e.g, if all withdrawn money is always spent on the trip), then reducing her withdrawal would save money.

The same principles apply to irrigation since water in a river at a point in time can be viewed as money in a bank account. The irrigator makes a water withdrawal to apply to crop production. Consumptive use by crops is like money spent on the trip. Crops consume only a fraction of the withdrawal for growth. In return-flow river systems prevalent worldwide, the unconsumed water is redeposited in the river as an irrigation 'return flow'. Is water saved in return flow systems if the farmer withdraws less water to meet the consumptive needs of crops after an increase in on-farm irrigation efficiency? The answer is no! The farmer only saves water by reducing consumptive water use (i.e., spending less on the trip); for example, by irrigating fewer acres, switching to less water intensive crops, or irrigation current crops at a deficit.

The bottom line is that public policies intending to conserve water instead encourage private behavior that perpetrates a 'return-flow' externality that can unintentionally reduce water supplies at the expense of other water users if improved irrigation technology increases consumptive water use by crops. The externality is invisible to other water users who don't connect the irrigation improvements of the neighbors with their own declining water supplies. This is a classic case of transaction costs due to imperfect information. Why does imperfect information persist? The answer may well be that improved on-farm irrigation efficiency brings several private benefits including increased crop production, reduced labor required to monitor water application, and improved drainage of salts. There is little private incentive to connect irrigation efficiency improvements to reduced water supplies that can be corrected by lobbying for new dam construction at public expense.

Conclusion

Green food production is a noble pursuit. However, recommending that it can be achieved with market policies drawn from a fictional perfectly-competitive baseline ignores externalities prevalent worldwide that would not persist if this baseline were realistic. These externalities persist because of high transaction costs that governments and international commissions have failed to correct. In most instances, as Coase predicted, government corrective measures are corruptible by rent-seeking activities of powerful groups representing only a fraction of resource users.

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Does the Economy Need to be "Shocked" to be Sustainable?

Massimiliano Mazzanti (University of Ferrara)

Economic systems face many complex environmental challenges: reducing waste and material production, and cutting down on CO_2 emissions and other local pollutants, to name just a few. The 'environmental efficiency' of these economic systems should be further enhanced in order to increase the chances of their sustainability in the medium-long term (Mazzanti and Zoboli, 2009) by moving towards an absolute de-coupling between economic growth and environmental pressures (OECD, 2002). This is a necessary–even if not sufficient–precondition to achieving sustainability, which has not been reached in cases of pressures such as GHGs. In fact, scale effects have been shown to dominate technological dynamic effects thus far using the IPAT framework as a reference (Marin and Mazzanti, 2013).

One issue that arose even before the 2008-2009 'economic-financial crisis', further exacerbated by the ongoing economic stagnation in some world areas (e.g. the EU), is whether a smooth process towards sustainability is possible, or if the transition towards a sustainable economy (Rotmans, 2013) requires some radical changes and shifts along the way.

This is not purely an argument between radicalism and incremental reforms such as that of the historical clash between Marxist schools and Karl Popper's idea of 'incremental' reforms of social systems. It has more to do with the relative efficiency (dynamic costs and benefits) and efficacy – both to be accounted for – of different policy actions. On the one hand aimed at smoothly changing the environmental performance of economic systems (namely, decoupling indicators, in terms of absolute and economically 'relative' pressures on the environment), and, on the other, eventually bringing about radical changes (e.g. sharp changes in income-environmental pressure elasticity).

Even in the evolution-oriented Schumpeterian tradition, economic crises provide benefits in terms of the 'selection' of firms and the redefinition of competitive advantages through the adoption of radical innovation. This idea was already debated during the 2009 recession (e.g. during the April 2009 G20 summit), specifically through the discussion of whether the recession would be capable of acting as a turning point towards a greener economy based on a different type of growth (greener eco-innovative firms, a greater part of the public budget devoted to environmental expenditures, etc.).

Schumpeterian economists illustrate the role of innovation as a main driver of change (Borghesi et al., 2013). In the realm of sustainability, this is also a key issue that touches on the efficiency and efficacy of sustainable transitions: that is to say, whether market and policy shocks are the best way to generate the radical forms of change needed (such as curbing the amount of waste generated per capita through technological but also radical behavioral changes, (EEA, 2013a) and cutting CO_2 emissions by around 80-90% within 2050 as per the current EU and UK perspective).

If these types of deep-seated changes have seldom occurred in the last decades (see figures 1 and 2 for energy intensity and EU CO_2 dynamics in overall terms, variegated but pretty break-free over the last two decades), even when relevant policies are introduced into the economic system (EEA, 2013b), the history of the evolution of economic-environmental systems has actually witnessed some radical breaks.

One important example of this is how the 1999 EU Landfill Directive brought about a sharp decrease of waste being landfilled and recycled (EEA, 2009, figure 3), even if it did not do the same for waste generation.

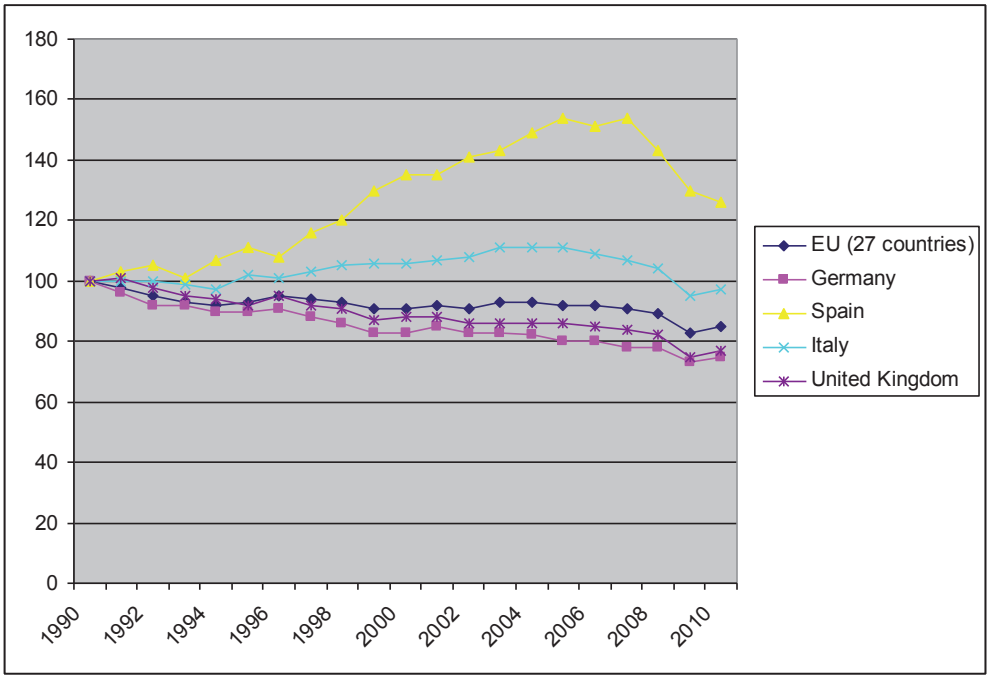

Figure 1. GHG trends (1990 =100), source EUROSTAT

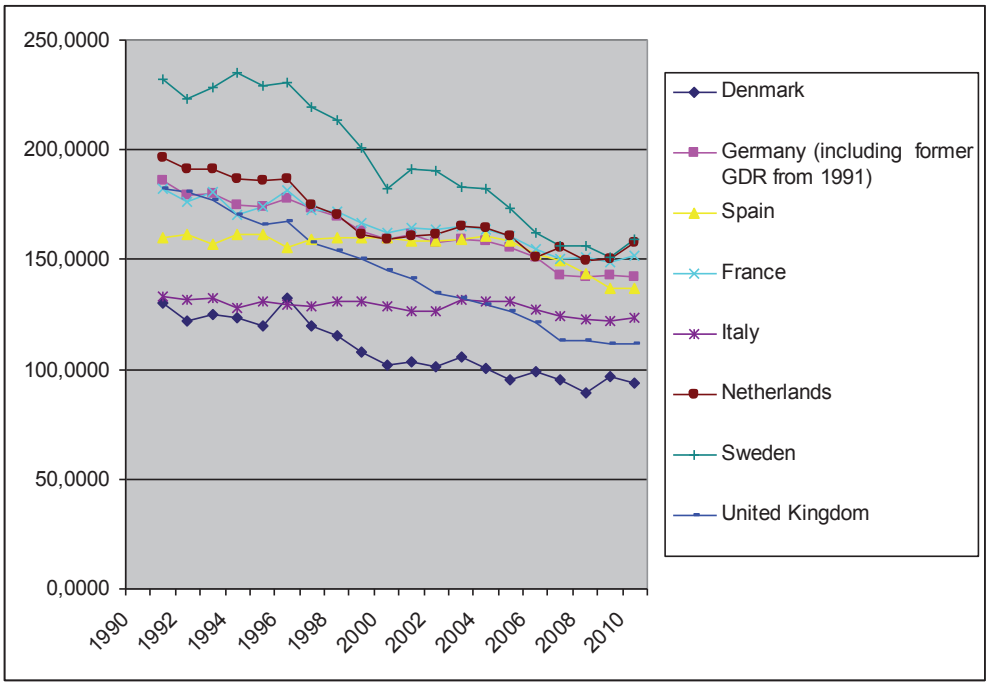

Figure 2. Energy intensity of GDP, source EUROSTAT

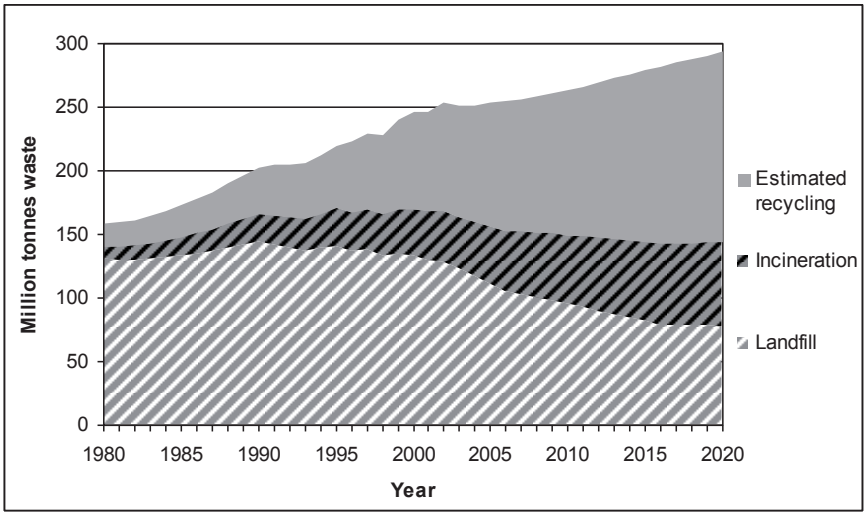

Figure 3. Waste Generation, waste management and disposal in the EU (EEA, 2009)

In addition, it is worth noting that the EU's compliance with Kyoto targets largely depends upon the very strong reaction – in terms of CO_2 abatement – of some Northern countries (Mazzanti and Musolesi, 2009, see Figures 4-6). Some of these countries had already promptly reacted to the market oil shock during the 80's and then introduced green fiscal reforms in the early 90's following the recommendations of the EU Commission lead by Jacques Delors ('The White Book').

These countries, that is to say Scandinavia, Germany, the UK as well, were most likely able to constructively react to shocks due to an accumulated relevant stock of 'institutional, social and technological capital' (Lehtonen, 2004): Stock that accumulates over time in societies and that sustains social and ecological sustainable development (e.g. factors considered in the Human Development indexes which encompass intangible sources of wealth as pre-conditions to development). Shocks of a market or policy nature are not effective in all frameworks. The build up of intangible forms of capital is the pre-condition in which shocks can modify more adaptable and flexible systems towards sustainable societies, through the emergence of technological and behavioral innovations. Adaptability depends upon the amount of 'knowledge' a system embodies. This approach is in line with the EU redefinition of the Lisbon agenda that focuses on sustainability through the integration of environmental, technological and social objectives.

Fiscal reforms - in the forms of carbon taxes (which periodically increase in real terms through a ladder system) and/or ETS systems with auctioned permits and decreasing caps - might complement market shocks (e.g. oil price peaks) and provide radical policy stimulus towards sustainability. Innovation are a key intermediate target for environmental policy to integrate sustainability and competitiveness (Costantini and Mazzanti, 2013): static efficiency of policies is necessary but not sufficient. Societies should think around the most effective ways to favour it: radical innovation changes have often reshaped the economic path.

The role of carbon pricing is harshly debated within the economic community and beyond. Carbon pricing is not the ultimate solution ensuring sustainability but it is an important part of this solution (Pearce, 2004). The correction of externalities and resetting of market prices are essential factors that need to be integrated within properly designed and mature socio-institutional systems (van den Bergh, 2010). Carbon pricing in its various forms, when properly adapted to different institutional systems (emissions trading, taxes, or a mix of these two approaches, which may also encompass the use of different economic tools, or command and control when deemed necessary for reasons of efficiency and efficacy), can deliver radical signals to economic institutions of private and public nature.

The current criticism of the EU ETS, primarily regarding its low efficacy and low induction of innovation, is reasonable, but this largely depends on two factors: the design of the EU ETS (in its lack of adjustment to times of recession, the absence of auctions in the first two phases), and the diminishing forecasts of (stringent) future policies (Borghesi, 2011), that the ongoing stagnation has further undermined, shifting policies towards growth and employment creation. Growth and employment cannot be generated, however, without sustainability, and thus it is necessary to reconcile the two. Well-designed environmental policy may provide a good starting point of a radical nature if it is deemed necessary (Chichilinsky, 2013, Chichilinsky and Eisenberger, 2009). The EU ETS has created a price where none existed; its current low level could be increased by reshaping the cap, and its efficacy could be augmented by using auction revenues to sustain innovation and new forms of economic growth (van den Bergh, 2011). Carbon taxes can complement this by covering non EU ETS sectors.

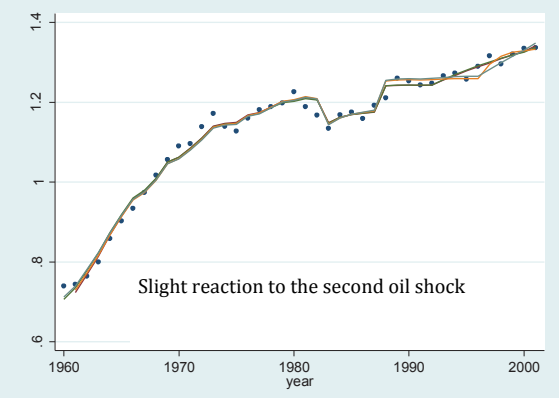

Figure 4. North America, Oceania, Japan CO_2 trends

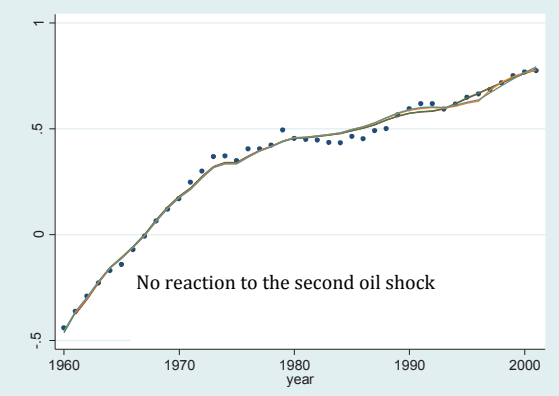

Figure 5. Southern EU CO_2 trends

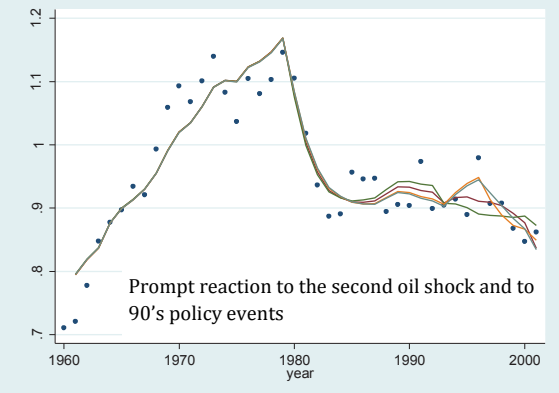

Figure 6. Northern EU CO_2 trends

Placing innovation at the center of the arena increases the chances of reconciling economic and environmentally-sound production. Innovation can be radically stimulated by a far-reaching and credible design of policies in terms of their expectations of firms and households, for example, a clear reduction of allowances and/or an increase in the carbon tax level up to plausible estimated costs of around 150-200$ per ton over a period of one or two decades. Credibility is both a part of policy design and of the intangible 'capital' societies possess (in policy making). This 'credible' shock can be healthy for overall economic sustainability. It should certainly be accompanied by institutional and social capital creation (Putnam, 2001), and able to provide the necessary stimulus – from the pricing/market perspective – for radical changes in behavior (the sharing and leasing of goods, a reduced use of materials in addition to recycling, etc.) and technology (private transport not reliant on fossil fuels, carbon capture and storage, a further increase in the integrated firm's efficiency, rather than isolated parts of production activity). Policy shocks might be useful for sustainability. To minimize costs. We must therefore define and construct the necessary social, institutional and technological preconditions to favor the positive effect of policies within ecological-economic systems. In this way, shocks may drive the evolution of new forms of technological and social capital as a result.

The thoughts presented here were largely stimulated by the lectures and paper presentations that took place in the framework of the workshop 'Modelling growth and socio ecological transitions–chances and challenges', for the European project WWW (Welfare Work Wealth), Wien, March 12th, 2013.

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Agriculture and Social Sustainability

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1. To the roots of social unsustainability

In the scientific and political debate on sustainability, the theme of social sustainability (SS) received prominence belatedly from the 1990s (Noorbakhsh, 1996; Sachs, 1999; UNCED, 1992; UN, 2001, 2004; EC, 2005, 2008, 2010; EP, 2007) and still is not totally explored, especially in agriculture and rural areas. Social issues in rural areas were, and still are, traditionally analysed in less developed countries and from different perspectives, from poverty and poverty reduction programs, to factors affecting social exclusion or strategies for social inclusion in rural communities, especially of vulnerable groups. In developed Countries where economic growth was supporting public expenditure in social services, less attention was given to SS.

More recently, worldwide countries are facing unexpected economic, social and environmental challenges that affect the idea of sustainability itself, especially from the social point of view. Global economy has been read as the capability of empowered actors to mobilise available stock of resources (goods and services, businesses, workers, information, capitals, OECD 2011). The management of mobilities take on a strategic value in the new regime of accumulation and it is the prerogative of a small number of businesses operating on the network (Gereffi, 2005)[1]. Such businesses have little interest in the social components of production and the related redistribution policies, as shown by the tendency to maximize gross profits - and therefore before - taxation (Palan, 2013). Touraine (2002) reads this as a process of de-modernization, which de-institutionalizes and de-socializes the production models. As a consequence economic growth seems not anymore able to affect the majority of people; meanwhile the process of growth itself meet new environmental limits perhaps sometime mis-considered. Such a process is contradictory in respect to the SS theme, which to unfold, needs different models to create economic, social and environmental values, and a new coherence in local life[2]. In the following chapters, thanks to the polysemy that the topic is acquiring, we will focus on the scientific and political debate on the meanings and implications that SS assumes in the agricultural-rural areas (SSARA).

2. Social sustainability: an evolving concept

Social sustainability (SS) is the third pillar of the wider concept of sustainability but only recently has found systematic and more organized attentions and definitions (Metzner, 2000). SS, in terms of for example the environment, refers to the possibility among current (intra-generational equity) and future (inter-generational equity) generations to have equal access to social resources, including traditional and emerging social aspects as presented in the table 1.

According with Colantonio (2007, 2008, page 6): "SS concerns how individuals, communities and societies live with each other and set out to achieve the objectives of development models, which they have chosen for themselves taking also into account the

1. Nowadays a small number of enterprises (less than 1500) produces a larger part of the world economic income (60%). In the main while one third of the wealth moves towards fiscal paradises and the Gini index is decreasing since the '80 of about 10%.

2. The Jackson' idea (2009) of "prosperity without growth" designs a system able to create a new overlay among three pillars of sustainability where the flattening of income earned and hours worked, may meet a stronger focus on the quality of relationships and social capital, on the environmental quality needed to support the welfare of people, investments in technology and work to protect and improve the environment (see also Stglitz-Sen-Fitoussi report).

Traditional	Emerging
Basic Needs, including housing and environmental	Demographic change (aging, migration, and mobility)
Health	Social mixing and cohesion
Education and skills	Identity, sense of place and culture
Employment	Empowerment, participation and access
Equity	Health and safety
Human rights and gender	Social capital
Poverty	Well being, happiness and Quality of life
Social Justice	

Table 1. Traditional and emerging features in social sustainability (Colantonio 2008)

physical boundaries of their places and planet earth as a whole. At a more operational level, SS stems from actions in key thematic areas encompassing the social realm of individuals and societies, ranging from capacity building and skills development to environmental and spatial inequalities. In this sense, SS blends traditional social policy areas and principles such as equity and health, with issues concerning participation, needs, social capital, the economy, the environment, and more recently, with the notions of happiness, well being and quality of life.

The theme of SS is on the border between theoretical insights and political dimension (Littig and Griessler, 2005) making reading and evaluation a complex task.

Following the urbanization of the world population and the urban crisis, SS has been explored with reference to urban regeneration (Colantonio, 2008; Dixon, 2011; Berkley Group, 2012) by emphasizing the tensions between economic development and progressive social disintegration (Polese and Stren, 2000), or by analysing paths to strengthen urban communities (Colantonio, 2008, Berkeley Group, 2012) and to achieve urban sustainability through participation, strengthening of social capital and the responsible behaviour of businesses. The urban project of SS, strengthen welfare and the efficient use of resources, the good quality of the environment, and the promotion of adequate systems of planning and management (Dixon, 2011; GRVD, 2004; Colontonio, 2007). Cities are called on to ensure SS (equity, inclusion, adaptability and security), by working on the way we live and work, building the collective identity of places, the way people learn, live and play, and managing the mobility of people (GVRD, 2004).

Another aspect of SS has been explored looking at the social implications of environmental sustainability (Vallance et al, 2012) and distinguishing between: development sustainability, which addresses poverty and inequity; bridge sustainability with its concerns about changes in behaviour in order to achieve bio-physical environmental goals; and maintenance sustainability, which refers to the preservation of socio-cultural patterns and practices in the context of social and economic change. This view is also relevant in agricultural and rural areas in connection with transition towards a more sustainable way of producing.

In our perspective, the debate on urban SS experiences two limitations:

- it neglects its relational aspects[3] and opens to a new rural/urban divide in SS analysis and disorients intervention and policies (Shucksmith, 2011),

3. Thus, access to food and health for urban classes is linked to socially sustainable food supply chains in terms of safety, health and food democracy (Psarikidou & Szerszynski, 2012, Morgan, 2009, Morgan et al 2008), but also the ethics of workers' rights. Similarly, in rural areas, access to health and services depends on welfare policies which cannot be separated by the onset of symbolic and material relations between territories.

- it has an ex-post evaluation logic which barely clarifies random factors. Conversely, the understanding of the relationship of cause and effect, offers an insight to the interdependency of diverse factors affecting SS[4].

In any case, the debate on SS highlights a stimulating research perspective for a better understanding of the meanings of SS in agriculture, in rural areas and in relations with urban ones. We will review the ways in which topics related to SS in the agriculture and rural environment are approached and try to suggest new way to explore the SS concept.

3. Social sustainability in agriculture and in rural areas

The social dimension in the rural areas seems to widely impacts not only on the quality of life of single persons, but also on the collective dimension of local communities, on the quality of the agricultural processes as well as on the territorial economic viability.

From this perspective SS everywhere matter to economic value creation itself, on the possibility to run agricultural economic activities, but also on the equity and fairness of the existing ones. In the agricultural and rural sectors, although the analysis on specific aspects of SS is widespread, recent organic reflections are lacking. In what has been called the "global countryside" (Woods, 2007), different social conditions of production have been interpreted, openly confronted by the liberalization of agro-food systems (Bonanno et al 2001; McMichel, 1996). As a result, agricultural products become carrier of new -positive or negative- social meanings. In this perspective, it is legitimate to question how agriculture and rural areas can support the growth of overall sustainability and, at the same time, the extent to which SS is affecting agriculture and rural areas (SSARA). We would suggest that SSARA concerns three dimensions:

- territorial: where SS is a prerequisite to ensure the tangible and intangible resources used by people and communities involved in the management of agricultural production (i.e., specialized, and in its evolution also multifunctional, diversified and cultural) and living in rural areas.
- procedural: which assesses the social implications of agricultural production. In this case, we will examine the positive and negative externalities of agricultural processes in the production of social

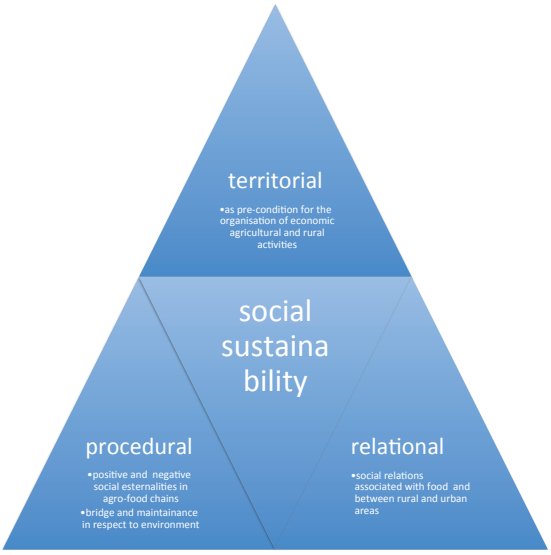

Table 2. Social sustainability in agriculture and rural areas (Source: Author)

4. Thus, the containment of eating disorders (anorexia, obesity, bulimia), which place great limits in western societies on access to food, requires coordinated policies to prevent food patterns (food that fattens), to increase the freedom of consumer choice, rethinking the operation / conditioning of agro-food systems. Equally, the fiscal crisis of the state, while demeans the presence of social-health services, requires a transition towards innovative models capable of contributing to SS in rural areas.

public goods, but we will also refer to the environmental vision of SS looking at the application of themes from the "bridge" to the "maintenance" of sustainability (Vallance et al, 2011) in the evolution of agricultural and land management in a key to environmental sustainability;

- relational: whose dynamic nature refers to the social relations - often beginning with food - established between different social groups, and which configure new topographies in the same relationships between rural and urban areas and new design concepts of rurality and habitus. This area of SS is linked to the former, albeit in a more dynamic perspective and design.

The three dimensions SSARA are integrated from factors and causal mechanisms and are combined to ensure the achievement of adequate levels of SS, not only in rural areas but logically, also in interaction with the urban ones, as indicated in the tab. 3.

SS	SS Agricultural / Rural		Outcomes of SS in urban areas
	Actions on	Impact on	
Territorial	Human capital: • social structure and changes • accessibility of formal /informal services for people, • education, and integrated development of tacit and codified knowledge Natural capital • Social aspects related to access to basic, natural and productive resources Share capital • identity, pride, belonging, sense of place, local culture • connectivity Institutional capital • Participation/management of local governance, claim	• Social inclusion and employment less empowered people, and gender issues, active participation in the communities of young and old, generational transmission of knowledge and social resources • Identity, professional and local pride • Accessibility to production processes by young people and new entrants to local areas • Replacement, stability of the population • Social mixing and integration between old and new inhabitants of a locality • Equity, quality of life, well-being, stability	Human capital: • Cultural diversity Natural capital • Use of natural resources in a non-urban context • Stability of local areas and civil settlements • access to basic resources: water, landscape, hreen infrastructure
Procedural	• Organization of processes: • Social Externalities -negative/positive- production processes • SS as a function of environmental change of management of processes and local areas		• Education and introduction to nature and its management • Nutritional education and critical consumption • Availability of food • Symbolic characteristics and quality of food consumed • Food stability and security in terms of shocks • Affordable access to food
Relational	Building new identities and new visibility, professional pride Social justice Human and gender rights Equity Social mixing and cohesion Participation in the construction of the future and new identities Inter-regional solidarity pacts		• Co-production of food • Knowledge building for the future • Construction of new identities • Construction of stability • Ethical attitudes of consumption • Inter-regional solidarity pacts

Table 3. Links and outcomes in Social sustainability in agriculture and rural areas (Source: Author)

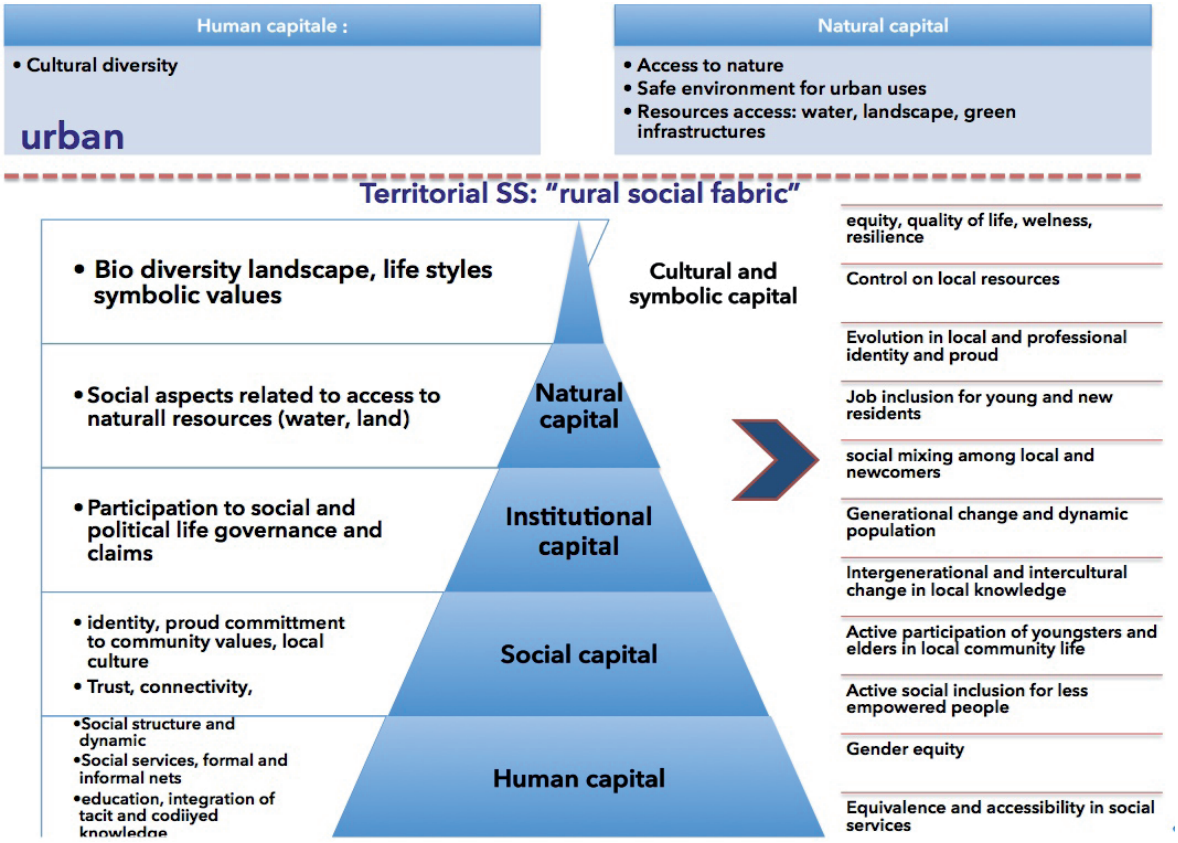

Table 4. Links and outcomes in Social sustainability in agriculture and rural areas (Source: Author)

3.1 The territorial dimension of social sustainability

The organization of vibrant and durable rural communities regards diverse elements linked to the organisation of human and social capital, the organisation of local culture and identity, access to services and to natural resources. Territorial SS ensures useful preconditions for the development of agricultural production, but has also a number of effects on the overall sustainability of the local system. It ensures the protection of the local area capable of providing physical security to civil settlements, access to important resources, including water in addition to food, the ability to access the diversity that rural communities with their environmental and cultural capital are able to provide the urban classes, for learning and recreation, but also as a source of funds for living and for the construction of possible prospects for the future. Thus, SS in its territorial dimension, in addition to being a prerequisite for the evolution of the presence and characteristics of agriculture, also constitutes the conditions for asserting the urban SS itself.

Territorial SS has been traditionally differently analysed in diverse Countries. In LDC rural communities, the focus on social issues has traditionally been on the material aspects of poverty and deprivation, and, recently, on the resilience of communities in the face of shocks (Skerratt, 2013; Smith et al, 2012; Marc et al, 2013).

Category	Relevant aspects	Possible actions	References
Young people	The formation of identity, pride in belonging, intergenerational relations, perception of rurality in relation to urban equality, structural conditions for the permanence or entry of other young people	Innovation welcome, granting of freedom, equal dignity of voice, open participatory processes Evaluation in the symbolic creation of the new rurality	Jentsch 2004; Rye, 2006 Byun, 2012; King, 2013; van Gundy, 2011; Schucksmith, 2004;
Women	the extension of their role in the social reproduction and economic phase with generally profoundly innovative ways compared to masculine management styles	Gender and conciliation policies, support for entrepreneurship and participation in public life	Bock, 2004; Bock et al, 2006
Elderly	Recognition of the role, evaluation of contextual skills, intermediaries in the production of trust	Active promotion of longevity, accessibility to services, participation an trust in local ties	Massoli 2003; Milbourne 2012; Glasgow 2012
Migrants	Analysis of their needs and fragility, the need for social integration	Local integration, services, policies for legal control and job rights	Kasimis, 2003; Findlay 2013

Table 5. Social groups in rural areas and specific issues (Source: Author)

Chambers and Conway (1992), reworking the Sen' concepts of capabilities and functioning (Sen, 1984, 1987), discussed the issue of livelihood strategies, as active pathways to generate prospects for sustainability. In the DC, attention was given to the theme of deprivation and the exclusion of specific social groups (Milbourne 2007, Milbourne et al 2012, Shucksmith, 2004, 2011, Shortall 2004), the crisis of opportunity (Shucksmith et al, 2006), and poverty and exclusion in/of rural areas (EC, 2008), but also to the availability of equivalent services in rural areas (OECD, 2008) and the difficulties/exclusions that can result for specific social groups (tab. 5) due to poor accessibility, also in terms of the health (Philo et al, 2003; Blackstock et al, 2006; Yang et al, 2011), or to the reorganisation of local immaterial value like trust, proud, identity (tab. 6). More recently, the debate on multifunctional agriculture and diversification (Huylenbroek 2003), the cultural turn (Marsden et al, 1993) have shifted the focus to immaterial resources, to the cultural deposits of development (Ray, 1998), and local capitals (environmental, economic, human, social, institutional and symbolic/cultural) as a resource for individual and collective paths in an area (Chambers et al, 1992; Haan, 2000). Such resources are activated through networks (Ploeg et al, 2010, Murdock 2000; Murdock et al, 2003) and flows - financial work, tourists, markets, information – that cross localities (Castells, 1996). According to this interpretation, the locality emerges from the social representation of space, in its manual and symbolic artefacts, meanings, values and identities of individuals (Harvey, 1996)[5].

5. The vision of the rural idyll is the result of this process generated, in large part, by the urban perspective of rurality. It assigns a positive relief to such features such as

element	features
trust	Indicates the level of expectation in terms of a second actor and the result of attitudes such as confidence, honesty, integrity, competence, and credibility (Curry, 2012; Fisher, 2013). It is created in personal relationships (personal trust), with or between organizations (system trust) or in interactions where exercising trust has a lower cost than a lack of trust (instrumental trust) (Simmel 1990, 1992). It is a temporary good audited and conditioned by the dialogue in the network. It is destroyed by the emergence of free-riding and is strengthened by positive confirmations.
identity	A personal and social construct linked to a shared perception of norms, structures and practices of the reference community, based on a sense of acceptance and belonging (Cloke et al, 1994; Gierveld Fast and de Jong, 2008) and is subject to a process of on-going mediation with new residents (Laoire, 2007), to pressures related to social fragmentation and to global trends, to possible strengthening resulting from the promotion of community resources (Di Iacovo et al 2004);
pride	Pride comes from self-esteem (Luhtanen and Crocker 1992) due to the convergence between a person's own way of being, feelings and personal expectations (Harter, 1985). In terms of the agricultural profession it stems from personal and collective appreciation in relation to professional identity - usually also in relation to the characteristics of the company, by the appreciation received from members within and outside the community with personal relationships are established (e.g. compared with consumers in solidarity purchasing groups) or impersonal (e.g. social acceptance of the shepard profession). Dessein (1997) identifies twelve concepts (Autonomy, Being part of the tradition, Craftsmanship, Family atmosphere, Visual attractiveness of the farm, Entrepreneurship, Attitude of the government, Affinity with nature, Respect from other agricultural actors, Acquiring money from farming, Being part of mainstream society, Dependence on subsidies, Farmer-citizen distance, Image of agriculture, The Sense of the job, Integrity, Perseverance, Product prices, Balanced proportions of work- family spare time, Producing food, Balance of power, Local embeddedness of the farm, Everyday surroundings, Creating employment) that - with reference to farmers in Flanders- are characterized - positively or negatively - by the pride of being farmers. Of these, especially the difficulty of managing relationships with institutions and with society in general, has negative influences. They concern socially constructed aspects, which vary with the development of agricultural models (traditional, modern, multi-functional) and social expectations with respect to the sector and rural areas (Villa, 1999; Burton et al, 2006).

Table 6. Pride, identity and trust in social capital (Source: Author)

In the perspective of the economic promotion of the symbolic values of the localities, agricultural processes became directly connected with cultural and relational community resources. But not without contradictions: especially when active members in the creation of the symbolic values do not take part in the economic benefits that they prop up (like the elderly or the unemployed). Also as a result of the growth of mobilities (Glasgow *et al*, 2012) communities are crossed by new flows - people, relationships and communications - which make cultural homogeneity more uncertain and questionable. The most influential groups and visions can thus exercise a domain in the organization, creation and exploitation of space, even in conflict with minority views, only to end up influencing the identity of the individual, the evolution of the sense of place and its symbolic representation but also favouring more modern exclusions, segmentation in new classes, enclaves and hierarchies (Shucksmith, 2011), new relations of power capable to control material and symbolic resources of the community (Munkejord, 2006; Prins, 2012; Laoire, 2007; Stockdale, 2006; Milbourne, 2007).

the existence of dense relational ties, direct and continuous relationships, the transparency of events, the quality of local environment and more peaceful life. This view contrasts the rural dull, according to which in rural areas, has a strong social control, a lack of tolerance towards diversity and change, and the absence of opportunities, knowledge and entertainment. The consequences of this are illness, stress, and distancing of some of its members, including youth, women and people with a higher level of education.

The territorial dimension of SS focuses on those factors that allow the reproduction of human, social, cultural and access to natural capital (more details in table 7), in the so-called "rural social fabric". There are organised the "spatial practices" (Lefevre, 1996) that affect the achievement of a level playing field, quality of life, well-being, and the stability of a rural community.

	Description	Specifications
Human Capital	*social structures*	evolution in a scenario of dynamic mobilities of local/external population; ageingand natural dynamic
	education, training and knowledge creation;	innovative ways to facilitate accessibility for different social groups as well as an integration between tacit and codified values and to facilitate transmission between generations and old/new residents and of such knowledge related to environmental and natural/production management
	access to daily support services for diverse categories	according with trends in national welfare (Esping-Andersen, 1990), the type of hierarchical/ welfare/paternalistic relations vs. co-production/social justice subsidiaries (Barnes, 2008) in the planning and management of services), the role taken by the state, families, third sector, and community relations in their organization and in the provision of both formal and informal nets, adopted. The daily routines of people depend on the availability of services, in terms of the cycle of life and practical needs (nurseries, support for parenting, sports services, social services, and healthcare). Their availability influences gender conditions (in the participation in stages of material production or reproduction of sociality, Bock, 2004; Bock et al, 2006), conciliation with the daily rhythms of life, inclusion of subjects with low bargaining power, the evaluation of non-active people in the market – the elderly (Davis et al, 2012, Milbourne et al, 2012) and young - the integration of new and old residents (Findlay et al, 2013; Stockdale et al 2013), affecting social reproduction and community relations.
Social Capital	the form and type of relationships that develop in the community (Putnam, 1985; Granovetter, 1985; http:// www.socialcapitalgateway.org)	Social capital is a gauge of the stability and collaboration capabilities of an area, although closure problems have been underlined, where strong group relations lead to the exclusion of non-homogeneous or conflicting actors. It is distinguished between: • *bonding capital or strong ties:* relationships between known members of a group - friendship, family, professional –; • *bridging capital or weak ties*: relationships between groups and distant actors – also geographically - and with different membership. It influence the evolution of community relations, in the professional and commercial networks, with institutions, the ability to actively co-design change, (Fisher, 2013), build new markets, manage relationships with consumers, especially in more direct relations, but also the organisation of shared norms, organizations and practices and the active participation in local governance of the members of the community in the development paths. Another distinction is made between: • *linking capital* related to the connections between hierarchically ordered social strata; • *contested capital*, which concerns the relations that are activated during the protest regarding access to certain resources (Woolcock 2001).
Cultural Capital	defines the way of life of a community and the sharing of ideas, values which are morally right/wrong and desirable, of knowledge and past experiences, standards and material dimensions (physical and natural artifacts including landscape and local products) (Wilkinson **1991;** Brennan, 2009; Williams 1970; Plant et al. 1992, Park 1950; Plant et al. 1992; Hoage and Moran 1998).	Since it is layered by a community over time, under the stresses of outside cultures and the environment (Sorokin 1957, Williams 1970; Plant et al. 1992; Hoage and Moran 1998; Salamon 2003), its ability to evolve, consolidate, or perish, depends on the change in the social structure of the community, on the circulation of flows of people and information in the local area, on the dynamism of the relations between old and new residents, with new and urban social groups, and on the capacity in the local community to experience interactions with new ideas and values. Culture characterizes the place, marking its distance from others. The place, if it fades with the global communication (Williams 1970; Where 1988; Hoage and Moran 1998, Ray 2001), is likely to close in on itself in a defensive manner in relation to the displacements of change. The terroir, the culture of a specific production (e.g. wine, grain), various symbolic values of a local area (Bourdieu, 1986 Berti, Brunori, 2003, 2006), are socially produced and given value, but are not unalterable under the influence of phenomena such as commodification, rural tourism, the attraction of capital income, the emergence of new power hierarchies and types of interest with respect to an area (by new residents, new businesses, and from the failure to transmit traditional values). Thus, the cultural capital and its evolution, conditions and is strongly influenced by SS, helping to form and evolve its own components such as solidarity, in belonging (Dessein), culture and gender identity ((Brandth 1995 2002; Grace and Lennie 1998; Oldrup 1999; Saugeres 2002a; Heather et al. 2005), in order to influence the characteristics and evolution of the agricultural processes.
Natural Capital	Concerns social and cultural aspects, that regulate access to tangible resources of the community and their ability to be used and evaluated by the various members especially the less empowered (youngs, women, minority groups)	An equal access to **land** has an impact on the feature of local production and its evolution/innovation and may generate the potential exclusion of people, skills and ideas. The **availability and the quality of natural resources,** including water, is an increasing constraint for agriculture, especially in the face of climatic stress. Regulations of their use and access are often the result of social dynamics - related to ownership structure, to widespread knowledge, and to the institutional rules and environmental governance adopted - which require new a focus, adequate social conditions of employment, public and private participation formulas in the management and development of a co-governance environment (Olstrom). The quality of natural resources, then, is conditioned by correct and transparent management regarding such matters: the waste cycle, industrial pollution, and urban sprawl.

Table 7. Territorial Social sustainability: human, social, cultural, natural capitals (Source: Author)

3.2 The procedural dimension of social sustainability

Any focus on the social dimension in rural areas should not detract from the outcomes that agricultural processes generate for SS, both for people participating in the agro-food chains, and consumers. There is an ever-increasing number of aspects of SS in the rural and urban environments that see food, as a possible vector of social un/sustainability, depending on the way production, processing, logistics, trade and consumption are organized. The procedural dimension of SS has a dual significance:

- the positive and negative externalities of production activities on social components;
- social aspects related to the introduction of the criteria of environmental sustainability management of the various stages in the agro-food chain (Bridge-maintenance SS) (Vallance et al 2011).

The social externalities of food production regard diverse elements. In a world with a growing population, agricultural processes ensure food to support the SS of all populations from many points of view.
The access to the food is not just a problem of production efficiency (Chambers, 1991), but rather to the organization of agro-food sys-

Appearance	Positive externalities	Negative externalities
Food production as food	• Quantitative qualitative security of national and urban supply • Economic accessibility to consumption • Ease of finding food	• Instability of supply • Contaminated and potentially harmful food
Management of agro-food production processes	• creation of jobs and income in agriculture • impact on economy and on the local identity in rural areas	• use of non contractual work, compression of union rights of representation and exploitation of workers' associations • absence of equitable remuneration of independent farmers (self-exploitation, suicide); • exploitation of child labour • health and safety conditions where the work is carried out (use of highly toxic chemicals, without adequate protection, failure to comply with safety standards in the use of equipment
Organization - multifunctional and diversification - associated with the management of production processes	• active creation of social values in the management of production processes through active social inclusion • the evaluation of agricultural resources - processes, spaces, relational resources for economic diversification in the businesses and in support of local areas (education, hospitality, knowledge, downshifting).	

Table 8. Agricultural process and social externalities (Source: Author)

tems capable of promoting broad access of the population to a quantitatively adequate and healthy food (i.e. nutritious and secure food). An unequal distribution of income and therefore of the available food, the absence of adequate local sources (temporary or famine), the persistent and/or growing imbalance between the availability of production areas and food needs, are harbingers of possible social crises, capable of leading to tensions or social marginalization related to food (Koc *et al*, 1999; Cummins *et al*, 2002).

Agricultural processes provide also other social externalities, positive and negative. The social quality of production processes contributes to building conditions of justice and equity in local areas, which are then transmitted through food purchases. The production of positive social externalities, through inclusive, educational and relational activities, provides new support to the vitality also of urban areas. Externalities can be also negative when workers are exploited and rights not ensured. The social outcomes depend

on the socio-technical decisions and relationships which characterise the organisation of diverse agro-food chains, as well as of the attitudes of the companies involved, and of consumer choices, including the influence of food culture and information made available by the food choice environment (Brunori *et al*, 2014). The ethical and social outcomes of the agro-food chains are sometime non-transparent to final consumers. Especially in global markets, the understanding and control of the social content of food, also due to different national regulations, may be unsure and not always consistent with the minimum social standards that consumers are willing to accept.

The SS of agro-food products is not new, in so much as initiatives related to brands have been launched that attest to the ethical content of products as for the "fair trade" system[6]. The focus on the social justice of food is today extending to developed countries as soon as un-fair social conditions along the global chains started to emerge and new relationships of the food chains are established (see Relational SS). Answering to these new trends, some agro-food businesses have increasingly focused on SS as a feature of distinction, visibility and reputation within broad markets adopting corporate social responsibility strategies and ethic standards, certifications, and social accountability tools (Briamonte, 2012; Di Iacovo, 2007; Di Iacovo *et al*, 2005, De Meo, 2003; Marotta, 2006). Other firms from the private or the third sectors are implicitly copying with public services and local communities in the perspective of the civic economy (Bruni, 2012; Bruni *et al*, 2004) and civic agriculture (Lyson, 2004, 2006) by supporting the quality of life of citizens/consumers, on topics ranging from education to training, to the inclusion of quality food, to hospitality both in rural and peri-urban areas. There, the creation of economic value, occurs in parallel with the creation of social values - human and relational – within the new markets in which the relationship, reputation and voluntary work acquire new meanings of integration between economy and social development (Di Iacovo *et al*, 2013) like is the case of social farming initiatives (Di Iacovo *et al*, 2009; Di Iacovo, 2008; Dessein *et al*, 2010).

Social aspects in agricultural processes are also linked to the introduction of the environmental criteria. The strengthening of environmental scarcity and global warming has increased the focus on the use of visions, techniques and farming styles that are more efficient and respectful of nature, also in agriculture[7]. The analysis of SS thus looks at the conditions used to assist the evolution of human, social and institutional asset, through appropriate transition programs aimed at overcoming environmental issues related to the management of agricultural production processes (bridging SS) (Vallance et al, 2011).

6. The market for fair trade has traditionally invited consumers to forge relationships in support of communities in developing countries, through the payment of a fair price to producers and to communities, according to a form of universal solidarity that is translated into purchasing decisions. The "world's shops" have also represented a meeting point for many groups and movements from different political and religious backgrounds, helping to raise awareness around social issues and bringing them to the attention of a progressively wider audience.

7. In the preservation of the soil, in water management, but also in the consumption of non-renewable resources, in the outcomes of the production of non-fossil energy resources - e.g. biofuels - in reducing the environmental consumption related to livestock and the production of greenhouse gases in the processing and distribution of food stages of production

Bridging SS is socially constructed through:

- non-transformative actions (introduction of technologies with a lower impact on basically unchanged agricultural processes);
- transformative actions, aimed at substantially modifying visions, approaches and styles of conduct by the way of: the reconstruction of a shared technical vision and of public-private co-governance of the environment and management of fragile areas; the adoption of styles of conduct and productive values aimed at low consumption of resources.

On the other hand, *maintenance SS* looks at the habits able to maintain existing structures, techniques and behaviours and to ensure positive environmental outcomes (preserving landscape and cultural resources and avoiding the risks of transformation). On the contrary it studies also the resistance to changes (in terms of economic problems, investment, but also of social resilience to change)in technical/management choices that would affect the introduction of innovative practices able to mitigate environmental impacts. Similar remarks can be made regarding changes aimed at promoting the production of social public goods within the agro-food system by individuals, groups of people or institutions themselves. Nevertheless, to strength environmental sustainability of agricultural processes it is necessary to focus on the social aspects involved in the formation of the new knowledge needed.

3.3 The relational dimension of social sustainability

Food constitutes a plurality of cultural values and relationships, capable of highlighting territorial affiliations (the food culture of a country) or epistemic (vegetarians, vegans), daily lifestyles, consumption practices, and conviviality (the taste of food), having impact on quality of life and well-being. Food is also the arena for new forms of exclusion/marginalization (Koc *et a*l, 1999; Cummins *et al*, 2002) linked to the economic crisis (Brunori *et al*, 2012), such as psychological conditions (anorexia, bulimia obesity and eating disorders). Food confers status (Hirsh) and establish new relationships, friendships and social groups, for istance in the relations between consumers, or consumers and producers, as well as between rural and urban areas. According to Granovetter (1985), different types of ties are achieved in food, strong or weak, which vary greatly depending on the social content (positive or negative of food). Thus, there are:

- consumption patterns that reflect ecological citizenship (Dobson *et al*, 2006; Fonte, 2013), and therefore the principles of organic and universal solidarity, achieved through weak ties (i.e. mechanical and neo-communitarian) achieved through new forms of direct relationship between producers and consumers;
- the persistence of food utilitarianism through the unconscious (indifferent) purchasing of food with negative social externalities (perhaps in countries with less stringent social regulations) commercialized through conventional distribution channels, or, worse, conscious consumption (domineering) of food from processes that generate social exclusion (e.g. illegal hiring in some areas of agricultural production) and which regard relations of direct quasi-exploitation, sometimes, even with widespread social acceptance of the existence of unequal relations, or rather, justified by the need to ensure individual accessibility to food.

Type of tie	Ecological / ethical citizenship	Food utilitarianism
weak	Organic solidarity Purchase and consumption of ethical products made by non-famous producers and communities	Indifference Purchase and consumption of food by processes with negative social externalities by non-transparent supply chains
strong	New mechanical solidarity New links and direct relations and solidarity between producers and consumers	Dominance Purchase and consumption of food by processes with negative social externalities on supply chains

Table 9. Consumption behaviour and societal issues (Source: Author)

Agro-food environment	Positive social esternalities	Negative social esternalities
Organization of information communication activities on food and health	• on education and health related to food	• behavior and inadequate consumption patterns with: • eating disorders and related illnesses • Resulting in the emergence of food related diseases (obesity, cardio-vascular disturbances, emergence of tumors)
Organization of the agro-food system	• food democracy and freedom of choice in articulated and plural systems • Resistance to climatic and economic stress of the offer	• Lack of food democracy and freedom of choice in systems dominated by few actors • Exposure to climatic and economic stress of the offer

Table 10. Outcomes of communication flows and organization of the agro-food system on health and rights (Source: Author)

While food utilitarism reinforce the dissemination of agricultural processes with low-SS, ethical citizenships, highlight the development of innovative niches in which consumption passes from a purely utilitarian perspective towards choices characterized by intrinsic motivations, linked to moral and social values (Seyfang, 2006) in support of SS.
The transition along diverse approaches, however, does not only concern the individual dimension of consumption as much as its collective vision, linked to the configuration of a specific agro-food system capable of designing the environment of choice for consumers (Brunori et al, 2014). The food choice environment (FCE) is defined by specific rules, structures, institutions, codes of communication, information content and standards, which are defined by actors exercising their own power in the agro-food system (Nestle, 2002; Thaler et al, 2008).
FCE becomes the arena in which different actors are confronted to draw a hegemonic narrative and strengthen their own interests, as producers or consumers. The construction of a FCE, therefore, is contestable, so that the creation of conditions for food democracy depends on building many opportunities to exercise food consumption choices in the field of SS. Individual choices and the building of the FCE are related. In fact, if the latter affects the decisions of consumers and producers, it is also true that consumers and producers, in turn, can exert political action for change through a better integration between how the food is known about and produced (Goodman *et al*, 2002). These events are created: individually and according to the criterion of the consumer-voter, through the selection of available ethically sustainable solutions; through new group formations and movements, developing new initiatives around food (Social Purchasing groups and CSAs.); by institutional actions of co-governance in food planning, aimed at extensively repositioning resources in an innovative FCE, with wide and plural accessibility (Di Iacovo *et al*; 2013, Morgan, 2008).
Innovation in the relationship between producers and consumers, which are achieved in peer relations (Rossi, 2012; Fonte 2008) helps to reform aspects of identity, values, design skills, activation of new resources

and superimposing individual choices with a political tension for change by expanding the conditions of food choices and promoting higher conditions for food democracy (Lang, 1999; Hassanein, 2003). Such alternative food networks (Lockie *et al*, 2000) show the way to new relations between social groups by co-producing initiatives on localization, footprint reductions, community building, collective actions, and the building of new infrastructures of provision (Seyfang, 2009) starts to define shared perspectives of the future between urban and rural dwellers. The aspects of SS in agriculture are thus redefined and reconstructed. This is also achieved through the organization of innovative practices of production and consumption, capable of considering nutrition education, equitable relationships in price formation, but also supporting products from production practices that actively ensure the inclusion of less empowered people and who generate a positive influence on the previous territorial, and procedural dimensions of SS in agriculture.

4. Agriculture, rural areas and social sustainability: towards a project?

The theme of SS investigates in depth the contribution that agriculture can offer from the perspective of the changes due to the current economic, social and environmental crises and the actual accumulation regime.
The themes of rights, solidarity and responsibility are found in the constitutions of many countries, and has have been traditionally faced –at least in developed countries - with the division of the state and market, the legal protection of rights and the national solidarity for the welfare for those, people or areas, who had no part in the production system, or lived in difficult conditions. The breaking of solidarity and responsibility pacts and the increasing phenomenon of tax evasion, is putting in the political agenda of the States the control of capital and the fight against the system of shadow banks and tax havens. Even the field of human rights - especially at work - demands a global interpretation, able to avoid social dumping and extending rules and controls with regard to respecting workers' rights. In this case too, the effective action of states, representatives of businesses, consumers and citizens can push for the definition of new forms of inter-geographical solidarity and responsibility, through the gradual extension of rights, their monitoring, and the ability to select suppliers capable of ensuring adequate guarantees in this regard, even in agricultural markets.
Growing social contradictions matter with the definition of innovative solutions able to face in the same while economic, social and environmental sustainability. This evidence moves the need in the search for solutions outside of the lamplight, by redesigning the field of human rights and designing new ways of creating economic and social values, but also redistributing it through appropriate forms of welfare. On this even geographical scale of reasoning, the issues of rights, solidarity and responsibility, new variations can be found through the principles, like (Di Iacovo *et al*, 2013):

- *subsidiarity*: according to which the State reduces its direct universal and standardized intervention, while maintaining its responsibilities and acting in support of private action in understanding and solving territorial problems (Carrozza, 2007; Quadro-Cursio, 2007)
- *co-production*: with planning between users and different providers of innovative solutions aimed at responding more effectively and with new, non-specialist and less costly resources, in the organization of

responses consistent with the needs of the community, i.e. by simultaneously creating economic and social values, of public and private goods (Boyle *et a*l, 2009; 2010 Olstrom, 1996; Alford, 2002; Brandsen *et al*; 2008 Parks *et al*; 1981, Cahn, 2001);

• *civil economy*: the building of new business attitudes, based on responsibility and the ability to include the values of sociality in economic processes, within production processes as in the construction of markets, based on reputation, trust and the creation of new networks, including consumption networks (Zamagni, 2011; Bruni, 2012) ;

• the spread of *lifestyles, of consumption* and new relationships between producers and consumers (relational SS) to support positive dimensions of SSPP, through the co-design and re-organization of the circuits of purchase;

• *new relationships* between rural and urban areas, also through integrated actions and integrated policies on a local and regional scale.

In our proposal for achieving SS in agriculture and rural areas, we identified three areas of work on which to focus the research: *the territorial*, *the procedural*, and *the relational dimension*.

The goal is to lay the foundation for a new congruence between the economy and sociality in the context of a given resource between rural localities, the formal representation of rurality, and everyday lives (Halfacree, 2007). To promote an alignment between the public, private enterprise, third sector in terms of the way people perceive, think and live rural areas (Lefebvre, 1966), and the relationships with urban areas in a perspective of SS. A view of the future that requires a substantial transformation (Geels, 2004, 2010) of the plurality of actors in local areas - of private enterprise, social, agricultural and non-agricultural institutions. citizens, consumers - and which requires paths of social innovation (Murray *et al*, 2010) and policies in support of the management of the subsequent transition in order to deal with its complexities and opportunities.

A discussion which, in the European and international debate, still does not appear to be very fruitful, with a lack of attention and delay with respect to the problems and potential that agriculture and the rural areas can express in terms of SS.

It is time, perhaps, for a new social inquiry into agriculture and rural areas, able to explain the changes that are taking place in order to make them part of a new debate in society. The aims is to bring the issue of food production and stability of rural areas back more clearly within the general debate on the production of social sustainability.

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Innovative Strategies for the Sustainability of Logistics Processes in the Food Chains

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1. Logistics and sustainability in food supply chains

There are several definitions of logistics as a consequence of many scopes and meanings of it. One of the best known definition states that "logistics involves getting, in the right way, the right product, in the right quantity and right quality, in the right place at the right time, for the right customer at the right cost" (Mangan et al., 2008). Another definition considers jointly the aims of efficiency and effectiveness: "Logistics concerns the efficient transfer of goods from the source of supply through the place of manufacture to the point of consumption in a cost-effective way whilst providing an acceptable service to the customers" (Rushton et al., 2009). According to the Chartered Institute of Logistics and Transport (CILT), logistics is "the process of designing, managing and improving such supply chains, which might include purchasing, manufacturing, storage and, of course, transport." The Council of Supply Chain Management Professionals defines logistics management as "that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers' requirements" (Van der Vorst et al., 2005). Considering these definitions and others not cited here, it is evident that logistics concerns an integration of information flows, transportation, inventory, warehousing, material handling, packaging and security systems. So, an efficient and effective logistics management needs an integrated approach where all the elements have to be considered to get a balanced service level that includes transit time, reliability and, above all, cost. From a corporate function, especially considered as a source of costs, logistics has become a process that adds value to the production. Increasing consumer standards for food quality and safety have driven the attention of food and beverage companies to logistics management for gaining a competitive advantage (Fearne and Hughes, 2000; Hayenga, 2000; Lambert and Stock, 1993).

The concept of sustainability is commonly referred to the definition of the World Commission on Environment and Development (1987), known as Brundtland Report: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs." It concerns the balance between economic, ecological and social impacts at the level of the society in the long term (Aiking and Boer, 2004) which increasingly affects companies operating in the agriculture and food sectors. In fact, they have got to deal with the increasing attention of governments towards environmental and social impact assessment policies and standards, such as HACCP, BRC or ISO 22000, the growing concept of extended producer responsibility, encouraging the shift from a "cradle to grave" to "cradle to cradle" perspective, driven by either governments or leading private institutions, and the gradually raising concern in society to satisfy the needs of the present generation without compromising future generations' welfare (Quariguasi Frota Neto et al,, 2009).

Subjects operating in the food supply chains are increasingly undergoing pressures and incentives regarding the different aspects of sustainability: regulations, market competition, purchaser demands, response to stakeholders, pressure groups and firm reputation (Seuring and Muller, 2008). As a consequence, management practices have turned

to taking into account economic, social, and ecological sustainability as cornerstones aiming not only at increasing profits and serving customer needs but taking into account a broader range of stakeholder interests and societal issues (Crane and Matten, 2004). Therefore, a product needs to be socially fair and environmentally friendly in addition to being produced efficiently, competitively, and profitably (Kepler, 2004). Sustainability also includes the health and safety of human resources, ethical issues in procurement of raw materials, and animal welfare (Kleindorfer et al. 2005). It is increasingly clear that markets and regulations do affect organizational and business strategies in relation to sustainability (Vasileiou and Morris, 2006; Wognum et al., 2011).

The growing awareness of sustainability by stakeholders inevitably affects the strategies of firms, including the planning of logistics activities (Bettley and Burnley, 2008). Food companies have turned their attention to improving the management of logistics as the last frontier to acquire and maintain a competitive advantage (Fearne and Hughes, 2000; Hayenga, 2000; Lambert and Stock, 2000). The design of logistics processes no longer involves just a function of the variable costs, but is driven by the combination of the three variables: Profit, People, and Planet (Van der Vorst et al., 2005). However, it is evident that the economic goals of the firm must be clearly and explicitly recognised when the environmental and social dimensions of supply food chain management are undertaken (Carter and Rogers, 2008; Wognum et al., 2011). This step requires an integrated approach that links the decisions about logistics to the three pillars of sustainability in the context of the management of product quality (Carter and Rogers, 2008; Wang, 2011; Wognum et al., 2011; Chaabane, 2012). In recent years interest in the study of sustainable logistics has grown, mainly focusing on the analysis of some indicators of sustainability such as the reduction of greenhouse gas (GHG) emissions, particularly CO2, through the use of the methodology Life Cycle Assessment (LCA). This is an analytical tool for assessing the environmental impact defined in the ISO 14040 and ISO 14044 standards (Petersen and Solberg, 2002; ISO, 2006; SETAC, 2008; Kenny and Gray, 2009; Iribarren et al., 2010). This methodology allows the highlighting, in a transparent manner, of the environmental impact of the production of a unit of product or of a firm, both in the vertical dimension of the process (size of chain) and in the horizontal (sectoral dimension), measured in terms of CO2-equivalent (Finkbeiner, 2009; Boguski, 2010; Musanighe, 2010). Although in the literature are not yet presented considerable studies on sustainable supply chain management in the agri-food industry, there are many contributions about the application of the life cycle assessment (LCA) to food chain products and processes (Roy et al., 2009; Virtanen et al., 2011). The growing awareness of the necessity for a commitment by both businesses and the community in encouraging sustainable production processes in food manufacturing is leading to an increase in applications of LCA methodology in different categories of products (Roy et al., 2009; Virtanen et al., 2011).

2. Challenges for sustainable logistics

Nowadays food supply chains are required to be particularly adaptable and reactive at low cost in order to comply with the frequently varying customer demand. According to Chopra and Meindl (2003) the organization's and supply chain's performance is affected by four drivers:

- Inventory: all raw materials, work in process, and finished goods within an organization. The level of inventories influences the product quality, the delivery lead time, and the costs associated with delivery.
- Transportation: involves moving inventory from a point to another in the supply chain and it can imply the utilization of many combinations of modes and routes.
- Facilities: sites where inventory is stored, conditioned, assembled or processed. Main decisions with a significant impact on the supply chain's performance regard location, capacity, flexibility, connections with supplying sources and with customers.
- Information: consists of data and analysis concerning inventory, transportation, facilities and customers throughout the supply chain. It is potentially the most powerful driver of performance as it directly affects each of the other drivers.

The Information Technologies innovations and the advent of the Internet have led to the emergence of new technologies and to new applications of those already existing. Such technologies, aiming to optimize business processes by reducing inefficiencies, are crucial to the profound structural changes in food chains (Clark and Hammond, 1997; Fearne and Hughes, 2000; Ghisi and Silva, 2001).

The requirement of traceability throughout the supply chain, for guaranteeing food quality and safety standards, and the characteristic of perishability of food impose a time-efficient supply chain (Myoung et al., 2001) enhancing the demand of innovative technologies of information and communication for logistics processes (Hill and Scudder, 2002).

2.1 Aims of application of the Information and Communication Technology

New Information and Communication Technology (ICT) tools facilitate more advanced information exchanges to meet the needs of the market (Cachon and Fisher, 2000), enhance organizational and technological collaboration in the supply chain (Christopher and Juttner, 2000), help companies to improve their responsiveness (Van der Vorst et al, 1998; Cachon and Fisher, 2000; Myoung et al. 2001; Bourlakis and Bourlakis, 2006; Shanahan et al., 2009 Salampasis et al., 2012), and allow a more efficient planning and optimization within the enterprise (Ahn et al., 2003). Information technology can deal in an effective way with operational inefficiencies, increase corporate productivity, and enhance firm competitiveness (Andersen, 2001; Lambert and Stock, 1993; Stratopoulos and Dehning, 2000; Zhang and Lado, 2001). Innovation in information technologies improves the management of traceability, providing that a proactive collaboration among food supply partners is required. It is evident that companies have to cooperate to achieve mutual benefits: an example is the collaboration between distribution chains and industrial companies for the evaluation of consumer demand and the determination of appropriate strategies offered through numerous applications of ICT (Ghisi and Silva, 2001; Hayenga, 2000; Iijima et al., 1996; Myoung et al., 2001; Vlachos, 2003).

One of the most common applications of ICT is Electronic Data Interchange (EDI), an inter-organizational system that is used to exchange business documents automatically as a mean to lower transaction costs and improve the efficiency of supply chains by eliminating human intervention (Nissen, 2001; Vlachos, 2003; Thakur and Donnelly, 2010). The design of EDI needs the proac-

tive relationship between the connecting parties, which, actually, has been observed to be scarcely applied in the fast modifying business environment and is one of the main barrier in reaching the required network externalities (Nissen, 2001). Moreover, EDI systems are costly for small and medium enterprises, which are the majority in the food sector (Vlachos, 2003).
Numerous examples are available to show that supply chain performance will improve when chain transparency and customer-oriented supply chains are created with associated operational coordination mechanisms. Nowadays, retail chains and manufacturers operate jointly to evaluate consumer demand and to choose the most suitable supply management and replenishment system to comply with the demand. This coordination has developed into some fast fulfilment techniques, such as Vendor Managed Inventory (VMI), Efficient Consumer Response (ECR), Collaborative demand Planning, Forecasting and Replenishment (CPFR), and Factory Gate Pricing (FGP) (Van der Vorst, 2004).

3. Innovative strategies for the sustainability of logistic processes in food chains

The reviews of the literature in this field are very limited (James et al., 2006; Seuring and Muller, 2008; Ahumada and Villalobos, 2009; Akkerman et al., 2010); the following paragraphs will propose an attempt of taxonomy of contributions found in the scientific literature that have been sorted into six groups considering the relevance of their subject.
The six subjects considered for the classification are: (1) structure of network, (2) designing distribution networks, (3) costs reduction and response to market dynamics, (4) improved food quality and reduction of food waste, (5) traceability and (6) sustainability in the food retail sector.

3.1 Structure of network

The increasing complexity of the agri-food system gives strong incentives to establish different ways of collaboration between partners such as retailers, manufacturers, and wholesalers in order to increase competitiveness. Such collaboration is based on forms of clustering and network integration of firms which create efficient links built on economic motivations, power, trust, and information (Bourlakis and Bourlakis, 2001; Trienekens et al., 2003; Aghazadeh, 2004; Groothedde et al., 2005; Gimenez, 2006; Ljungberg, 2006; Bartlett, 2007; Sandberg, 2007).
Many authors have focused on this topic, highlighting several aspects of the advantages of these strategies: economic, social, and environmental benefits (Aghazadeh, 2004; Mikkola, 2008); efficiency of such supply chain management and implications with the environmental impact (Aronsson and Brodin, 2006; Kaipia, 2009; Nilsson, 2009; Sandberg, 2007); and reduction of the environmental impact (Nagurney and Toyasaki, 2003; Aronsson and Brodin, 2006; Sandberg, 2007; Kaipia, 2009; Nilsson, 2009). Considering the sustainability objectives of logistics integration, the creation of networks has the following advantages: to operate coordinated transportation systems of food products and to reduce distances and times by means of optimized routes (Ljungberg et al., 2007); to expand the market for producers (Jones et al., 2004); reduction of costs and increase of competitiveness (Bourlakis and Bourlakis, 2001; Aghazadeh, 2004; Groothedde et al., 2005; Sandberg, 2007); strengthening the partnership between producers, distributors, and retailers (Trienekens et al., 2003; Gimenez, 2006; Morgan, 2007); and encouraging the exchange of knowledge, experiences, and information (Trienekens, 2003; Saltmarsh and Wakeman, 2004; Forsman and Paananen, 2010).

3.2 Designing distribution networks

Distribution networks design concerns long-term decisions about the distribution organization of a new network or about the redesign of an existing network, regarding both physical distribution facilities and transport routes (Meixell and Gargeya 2005; Melo et al. 2009; Chopra and Meindl, 2010): e.g., number, position and dimensions of warehouses and cross-docking points, with the linked transport network. The organization of distribution networks is a significant component of the total costs of the supply chain because it entails considerable investments and has a critical influence on efficiency of processes and on quality of customer service (Jayaraman, 1998).

The most important decisions usually affect the place of facilities and the organization of the linkages between them, particularly, in case of connection of different stages in the supply chain (Meixell and Gargeya, 2005; Melo et al,. 2009). Technological progress in logistics and ICT has enabled the development of innovative logistics paradigms founded on co-operation, which improve the consolidation of goods[1]. The outcome is the reduction of costs and the strengthen of partners' responsiveness, as in the case of the Manufacturing Consolidation Centers and the Fresh Consolidation Centers, which are facilities where many small lots of goods, arriving from different suppliers to be delivered to the same customer, are consolidated into fewer, bigger loads for efficient onward shipment (Van der Vorst, 2005).

The studies about localization of facilities, joined to the choice of suppliers and transportation mode, and about more tactical and specific operational decisions on production planning, have been undertaken by means of linear programming models having as objective function the cost minimization or the profit maximization, subject to constraints on resources utilization and to flexibility of service to customers (Klose and Drexl, 2005; Cordeau et al., 2006; Melo et al., 2009).

The issue of the optimization models for the choice of the best place of logistic facilities has been analyzed by some authors for specific food industries, applying mixed-integer linear programming approaches, most of them comprising the locations both of manufacture plants and distribution centers: setting up of distribution centers for a large US food manufacturer (Geoffrion and Graves, 1974); dairy industry (Gelders et al., 1987; Pooley, 1994; Köksalan and Süral, 1999; Wouda et al., 2002); beer industry (Levén and Segerstedt, 2004; Gelders et al., 1987; Köksalan and Süral, 1999); building up a network with the goal to optimize the itinerary of palletized products between manufacture plants of firms and distribution centers of retailers (Groothedde et al., 2005); fresh produce (Blackburn and Scudder, 2009); and total quality decay of a good throughout the stages of the supply chain (Zhang et al., 2003).

The design of distribution networks influences some crucial variables: the number of actors, the level of dispersion of a product through the network, the time a product could be preserved by quality degradation during distribution, so affecting the safety of the food product. The effect on sustainability is connected to the distance products have to travel to arrive at the final consumer and to the environmental impact of the adopted transportation mode. The design of a distribution center between the production site and the retail facility does reduce the bullwhip effect looking at different demand pat-

1. Consolidation is the process of combining multiple orders onto one tracking number so all packages will be delivered together but in their original packages.

terns[2] (Reiner and Trcka, 2004; Bourlakis and Weightman, 2004). A new simulation environment with the particular target to provide for the design and redesign of food supply chains is presented by Van der Vorst et al. (2009), who take account of quality decay and sustainability measures in their modelling environment.
The significativity of the coordination between the phases of production, transport, and warehouse management has been stressed by some authors who have emphasized the need of an integrated approach with the goal of creating synergies and increasing the efficiency of all interconnected processes (Eksioglu, 2002; Mula et al., 2010; Chen et al., 2009). Some authors have dealt specifically with reference to the environmental impact of transport in terms of CO2 emissions (Gebresenbet and Ljungberg, 2001; Van der Vorst et al., 2009; Bilgen and Ozkarahan, 2007; Akkerman et al., 2009). In particular, Gebresenbet and Ljungberg have considered several variables including: level of use of the carrying capacity of means of transport in terms of volume, fuel consumption in relation to driving behavior, length of the route, speed, and road conditions.

3.3 Costs reduction and response to market dynamics

Supply chain management has the target of a better customer service with less cost while complying with the needs of other stakeholders in the chain (Van der Vorst and Beulens, 2002; Van der Vorst et al., 2005). Companies are regularly confronted with trade-offs between the minimization of costs in the supply chain and the management of a flexible system that quickly responds to market dynamics (Van Donk, 2001; Van der Vorst et al., 2005). Moreover, attempts of achieving sustainability goals could come at costs for companies at different stages of the supply chain, so a plurality of objectives, sometimes mutually conflicting with each other, have to be managed.

3.3.1 Costs reduction

The increasing process of globalization and the economic crisis have raised the importance of minimizeing costs even in food supply chain, leading to redesign of logistics operations and adoption of economies of scale in network management. The growing difficulty of challenges, such as the organization and coordination of geographically dispersed facilities, requires even more complex solutions, resulting in the development of automation technologies (Bilgen and Ozkarahan, 2007; Brown et al., 2001; Chopra, 2003; Simchi-Levi et al., 2009). Innovation has resulted in more efficient processes enabling companies to adopt advanced models and tools for planning logistic operations (Mula et al., 2010). The use of innovative techniques for conservation and transport to reduce the continuous process of food quality degradation, based on temperature control during storage and distribution, normally requires energy consumption and a consequent negative impact (James et al., 2006; Twinn, 2007). Reduction of energy consumption throughout the chain, while maintaining operations, is the common aim of some studies. Some authors take the sustainability of the transportation system explicitly into account by trying to reduce energy consumption (Hsu et al. 2007); some eithers focus on energy consumption from maintaining temperature (Zanoni and Zavanella, 2012) or on operations

2. "The bullwhip effect is a well-known phenomenon in supply chain management. In a single-item two-echelon supply chain, it means that the variability of the orders received by the manufacturer is greater than the demand variability observed by the retailer" (Boute R.N. and Lambrecht M.R., 2009).

such as heating, lighting, or machine use (Oglethorpe, 2010). Other authors consider relevant costs related to food quality decay, waste disposal, and product loss (Ahumada and Villalobos, 2009; Blackburn and Scudder, 2009; Rong et al., 2011).

3.3.2 Responsiveness to market dynamics

The increased product variety and competition have enhanced demand uncertainty, so flexibility and capability to respond appropriately and in a reasonable time for requests from the market are critical to maintain customer satisfaction in the food chain (Lambert and Cooper, 2000). Some authors have indicated the following key factors for a responsive supply chain: timely information diffusion, reduction of the total cycle time, coordination of the workflow between the stages in the chain, implementing proper decision support systems, shortening lead times, integrating information about processes and procedures, cutting unnecessary operations and creating adaptable capacity (Gunasekaran et al., 2008).

The purpose of providing a timely response to the needs along the supply chain has two main dimensions: (1) the speed with which firms respond to market dynamics in terms of introduction of new products and new opportunities for supply; and (2) the lead time, that is the time between the moment an order is placed to the moment that ordered goods are received (Fisher, 1997; Beamon, 1998).

The second dimension, lead time, affects logistic issues and is incorporated into models by taking into account variables such as: transport carriers, distances, load capacity (Gebresenbet and Ljungberg, 2001; Osvald and Stirn, 2008), required transportation times (Hsu et al., 2007; Dabbene et al., 2008), necessary production times (Wang et al., 2010), and transport utilization on environmental impact in terms of CO2 emissions (Akkerman et al.2009). In response to the evaluation of multimodal transportation networks, some studies consider simultaneously different transportation alternatives such as road, train, and air (Apaiah and Hendrix, 2005; Bilgen and Ozkarahan, 2007). These categories of models are more adaptable for decision makers and present more easiness of cost minimization and on-time distribution options whilst managing the entirely network. In addition, other authors consider variables such as dual sourcing (Ioannou, 2005; Zuo et al., 1991), transhipment between facilities (Wouda et al., 2002), and indirect shipments (Higgins et al., 2006, Tarantilis and Kiranoudis, 2002).

The cost and schedule constraints are crucial for market responsiveness and some cases have been studied: a customer could require specific production batches to be completed by a certain deadline (Ahumada and Villalobos, 2009; Bilgen and Gunther, 2010); it could be unexpectedly necessary to short the time of processing and delivery or to increase the frequency of the processes (Van der Vorst et al., 2000); the management of delays and missed deliveries (Jansen et al., 2001); cost of timely deliveries with respect to storage problems (Dabbene et al., 2008); loss of reputation due to violation of delivery lead time (Chen et al., 2009); and costs for lost sales due to stock-outs (Van der Vorst et al., 1998).

3.4 Improved food quality and reduction of food waste

The growing attention to food safety by consumers affects quality management procedures along the supply chain. Systems that were originally developed to control food safety, such as HACCP, are also used to improve product quality along the supply chain

and to preserve nutritional quality (Panozzo et al., 1999; Rodrigues et al., 2010). The extension of these systems of quality management and safety control in the supply chain contributes to the objectives of sustainability (Fritz and Schiefer, 2008). The available technology designed to increase the transparency of food supply chains has been broadened to rise sustainability (Wognum et al. 2010) through the extension of responsibility for the quality of the product in the social and environmental performance of the food chain (Smith, 2008). The preservation of product quality and freshness is affected by several intrinsic and extrinsic factors: temperature, oxygen concentration, relative humidity, solar radiation, acidity, microbial activity, endogenous enzyme activity, etc. (Alasalvar et al., 2001; Howard et al., 1994; Riva et al., 1999; Zhang et al., 2009). The control of these parameters in correspondence with the logistics activities may require the use of inputs with high environmental impact, production of waste material, waste management, and loss of product.

The perishable nature of the products is closely linked to sustainability, resulting in: problem of waste production (Entrup et al., 2005); cost of losses incurred during transport (Osvald and Stirn, 2008; Ahumada and Villalobos, 2009; 2011); temperature control and product quality (Van der Vorst et al., 2009; Rong and Grunow, 2010); costs associated with the use of energy, transport and deposit (Akkerman et al., 2009; Blackburn and Scudder, 2009); calculation of costs for processing food waste and disposal (Rong et al. 2011; You et al.,2012); quality control with regard to the management of the warehouse (Van der Vorst et al., 2000; Eksioglu et. al, 2006; Yan, 2011; Ahumada et al., 2011); and different temperature control for multiple products management (Bosona et al., 2011).

3.5 Traceability

"Food traceability is part of logistics management that captures, stores, and transmits adequate information about a food, feed, food-producing at all stages in the food supply chain so that the product can be checked for safety and quality control, traced upward, and tracked downward at any time required" (Bosona and Gebresenbet, 2013).

The increasing importance of traceability in food supply chain management is due to risks related to food safety, to quality management, and to the interest in supply chain management with a sustainable approach (Van Dorp, 2003; Hobbs et al., 2005; Bertolini et al., 2006; Kelepouris et al., 2007; Van Rijswijk et al., 2008; Engelseth, 2009; Hong et al., 2011; Wognum et al., 2011; Liao et al., 2011; Liu et al., 2012; Salampasis et al., 2012). An effective and efficient traceability system requires a high level of integration between the information systems of the actors in the supply chain with the application of advanced technologies (Shanahan et al., 2009; Azuara et al., 2012). Innovation is crucial for the integration of traceability systems through the improvement of the level of interconnection and communication (Thakur and Donnelly, 2010; Xiaoshuan et al., 2010; Bosona, 2013). Information flows are realized through the integration of traceability data which can be considered of two types: static (date of preparation or packaging, country of origin, size, etc.) and dynamic (batch code, order code identification, shipping date, taste, etc.) (Folinas et al., 2006; Olsen and Aschan, 2010). An efficient and effective traceability system could represent a substancial way to enhance transparency towards consumers by presenting detailed information about product characteristics and processing methods (Fritz and Schiefer, 2009; Wognum et al., 2011). Information

can be communicated to customers and other stakeholders, improving confidence in food and resulting in higher customer satisfaction and reduction of complaints (Arana et al., 2002; Mousavi et al., 2002; Shanahan et al., 2009; Chrysochou et al., 2009; Liao et al., 2011). Moreover, food traceability can contribute in reducing food-related (health and economic) crises because it is a proactive strategy centred on information and data provision (Opara, 2003; Golan et al., 2004; Hayes et al., 2005; Schwägele, 2005; Smith et al., 2005; Hobbs et al., 2005; McMeekin et al., 2006; Van Rijswijk et al., 2008; Atkins, 2008; Negrini et al., 2008; Tamayo et al., 2009; Canavari et al., 2010; Kher et al., 2010; Hall, 2010; Thakur and Donnelly, 2010; Mai et al., 2010; Dabbene and Gay, 2011; Azuara et al., 2012; Donnelly et al., 2012; Randrup et al., 2012; Saltini and Akkerman, 2012).Traceability contributes to increasing the efficiency of the food supply chain management by reducing costs of activities in the supply chain, providing information from raw agricultural inputs to goods at the retail stage, allowing firms for an efficient management of resources, and pushing partners to increase mutually cooperation (Li et al., 2006; Rábade and Alfaro, 2006; Riden and Bollen, 2007; Regattieri et al., 2007; Bollen et al., 2007; Engelseth, 2009; Rong and Grunow, 2010; Hong et al., 2011; Dabbene and Gay, 2011; Karlson et al., 2013). Partnership strategies in food traceability can improve competitive advantages in the supply chain as well, enabling the understanding of food safety problems in relation with the logistics system and strengthening marketing strategies (Alfaro and Rábade, 2009; Xiaoshuan et al., 2010).

Finally, the increasing implementation of traceability is an important determinant for the development of professional skills (Van Dorp, 2003; Bourlakis and Bourlakis, 2006; McEntire et al., 2010; Heyder et al., 2012; Schroeder and Tonsor, 2012) and for technological and scientific development (Mangina and Vlachos 2005). An effective traceability system for food is an important tool not only to manage the risks related to quality and safety, but also to promote the development of effective management in the supply chain. There are two main categories of traceability technologies: identification tags (i.e., barcode, label, RFID tag) that accompany a product with a specific code and data loggers (also called "black boxes"), whose objective is to track and record environmental conditions and all characteristics of a product in the supply chain. The development and implementation of such systems of traceability in the food supply chain is an effective way to preserve specific characteristics of food products, particularly fresh products and perishables, in accordance with safety and quality standards, rules, and customer satisfaction. The monitoring along the supply chain through appropriate black boxes allows the reproduction and simulation of real environmental conditions for products and packaging during logistics processes (e.g., purchasing, manufacturing, handling, warehousing, transportation, etc.), with the aim to evaluate their impact on food quality and safety. Literature presents some works on the application of RFID (Radio Frequency Identification) technology in food supply chains for the identification of products such as barcodes and RFID tags, (Manos and Manikas, 2010; McEntire et al., 2010; Azuara et al., 2012). A recent review on RFID technologies and applications is presented by Zhu et al. (2012). In particular, meat industry has been advantaged by the application of tools as barcodes, radio frequency tags, voice recognition systems, microcircuit cards, tran-

sponders, biocoding, and chemical markers (Mousavi, 2002). Wang et al. (2009) and Sarac et al. (2010) analyze problems and traceability aspects concerning the guarantee of food safety in processing and handling in the supply chain with the aim to transform the additional costs, subsequent to the introduction of ICT, into competitive advantages. In the future, the application of RFID in the food chain will increase in consequence of the reduction of its costs and of the development of new technologies especially related to nanotechnology (Chrysochou et al., 2009; Karippacheril et al., 2011; Azuara et al., 2012; Salampasis et al., 2012).

3.6 Sustainability in the food retail sector

This subject is quite new as area of study and for this reason the literature does not present many formalized studies about sustainability in food retail sector but there are exploratory case studies of companies with reference to known issues on sustainability (Claro et al., 2013).

The retail industry is the last stage of the supply chain but has the power of driving the upward sectors with economic, environmental, and social consequences. Strategies of the distribution companies are increasingly oriented toward the objectives of sustainability, implementing globally interconnected systems with the aim of guaranteeing the control of quality, safety, and sustainability together with the minimization of costs (Banerjee et al., 2003; Iles, 2007; Apaiah et al. 2005; Baldwin 2009). In response to this growing attention, retail companies have created programs and investments in environmental and social issues in order to enhance the brand reputation and the propensity of consumers to repeat purchases with advantages on firm performance (Womack and Jones, 2005; Luo and Bhattacharya, 2006; Truch, 2006). Such strategic initiatives are strongly grounded on communication activities, innovation policy and efficiency of coordination in the supply chain (Ganesan et al. 2009). The impact of the investments can affect directly the social dimension and indirectly the environmental and economic dimensions. Some companies, taking into account the society and public opinion attention toward issues of global warming, deforestation and non-renewable resources, have directed their efforts in reduction of their carbon footprint, water footprint and waste disposal. Investments concern many activities (Bhattacharya and Sen, 2004; Perry and Towers, 2009): projects for the benefit of local communities, development of local suppliers, adoption of codes of conduct and standards for suppliers, social marketing campaigns, adoption of environmentally friendly packaging, commitment to reducing the carbon footprint in the process, commitment to waste reduction, realization of structures with low environmental impact, staff training on sustainability issues, and education campaigns for clients (Kovacs, 2008; Nidumolu and Prahalad, 2009; Freitas, 2009).

Three groups of relevant drivers can be considered to lead investments in sustainability strategies by distributive companies (Claro et al. 2013):

1. Internal capabilities (Helfat, 2000; Burger and Marius, 2011): ability to process, human resource capacity, customer driven capacity, brand image, reputation, profits, product, and process innovation.
2. Relations with suppliers (Mohr and Speckman, 1994; Brown et al., 2006; Ganesan et al 2009; Perry and Towers, 2009): development of relationships on processes and policies, strategies of communication, development of local

suppliers with impact on the welfare of the local economy, and adoption and sharing of codes of conduct for acceptable practices and joint standards.

3. Exogenous conditions (Ganesan, 1994; Klein et al., 1990): political and economic contest, legal framework, market competition and uncertainty.

In a new perspective, retailers consider sustainability as a business objective because it allows to develop competencies that give rise to competitive advantages improving the company reputation and, consequently, the store loyalty (Luo and Bhattacharya, 2006). This is built through the direct contact with consumers, stimulating their environmental and social consciouness and responding to thir needs. Responsiveness will be more effective if retailers estabilish a relationship with suppliers based on a common strategy of sustainabiity.

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CONSUMER PREFERENCES AND SUSTAINABILITY IN AGRI-FOOD CHAINS

Sustainable Choices: from Motivations to Purchases, from Food to the Lifestyle

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Abstract

The paper focuses on food choice with a twofold objective: 1. to assess motivations and attitudes, between organic and conventional consumers; 2. to check the consistency between sustainable behaviour in food choice and in the general style of household's life. The study is carried on inside an interdisciplinary pilot project about conventional and organic food styles (SAFEBIO) that deeply analysed a sample of 30 households. Results confirm the relevance of health benefits both among the food quality attributes –conventional and organic-, the motivations and the willingness to pay for organic foods; other sustainability attributes fall behind in the hierarchy of relevant drivers. The environmental impact of the household's lifestyle, even if is not a prerogative of the organic clusters of consumers, it is more evident among them. Besides that, the paper could give a contribution on a methodological aspect, looking at which criteria could be more suitable to define organic consumer profiles.

JEL Classification codes: Q01; D12; C38

Keywords: Household's behaviour, organic and conventional food, cluster analysis.

Introduction

In a period of strong economic crisis, the consumption of organic food in Italy, even if not very high among European countries, presents an increasing trend not observed for other food items; moreover this trend is still continuing since 2005, while the trend of food consumption as a whole was slightly negative in 2010 (ISMEA, 2011). Because of this trend and to support the national organic sector, a deeper understanding of the food purchasing behaviour of organic and conventional consumers - the values, attitudes, determinants of choice - it is essential to put in place effective strategies to support and enhance an important sector of the (Italian) agro-food system. The topic of food consumption has been studied in depth and, over the time, the literature on that item has been enriched with new contents, methods and multidisciplinary approaches, proposing different categories of relevant attributes and taking into account the context of purchase decisions.

After having described our conceptual framework and paper aims, we present results about which criteria are useful to define household's food profile and which characteristics are relevant in grouping consumer's behaviour. We conclude with some comments and linkages with the literature findings.

The conceptual framework

Inside the literature on food choices great attention was devoted to organic choices, as revealed by many reviews on the topic (among these, Moser et al., 2011).

An extensive literature on the motivations and attitudes of the organic consumer considers how and in which measure aspects like health and nutrition, quality, value and ethics, price, trust and food safety, environment and animal welfare, play a role in influencing consumer behaviour (Annunziata et al. 2009; Gracia et al., 2008; Hjelman, 2011; Idda et al., 2008; Krystallis et al., 2012; Naspetti et al., 2009; Smed et al., 2013; Young et al., 2010). As far as the difference between motivation, attitudes towards a product, and

consistent buying behaviour, some studies affirm that the correlation between values, attitudes and behaviour is not very strong since other variables, in particular the economic ones, affect the actual buying behaviour and sustainable food consumption choices (Padel et al., 2005; Boccaletti, 2009). Regarding Italian market, some authors identify three trends in organic consumption (Gracia et al., 2008; INEA, 2009; Pellegrini et al., 2009): the first trend responds to the health needs; the second trend refers to environmental and ecological interests; the third trend concerns social motivations. In all cases, it appears that food is no longer merely a means of satisfying a basic need, but also as a vehicle for the realization of a desire to belong to particular ways of living and thinking; the food style is the result of a lifestyle that for the organic consumer implies, among other things, a reconciliation with the rural world, its culture and history.

Some studies on consumer's behaviour verify if choosing organics is a component of a sustainable lifestyle (Young et al., 2010). In Gracia et al. (2008) environmental responsible behaviour is correlated with organic food consumption, as avoiding purchasing goods in non-environmental friendly packages or easy recycling. In Nie et al. (2011) a segmentation of consumers is proposed, the segments exhibited significant differences in organic and local food consumption: these differences were correlated with consumers' environmental concerns, knowledge and practices, health concerns and practices, as well as some demographic characteristics. The study carried out by Pellegrini and Fariniello (2009) demonstrates that in Italy consumers acceptance of organic products is strongly associated with behaviours that orientate different lifestyles among types of consumers.

Following the above multifactorial approach and using clustering methodologies, the present study analyse different clusters of consumers investigating the following topics:
- motivations, attitudes and willingness to pay, between organic and conventional consumers;
- the sustainable behaviour in food consumption and in the more general lifestyle.

The present research was carried out within the SAFEBIO Project[1], a pilot study which results could have methodological purposes only, and are not intended with a statistical significance.

Data and methods

Data refers to a small nonrandom sample of households that was homogeneous and *a priori* defined. Households were selected on the bases of those socio-cultural and economic characteristics considered the most relevant in environmental responsible and organic food consumption literature, even though consistent results cannot be always found. According to some literature, organic consumer typically lives in households with 2-4 components, with at least one child younger than eighteen years old; he is often graduated with a medium-high level of income (Annunziata et al., 2009; INEA, 2009). We focused on a thirty households, conventional or organic, with the above mentioned characteristics, that is with at least one child younger than eighteen years old and with a high-medium educational level and income (Table 1).

The analysis of food consumption behaviour relies on the self-reporting of purchase and consumption behaviour, individual attitudes and personal values. Data were collected through a structured survey with on

1. SAFEBIO Project is funded by the Italian Ministry of Agriculture and coordinated by the Italian National Institute of Agricultural Economics (INEA).

	Respondent	Partner
Gender (female)	76%	
Age (mean)	46.8	47.2
Education degree: graduate	72%	62%
Work (main type)	Employee: 48%	Manager: 24%

Food expenditures/ Income	(%)
< 15%	10,7
15% -20%	25.0
20% - 25%	35.7
25% - 30%	7.1
> 30%	10.7
I don't know	10.7
Total	100.0

Table 1. Main sample characteristics.

line questionnaires, conducted in 2012 and administered to that household member with the primary responsibility in food purchasing. The questionnaire items and variables were defined based on the review of the literature above mentioned. We looked at the literature to find out and include in our analysis the most important attitudinal factors affecting consumer decisions, product knowledge and personal beliefs, together with the search and experience attributes (like price, taste, freshness, appearance), but also the credence attributes (like health concerns, environmental benefit, local origin). Socio-economic data were analysed through descriptive statistics and cluster analysis. Cluster analysis was performed with the R package. We followed a hierarchical method, applying the complete linkage method and the Gower similarity index as distance measure.

Besides socio-economic data, we considered some nutritional data collected through the compilation of a daily food booklet by each individual household's member for three days –but weekend- in a week, during the four seasons, following the National Research Institute for Food and Nutrition (INRAN) approach (Leclerq et al. 2009).

Results

How to define organic food consumers?

Before addressing the two main topics of the paper, a preliminary question concerns which is (are) the more suitable criterion (-a) to define the different household's food profile. Apart from those households who do not buy organic food, some considerations require the definition of the organic food styles. To get insight into the organic profiles, several studies often propose two criteria (sometimes conjointly, sometimes separate-

Household Profile	**Single Criterion**					**Multiple Criteria**
	Frequency of purchases	% of organic expenditure	% of expenditure for single organic items	30% of organic grams	50% of organic grams	
Not Organic	31.0	31.0	31.0	34,5	34,5	31,0
Weak Organ.	48.3	37.9	24.1	34.5	44.8	41.4
Strong Organ.	20.7	31.0	20.7	24.1	13.8	27.6
N.r.			24.1	6.9	6.9	
Total	100.0	100.0	100.0	100.0	100.0	100.0
Legend:						
Not Organic	Never	0	0	0	0	0
Weak Organ.	< 1/week	<30%	2 or less items <30%	<30%	<50%	At least 2 criteria
Strong Organ.	> 1/week	>=30%	More than 2 items >=30%	>=30%	>=50%	

Table 2. Household's food profile and organic classification criteria (% distribution of sample units).

ly) concerning the frequency of purchasing (Barrena et al., 2010; Pino et al., 2012) and the percentage of organic food expenditure on total food expenditure. Following these two criteria, we define a priori some cut off point to distinguish between weak and strong organic buyers (Org-weak and Org-strong, see Table 2). The distribution of our sample between the two organic food styles reveals that some differences emerge in the frequencies per each group, so that following one criterion instead of another, in some cases the household's profile could be considered as that of a weak consumer, in other cases can be that of a strong consumer. Besides the total organic expenditure, we took the percentage of organic purchase for a semi-opened list of single food items -being impossible to take account of all foodstuffs in a diet, but also giving the chance to add new items-, selected among the most important food items for Italian organic consumer; then, we chose some a priori threshold values, obtaining a sample distribution between weak and strong organic styles that show other differences.

Looking at the distribution of the organic sample units according to the three mentioned criteria (Table 2), it is evident that the organic weak group become smaller moving from the criterion of the frequency of purchases to the percentage of total organic

expenditure, the opposite obviously happening in the strong organic group. As far as the criterion of single item expenditure, the high percentage of not respondent could indicate that people find more difficult to evaluate for single items the relevance of organic on total expenditure, leaving with an area of uncertainty also in the strong and weak organic classification. Even with this differences, the above three criteria -the frequency of purchases, the relative weight of organic total expenditure and of single item expenditure- are the most commonly used in economic analysis to get to some organic consumer classification.

A strong point of our approach inside the SAFEBIO Project is that we collect for each sample unit both consumption of single foods for the nutritional assessment analysis and food expenditure variables. We get data for all the dishes (in terms of grams) every single household's member takes in each meal during three days per season. Using those data, we introduce an organic classification criterion in terms of the (mean) percentage of organic dishes (the grams taken in three days for each seasons) and defined two thresholds values (30% or 50% of organic food on total food) to discriminate between weak (more than zero up to the threshold) and strong organic consumer (over the threshold).

Obviously, the two sampling distributions obtained applying the quantity criteria are different from those emerged with the economic criteria, of frequency and of expenditure: moreover, some households matching a low level of organic economic criteria appear not organic according to the organic intake, even if this could not be completely accurate because the intake was collected only in three days per each season.

These results lead us to make the following statements:

- the a priori definition of food styles according to one single classification criterion could be misleading in some cases. It would be better, if possible, to check for several criteria and test their statistical relevance;
- the a priori definition of threshold values could be equally misleading, mostly when a single criterion is applied. It would be better to get these values from the data, especially with large and representative samples;
- using a combination of criteria, eventually with different weighs, could get a more accurate household food styles classification.

Food quality attributes, process related characteristics and organic purchasing behaviour

The first research line investigates respondents opinions[2] on which are the most important internal and external quality attributes and influential factors in food choices, deepening the analysis of green aspects and organic food choices. We considered the following topics: attributes of food quality; process related aspects; knowledge and information on organic foods characteristics.

Performing cluster analysis, we obtained three homogeneous clusters of households with an increasing attitudes and knowledge about organic foods (Table 3), as follows:

- the "Conventional". The first cluster includes conventional consumers that do not recognize a high level to the quality attributes of organic foods, as the lowest mean values for almost all the items/variables indicate. To these households health benefit could be the main reason to pay a higher price for organic foods,

2. Opinions are expressed on a 5 point Likert scale: not at all (0), a little (1), fairly (2), a lot (3), at all (4).

The cluster profile		The Conventional	The Fuzzy	The Organic
Households (% on total sample)		25.0	37.5	37.5
List of variables (mean value in the cluster)				
Knowledge (0No/1Yes)	About controls on organic food	0.7	0.6	1.0
Degree of importance of quality attributes in organic food	Taste	0.8	1.6	2.4
	Freshness	1.7	1.7	2.9
	Appearance	1.3	1.3	1.4
	Health benefits	0.3	2.2	3.8
	Nutritional content	0.3	2.0	2.9
	Lack of chemical residues	0.8	1.6	3.7
	No GMO ingredients	1.2	1.8	3.7
	Fat/Sugar content	0.2	1.6	1.8
Degree of importance of process/ product characteristics in choosing organics food	Environmental and animal wellbeing	0.8	2.0	3.0
	Not grown in greenhouses	0.5	1.2	2.2
	Traditional farming	0.3	1.4	2.7
	Seasonality	0.5	1.8	3.1
	National origin	0.3	1.8	2.9
	Local identity	0.3	1.9	2.6
	Cultivation in unpolluted area	1.2	2.1	3.3
	No long life shelf treatments	0.5	1.7	2.8
	Health protection	0.7	1.9	3.9
	Safety guarantee	0.8	2.1	3.2
	Trust in controls and certification	1.3	1.9	2.7
	Specific labelled	1.0	2.1	2.7
	Practicality of use	1.0	1.3	1.4
	Easy availability	1.8	1.6	1.6
	Shelf life	1.8	1.3	1.0
	Range	2.0	1.8	1.2
	Advices	0.8	1.3	1.0
	Curiosity	1.3	1.7	0.8
	Exclusivity	0.5	0.6	0.0
Extent to which have more information on organic food aspects	Area of origin	2.3	3.0	3.0
	Quality assurance	2.2	2.9	3.4
	Controls	2.5	2.7	3.2
	Environmental impact	2.5	2.1	3.1
	Nutritional intake	2.5	2.1	3.0
	Health benefit	2.3	2.7	3.2
Reasons for buying or not organic food	Higher income	1.7	2.2	1.6
	Lower prices	2.7	2.3	2.2
	Ease availability	2.7	2.0	1.8
	Wide range	2.2	1.9	2.2
	Long shelf life	1.8	1.2	0.6
	Ready to eat	1.5	1.2	0.8
	Diet/health reasons	1.7	1.9	1.6
Reason for paying or not a higher price for organic food	Quality assurance	1.7	2.3	2.9
	Controls	1.3	2.1	2.9
	Environmental impact	2.0	2.0	2.6
	Nutritional intake	1.7	1.7	2.7
	Health benefits	2.3	2.1	3.4
	Any reason	0.5	0.6	0.0
With sales promotions	Buy organic food	1.0	1.8	3.1

Table 3. Organic foods. Clustering household's behaviour.

even if they consider high prices and limited availability as obstacles to purchase organics;

- the "Fuzzy". This cluster includes some a priori defined weak organic and conventional consumers. These households are sensitive to the quality attributes of organic food, even if with a minor level of importance than the following cluster. Income and prices seem to constraint consumer purchases and, maybe for that, our respondents could pay a higher price mainly for superior personal needs, as for diet or health reasons;
- the "Organic". In this cluster, we find the highest mean values for many attributes of organic quality and characteristics of products and processes. The Organic households attach a strong importance to all aspects related to the health benefits, followed by variables concerning the quality assurance systems and controls; a wider range of organic foods would increase their purchases together with lower prices, as confirmed by their attitudes towards the impact of sales promotion.

The green behaviour: from food to the general lifestyle

This analysis investigated if organic consumers were more aware of environmental problems than conventional ones and if, for this reason, they followed a more sustainable way of life.

Data refers to food and other organic products; awareness and sensitivity towards the environmental impacts of consumption activities; the membership in environmental initiatives and association; the issue of waste and food waste. The selection of variables to measure environmental concerns and knowledge was based on the review of the literature on general and food consumption choices (Nie et al., 2011).

Performing cluster analysis (Table 4), three household's groups emerged with a decreasing level of environmental awareness:

- the first cluster, "the Green", is clearly identified by the highest mean values for almost all the environmental variables -but the lowest frequency of red meat consumption-, as well as by an environmentally friendly food habit. This cluster includes only strong and weak organic consumers;
- in the middle there is "the Grey" group, including the three types of consumers –from strong to not organic-, that for many variables follows closely the environmental behaviour of the Greens;
- "the Red" cluster is opposite to that of the Greens having the lowest values on all the variables except the red meat consumption. It is worthwhile to mention that this cluster includes mainly conventional consumers.

In the final step of our analysis, we overlap the results of the two clustering applications trying to get a joint look at household's styles. It is clear that, moving from a small sample, this exercise will produce even smaller groups. Notwithstanding, at least the most significant consumers profiles could be considered for further analysis on a broader sample dimension.

Giving answers to the second aim of the paper, we jointly consider the two clustering applications. Looking at the distribution of sample units inside the three homogeneous groups, (Table 5) it can be observed some sort of coherence between food styles and general lifestyle, even if we would like a more strong correspondence between styles. In other words, those households that follow

The cluster profile	The Green	The Grey	The Red
Cluster dimension : Households (% on total sample)	29.2	37.5	33.3
Environmental variables (mean value in the cluster)			
Environmental awareness index*	2.1	1.4	1.2
Frequency of red meat weekly consumption (1=once a week, 2=2 times; 3=3-4 times)	1.6	2	2.8
Separate food waste collection (0 no; 1 yes)	0.6	1	0
Weekly frequency of food waste (0 never; 1=<once)	0.4	0.3	0.3
Relevant factors: Environmental protective farming methods	3	2	1.8
Relevant factors: Cultivation in not polluted areas	3.6	2.8	2.1
Environmental friendly packaging**	1.9	2.2	1.7
Information claim on environmental impact	3.4	2.5	2
WTP for reducing environmental impact	2.9	2.3	1.6
Food safety problems from contaminants	2.6	3.2	2.3
Food quality attributes: Free of chemical residues	3.7	3.1	2.4
Food quality attributes: GMO's free	3.7	3.4	2.6
Process characteristics: Open field farming	2.1	2.3	1.3
Process characteristics: Seasonality	2.9	2.5	2
Drivers of food choices: Short chain	2.7	1.9	1.9
Drivers of food choices: Environmental certification	2.4	2	1.3

Table 4. The environmental style of consumption behaviour: the clustering of household's profile.
Note: unless otherwise indicated in the table, see note 2 for the range of scores.
* This index refers to the mean value of scores given to several statements concerning green behaviour. It includes animal welfare, recycled products, public transport, separate waste, environmental group membership, not plastic bags, renewable energy, class of product energy efficiency, vending machines.
** It represents the mean value of scores respondents gave to the selection of items which package produces less waste, contains less polluting materials, is made of recycling materials, when buying foods.

an Organic diet belongs mainly to the group of units that adopt a Green lifestyle, even if is also important the Grey area; nobody among Organics has a "Red" light in their sustainable lifestyle. On the other side, few of those who choose Conventional foods appear to be Grey or Green in their general behaviour. In the intermediate groups results are less definite: the Fuzzies according to the food style concentrate mainly in the Red then in the Grey lifestyle cluster; on the other side those who have a Grey lifestyle are more than other Organic food consumers or, in a lesser extent, stay in the middle food style.

From the above comments, it seems possible to conclude that the attitudes towards a sustainable food consumption are stronger than the commitment of a green general lifestyle. It could be interesting to have other findings confirming the last conclusion and to find out its main causes, maybe related to the relevance of personal impact and to the healthy implications of a proper food diet.

Discussion and conclusions

The literature on organic and green food choices is very rich of contributions that give many insights concerning organic and con-

	Household's lifestyle			
Household's food style	**The Red**	**The Grey**	**The Green**	**Total**
The Conventional	17.4	4.3	4.3	26.1
The Fuzzy	17.4	13.0	4.3	34.8
The Organic	0.0	17.4	21.7	39.1
Total	34.8	34.8	30.4	100.0

Table 5. The clustering of green household's behaviour: from food to the lifestyle.

ventional consumer's food choices. Even if our findings on a small pilot sample could not be extended to the universe of consumers, they refer to a wide spectrum of phenomena providing some suggestions from a methodological perspective, and giving insights that could be further investigated on a broader sample base.

Assessing motivations, attitudes and buying behaviour, we observed that it is important to consider the complexity and the hierarchy of relevant aspects in consumer purchasing, from stronger to weaker drivers. In other words, for some priority aspects consumers behave in a way coherent with their motivations, namely the health benefit of a right eating habit, so confirming the shared importance of this aspect in choosing conventional foods and, even more, organic foods. This conclusion also emerges from a rich body of literature. In an OECD review on environmental responsible food choices (2008), personal health reasons seem to prevail, as consumers are very concerned about residues and content of "bad ingredients". Also the research carried out by Gracia et al. (2008) confirms the importance of perceived benefits of organic food as it concludes that "the more highly Italian consumer value the health and environmental benefits of organic food; the higher is the probability that they buy them". With regard to Italian market, Idda at al. (2008) confirm that safety is the most important driver for organic food consumers, while environmental safeguard is less important; in Annunziata et al. (2009), consumers purchase "functional and organic foods mainly for health reasons, assuming that these products are healthier than conventional ones". Barrena et al. (2010) find that health is an essential component in purchase choices, mainly for regular consumers, while Smed et al. (2013) focus on the effect of perceived health benefits of organic consumption.

As far as non-organic buyers, we observed that they do not appreciate so much the organic food quality, while the difficulty in finding products and above all the high price are strong obstacles for consumers switch from conventional to organic food. These obstacles have to be considered very carefully on the supply side because removing them could have a wide market potential (Sgroi et al., 2012).

In our analysis, consumers, even following a personal health objective, appear to have a global sustainability perspective, being interested not only in environmental aspects but in other attributes, related to health but also to social content of food, and to ethical and cultural values. That is consistent

with previous findings showing that ethical considerations (animal welfare) and political considerations (environmentalism) – together with health and quality considerations – play an important part for organic consumers (Hjelman, 2011). Altruistic arguments (e.g. environmental and animal welfare) are strong motivations influencing consumer attitude and purchasing behaviour of organic food, to the point that sometimes the ethical attributes like 'animal welfare', turned out to be the most important in consumer purchase decisions (Bergès et al., 2013; Bravo et al., 2013; Gracia et al., 2008; Zander et al., 2010). These findings could suggest the organic sector to differentiate their products, jointly taking account of all sustainability pillars and of other attributes relevant in consumer assessment, while still preserving the essential environmental dimension.

Our results confirm that an environmental friendly lifestyle appear to be associated with the likelihood of being an organic food shoppers (Nie et al., 2011). Choosing organics seems to be a matter of lifestyle choice, particularly in strong or regular organic consumers behaviour (Lockie et al., 2004, Pino et al., 2012), being the acceptance of organic products associated with behaviours that orientate different lifestyles among types of consumers (Pellegrini et al., 2009). These findings too could be important from a marketing perspective, in that there could be an indirect leverage effect of a growing environmental awareness in increasing the dimensions of organic market niche.

Finally, the paper could give a contribution on a methodological aspect. Looking at the main economic criteria (organic food expenditure, frequency of purchases, expenditure on specific organic foodstuffs) used in the literature to define *ex ante* the organic consumer profiles, we found that applying to our sample just one criterion could be somewhat misleading, namely in the definition of the intermediate profile. This statement might suggest to use several economic criteria jointly, and to match other kinds of criteria, as the one based on nutritional intake followed in our paper. Moreover, according to our findings, ex post classification with clustering techniques could be more accurate and may include many variables, so it could be better to apply them and to avoid ex ante classification of consumers' types.

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"Ready to Eat" and Fresh Products Demand Through Scanner Data

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Abstract
Fresh-cut and ready-to-eat (RTE) products are gaining market shares over fruits and vegetables. Changes in life-style prices could be playing an important role in the substitution between fresh products and RTE alternatives. Therefore, the present paper tests the following hypotheses: (i) measuring the direct price effect on the demand of fresh-cut and RTE vegetables; (ii) measuring substitution and complementarity effect between fresh products and RTE; (iii) understanding market and consumption trend. The hypotheses have been verified throughout the estimation of a LA/AIDS model, using data collected by IRI-infoscan about Italian grocery sales for the years 2008-2010. Results provide evidence that the market boom for fresh-cut and RTE products can be considered both quality (convenience) and price driven, while the substitution effect is negligible. Promotional activities and private label strategies could be winning strategies in order to gain market shares within fruits and vegetable market.
JEL Classification Code: C32, D12, Q1
Keywords: Fresh-cut, ready-to-eat, AIDS model, fruit and vegetables, substitution effect

Introduction

The European market for fresh-cut and ready-to-eat (RTE) fruit and vegetables (F&V) has been characterized by a stable increase of between 5 percent and 10 percent in trade during the decade 2000-10 (Rabobank, 2011). This growth continued in line with the trends of other countries with mature economy. Italy is the only country to have experienced a stop in 2008 (-1.4% in volume and -3.8% in value) (Ismea-Nielsen, 2011), however, followed by a gradual resumption of trade in 2009 with an increase of 5.8% in value (€ 700 million in revenue), while the quantities amount reached 146 thousand tons, an increase of 11% compared to 2008 (Ismea, 2011).

Many studies have analyzed the growth and development of fresh-cut products to identify the success factors (Caccetta and Platania, 2006), or psychosocial reasons that determine consumption of both fresh F&V (Brug et al., 1995) and fresh-cut.

On the demand side, the changes in the socio-demographic structure of the population, such as the reduction in the number of family members or the larger number of people following a urban lifestyles, is leading the need for high convenience products, and could justify the increasing consumption of RTE F&V. Actually, the penetration of these products in household consumption is increasing as well as the percentage of consumers that recognize fresh-cut produce as an ideal solution to save time due to their ease of use and keeping the organoleptic quality and safety (Bacarella, 2002; Stampacchia et al., 2008; Baldi and Casati, 2009). Post-modern consumers pay much emphasis on the availability of healthy and fast meals to cope with the increasingly urgent rhythms of contemporary society and the personal health related interests.

The retail sector has received benefits from the development of fresh-cut products. Historically suffering in the F&V departments, the development of these products allowed the distribution to adopt differentiation strategies and a faster turnover of the whole category (Sodano and Hingley, 2007).
Based on these elements of success, research interest focuses the analysis on demand. The framework of the economic crisis raises doubts on a further growth of the market at the same pace, however, understanding the market allows predicting future trends.
Starting from the sell-out data at retail level, the research aims to achieve the following objectives:
I) measuring the price effect on the demand for the fresh-cut products to analyze the effects of elasticity. The presence of a high sensitive demand to price movements represent an element of fragility competitiveness for companies and low profitability in the presence of price wars;
II) measuring substitution and complementarity effects in order to test the hypothesis that the positive trends of the market are due to a substitution effect between RTE and fresh products;
III) better understanding market and consumption of F&V.
In the following pages, after a qualitative analysis of the characteristics of the market, the theoretical approach, the model of analysis, the results and finally concluding remarks will be presented.

Italian market of ready-to-eat products

In Italy, fresh-cut products have been introduced during the second half of the '80s, so they represent a segment still relatively young compared to the U.S. market. However, the market shares of these products are steadily increasing since they seem to be able to satisfy new needs connected with the changing lifestyles.
The total consumption of F&V in Italy decreased by about 22% from 1998 to 2010, although it is widely demonstrated that the assumption of F&V is the basis for a healthy and balanced diet, and how diets rich in vegetables have a protective function in the prevention of chronic degenerative diseases[1] (Feldesein and Tucker, 2007).
Positive signals come from the market analysis of fresh-cut products sales where, in a time span of ten years, consumption increased, on average, by more than 200% (Ostidich, 2008). Several factors contribute to this success: the time saving factor (convenience); a greater level of quality and a longer shelf life compared to the fresh counterpart, thanks to the use of specific varieties and to appeal to the storage in a modified atmosphere.
Moreover, the new consumers' perspective towards foodborne diseases exposure allow preferring fresh-cut products because of the strict hygienic and sanitary controls on processing firms (Rico et al., 2007).
Previous research tried to highlight and outline the general profile of the consumer "type" of RTE products in Italy (ISMEA,

1. Several studies, in fact, have shown that a diet rich in F&V decreases the risk of developing some types of cancer (Lee et al., 2006), reduces mortality due to vascular disease, helps prevent diabetes (Hodge et al. , 2007) and helps to maintain a healthy body weight (Bazzano, 2006) (Pearson et al., 2009). The governments of several countries, supported by scientific evidence, have adopted a policy of information and education in order to raise awareness of the benefits associated with a diet rich in F & V, and improve eating habits of citizens (Bloom et al., 2012). Even in Italy, initiatives to raise awareness of the risks related to poor nutrition (Frutta nelle scuole e guadagnare salute) have been promoted. These educational initiatives are one of the policy instruments classified as "information measures", whose validity and effectiveness is still debated by several authors (Gordon et al., 2006; Seiders and Petty, 2004; Mazzocchi et al. 2009).

1993; Nomisma, 1994), (Colucci et al., 2012; Panza, 2013), according to which, " RTE F&V" consumer falls in the range 25-55 years, higher education, higher willingness to accept packaged and processed products; household of 2-3 people.
Currently, about 40% of sales concerns mixed salads, as opposed to monotype salads, 35% of vegetables ready-to-cook, the remaining 25% of monotype salads and other products. The turnover of RTE market in 2011 was about 780 million euro, with a positive trend 4.4% (Largo Consumo, 2012). With regard to sales channels, the most part of sales is still managed by "large-scale retail trade" (about 86% of sales in 2009 in hypermarkets and supermarkets).
The bagged salads are always the leaders of this market with a share of 85%, but in terms of trend, "salad enriched" with kit of condiments to have recorded the strongest growth with +20% (Largo Consumo, 2012). The presence of a brand, finally, allows the use of a wider set of marketing instruments compared to fresh and undifferentiated products and this promotes loyalty mechanisms that feed and stabilize the demand for convenience foods. In fact, the market for fresh-cut products is mainly characterized by private labels, which with own brand manage to gain a form of loyalty. Fresh-cut F&V and fresh products, are characterized by a significant difference in price. In 2008, a fresh-cut product has been paid on average 8.2 €/kg compared to 1.48 €/Kg of fresh product: the average difference in the period 2002-2008 amounted to around 6.8 €/Kg.
Price could represent more a barrier to entry for consumption of F&V (Powell and Bao, 2009) rather than as a marketing tool to attract to new consumers in the market (Glanz and Yaroch, 2004). In other cases the effect of the price has been indirectly estimated as a positive component by assessing the willingness to pay (Carpio and Isengildina Massa, 2008) or as a negative component, by analyzing the cost differences between a healthy lifestyle (which includes F&V) compared to the modern lifestyle (Acharya, 2001).
The empirical studies carried out in Italy clearly demonstrate that the price, as well as the socioeconomic status of the consumer does not seem to characterize the consumption of these products (Bertazzoli et al., 2005; Stampacchia et al., 2008). In a case study, only 7.2% of consumers of South Italy declared to attribute to high prices of fresh-cut products the decision not to buy them, giving more importance to sensorial attributes (Bacarella, 2002).

Method

The theoretical model

The economic specification of the demand is the *Almost Ideal Demand System* (AIDS), which derives directly from a PIGLOG – *Price Indipendent Generalised Logarithm* – cost function (Deaton e Muellbauer, 1980_a e 1980_b). The frequent use of this model in this type of analyses is due to the possibility of linearization and the adaptability to cross-section, time series and panel data. The AIDS considers market shares as dependent variables, while the log of prices and expenditure as independent variables. Dependent variables have been calculated as:

Function (1) $w_{it} = p_{it} q_{it} / x_t$

where *i* refers to the product category, *t* to the corresponding time, *p* to price, *q* to the volume of sales, and *x* to the total expenditure for the product categories considered in the analysis.
The specification of the AIDS model, given *k* categories, is the following:

Function (2)

$$w_{it} = \alpha_i + \sum_k \gamma_{ik} \log(p_{it}) + \beta_i \log(x_t/P_t) + \varepsilon_i$$

where, given each observation at time *t*, we have: w_{it} market share of good *i*; p_{it} price of good *i*; $\log(x_t)$ total expenditure; $\log(P_t)$ Laspeyers price index of: $\alpha_0 + 0.5\sum_k\sum_i \gamma_{ik} \log(p_i) \log(p_k)$; ε_i a vector of error distributing as $N(0,\Omega)$.

The AIDS model has been linearized by substituting $\log(P)$ with the geometric Stone index: $\log(P^*) = \sum_k w_k \log(p_k)$.

AIDS specification can be modified by applying restrictions in such a way that the theoretical properties of demand are respected: omogeneity ($\Sigma_i \gamma_{ik} = 0$) additivity ($\Sigma_i \alpha_i = 1$; $\Sigma_i \beta_i = 0$), and symmetry ($\gamma_{ik} = \gamma_{ki}$ for each *i* and *k*).

The estimation of Hicksian elasticities (eq. 3), which measure only the price effect has been conducted starting from estimated parameters of the demand system:

Function (3) $\varepsilon^*_{ik} = \varepsilon_{ik} + w_j (1 + \beta_i / w_i)$

In order to improve the prediction ability of the model, other variables have been included in the model, such as the percentage of promotional activities, the inflation rate and the consumption price index and a sin function able to capture the seasonality of demand.

Estimation has been carried out through a SUR – Seemingly Unrelated Regression model, firstly proposed by Zellner in 1962.

Data and the empirical model

The econometric analysis of fresh and RTE F&V has been conducted using scanner data. Information concern the population of grocery stores across Italy. Data has been collected monthly over the period 2008-2010 by *Symphony IRI* and divided by area *Nielsen*. More specifically, the *dataset* has been structured into ten product categories. Six categories refer to RTE and fresh-cut products, while the others are concern F&V. The fresh-cut and RTE products are the following: enriched salads (salads with dressing), ready-to-cook vegetables, cruditès (raw greens), baby leaf salads, monotype salads and mixed salads. Fresh products categories, on the other hand, include: salads, greens, dry legumes and a final aggregate including what is not considered in the other categories (called "other vegetables"). At each category those data include information such as: monthly sales volumes (q_i); average price of the month (p_i); monthly market share (w_i).

The preliminary analysis of data highlights that Italian RTE and fresh cut market has a positive trend. Meanwhile, fresh produce market has registered a negative trend, although the dimension of the two markets is 1 to 10. The two years observed recorded an 11% increase in sales. Real prices have declined, although fresh produce prices decreased more. Whether there has been a substitution effect or complementarity, in such a market situation, could add economic rationality into the clarification of the effects of the presented trends.

Results

Estimation AIDS

Table 1 shows the values of the estimate of AIDS model, applied on two-year data 2008-2010 of the vegetable Italian market, divided into ten categories, as described previously.

The goodness of fit of the model is expressed by *R squared* with a value ranging between 0.76 and 0.96 for each equation set in the system. Furthermore, it should be added that, about 60% of the 45 free parameters estimated by the model are statistically significant at least at 10% probability. Each value of the coefficient is interpreted in terms of

	Equations									
	eq. 1	**eq.2**	**eq.3**	**eq.4**	**eq.5**	**eq.6**	**eq.7**	**eq.8**	**eq.9**	**eq.10 (x)**
α	0.374*** (-3.68)	0.164 (-1.38)	0.133* (-1.77)	-0.031 (-0.21)	0.036 (-0.54)	-0.09 (-0.72)	0.599*** (-5.04)	-0.288 (-1.22)	0.238** -2.21	-0.136 (-0.53)
logP1	-0.006 (-0.99)	_	_	_	_	_	_	_	_	-0.024*** (-2.9)
logP2	-0.002 (-0.94)	0.039*** (-11.49)	_	_	_	_	_	_	_	0.016* -1.9
logP3	-0.002 (-0.44)	0 (-0.49)	0.030*** (-6.61)	_	_	_	_	_	_	-0.003 (-0.42)
logP4	0.026*** (-3.388)	-0.024*** (-9.14)	-0.006 (-0.75)	-0.110*** (-4.06)	_	_	_	_	_	0.035*** (-3.03)
logP5	0 (-0.16)	-0.002 (-1.55)	0.002 (-0.83)	-0.003 (-0.39)	0.024*** (-7.72)	_	_	_	_	-0.020*** (-3.17)
logP6	0.006 (-0.84)	-0.006** (-2.35)	-0.012* (-1.93)	-0.033* (-1.71)	0.001 (-0.13)	0.196*** (-5.67)	_	_	_	-0.025** (-2.25)
logP7	-0.035*** (-5.63)	0.003 (-1.35)	0.006 (-1.23)	-0.006 (-0.46)	0.011** (-2.44)	0.034*** (-2.85)	0.102*** (-8.59)	_	_	-0.058*** (-5.55)
logP8	0.027*** (-3.02)	-0.008 (-1.46)	-0.012* (-1.94)	-0.065*** (-5.33)	-0.003 (-0.54)	-0.055*** (-4.72)	-0.020* (-1.69)	0.138*** (-4.62)	_	-0.024 (-1.09)
logP9	0.011** (-2.29)	-0.012*** (-5.72)	-0.002 (-0.52)	0.025*** (-2.78)	0. 004 (-1.25)	-0.004 (-0.52)	-0.024*** (-3.67)	0.024*** (-2.61)	-0.017* (-2.26)	-0.036*** (-3.64)
logP10	_	_	_	_	_	_	_	_	_	0.213*** -7.99
β	-0.020*** (-3.79)	-0.006 (-0.89)	-0.006 (-1.55)	0.005 (-0.58)	-0.002 (-0.41)	0.009 (-1.32)	-0.258*** (-3.91)	0.039*** (-3.02)	-0.013** (-2.09)	0.0184 -1.32
var%IPC	0.007*** (-2.65)	0 (-0.1)	-0.002 (-1.02)	0.003 (-0.95)	0 (-0.20)	-0.004 (-1.55)	-0.004* (-1.69)	0.011* (-1.67)	-0.001 (-0.37)	_
season	4.01E-09 (-1.19)	-1.72e-08*** (-3.10)	1.17E-09 (-0.51)	2.01e-08*** (-4.78)	4.74e-09* (-1.9)	2.63E-09 (-0.72)	4.48E-10 (-0.13)	-2.73e-08*** (-2.93)	8.73e-09*** (-2.79)	_
prod.	0 (-1.31)	0.003 (-0.89)	0.002 (-1.4)	0.006** (-2.55)	-0.001 (-0.65)	0.003 (-1.48)	-0.006*** (-3.18)	0.001 (-0.21)	0 (-0.14)	_
trend	0 (-1.31)	0 (-0.6)	0 (-0.67)	0 (-0.47)	0 (-0.05)	0 (-1.59)	-0.001** (-2.35)	0.001 (-1.26)	-0.001** (-2.42)	_
R - squared	0.8932	0.9232	0.7576	0.98	0.9474	0.9609	0.9619	0.7769	0.963	

Tab. 1 – Estimation results

(x) With restriction

Source: our elaborations from *Symphony* IRI data (student *t* value in parenthesis)

(* significant at 90%; ** significant at 95%; *** significant at 99%)

percentage change in the purchased quantity of good *k*, respect to the change of one percentage point of the price *p* of the good *i*. This value is calculated through the inverse relationship (exp(logP_{ik}) - 1)*100.
With reference to fresh vegetables, the value and the sign of the coefficients in the equations of the system highlights that the market behavior of these categories in response of a change in the price of vegetables RTE products is not unique, thus, the two markets are not connected by a direct relationship. A change in the market prices of fresh products determines an increase in the market share of RTE, between -5.5% (logP_{68} = -0.055) and +3.5% (logP_{510} = 0.035). By excluding the presence of a substitution effect, changes in the sales of fresh products, could be attributed to other external factors and no to direct competition with RTE categories.
On the other hand, the interpretation of the coefficients related to RTE categories is different. With a percentage point change in the categories of RTE, we have a less marked decrease in the market shares of the same categories, except for *baby leaf* category that show an increase in the sales of 2.6% further to the increase of a percentage point of the *enriched salads*.
Also in the case of *crudités* it is possible to state that the price is not a decisive factor in driving demand of other categories, so the existence of a substitution between the RTE products is to be excluded. The price increase in a category, never leads to a purchase decrease of the same category, for the benefit of other potentially replaceable ones. In this way, if the consumer decides to not buy a RTE product because of its price, he does not replace it with another one.
The coefficients among the several categories of fresh vegetables, show less significant changes. Among these, the coefficient logP_{89} (0.024) should be emphasized, which represents a increase of 2.4% in the *legumes* in response to an average increase of 1% in the *greens* price.
Among the variables considered in the empirical model, the *seasonality* turns out to be statistically significant for most of the categories, confirming that this factor is decisive and that it may influence the demand of vegetables. At the same way, the *production* is an influential factor in the demand, mostly for the *baby leaf* and for f*resh salads*.
These results allow to confirming that the positive trend in the Italian market of RTE vegetables is not due to a factor of substitution between the RTE product and the fresh products. The positive trend could be controlled and influenced by other variables, which may be high quality and *convenience* of products, changes of lifestyle, greater purchases in store with more RTE products, and other variables. Moreover, the result of greater purchases and consumption of RTE vegetables, without negatively affecting the fresh segment, could be the results of a greater attention to food quality.

Elasticity of Demand
The expressed values by the diagonal in the table 2 represent the Hicksian elasticity of demand related to price. As regard the elasticity of the RTE products, it is not possible to treat all categories together, because of their different behaviour. The category of the *enriched* salads is the only with an elastic demand, confirmed by a highly statistically significant coefficient equal to -1.45. It indicates that with a decrease in price, we have a more than proportional increase in the purchases, followed by an increase in the total revenues. In this case, the positive trend in the purchases of this category could be attribute to the price factor. For the other categories, the situ-

Price									
enriched	**To cook**	**crudités**	**baby leaf**	**mono-type**	**mix**	**salads**	**legumes**	**vegeta-bles**	**other**
fresh-cut	fresh-cut	fresh-cut	fresh-cut	fresh-cut	fresh-cut	fresh	fresh	fresh	fresh
-1.454***	0.521***	1.015***	0.01	0.341**	0.274	-0.101	-0.654***	-0.009	-0.003
(-2.75)	(-3.93)	(-3.33)	(-0.04)	(-1.96)	(-1.22)	(-0.96)	(-8.72)	(-0.02)	(-0.02)

Tab. 2. Own Price Elasticities
Source: our elaborations from *Symphony* IRI data (student *t* value in parenthesis)
(* significant at 90%; ** significant at 95%; *** significant at 99%)

ation seems to be quite different, because the estimated coefficients for the elasticity of the *baby leaf* and of the *mixed* salads, are not statistically significant, disproving the presence of a price effect on the bases of the positive trend of these two categories. The categories of *ready-to-cook* vegetables, *crudités* vegetables and *mixed* salads, are represented by a positive sign in their coefficients, interpreted as an increase in the purchased quantities because of an increase in the price. Should be noted that this interpretation is influenced by other external variables that can support the purchase of these products though the price tends to increase.
Also fresh vegetable demand turns out to be inelastic where the only statistically significant coefficient belongs to *legumes* (-0.65), which has an absolute value less than one, and therefore greater total revenues.
Cross elasticity of the demand related to price among the different RTE vegetables confirm whether they are substitutes or complementary goods. The following combinations: *baby leaf – ready-to-cook* vegetables, *mixed salads – ready-to-cook*, *mixed salads – crudités*, *mixed salads – baby leaf*, are characterized by a negative value and less than one confirming the complementarity.. The only positive coefficient and greater than one belongs to pair of *enriched – baby leaf*, indicating them as substitutes goods.
The analysis of cross elasticity among the RTE products and the fresh produce shows that most of the coefficients has negative sign, confirming that, between the two wide sections of vegetables, mainly, exists a relationship of complementarity and not substitution. The analysis of the cross elasticity among the fresh categories, confirms that the different fresh products are complementary goods, with the only exception of the legumes and the greens.

Conclusions

The two-year period 2008 - 2010 showed for the Italian vegetable fresh-cut market a positive trend with increase in consumption of 11%. This market was analyzed by the model LA/AIDS, in order to estimate the change in the market shares of the different product categories to vary the price factor and to check for a possible substitution effect between the different product categories.
In general we can say that between the two compartments, the fresh-cut and the fresh produce, there is not a real relationship, nevertheless, it seems that they are weakly

influenced. In fact, an increase in the price of RTE products does not involve a decrease in purchases, and at the same time it does not yield any market shares at fresh products. Simultaneously, the model suggests that, as prices of fresh-cut categories increase, sales increase as well, confirming that the price factor does not represent a barrier for the purchase of this products, but it is associated at information on quality and safety. In the light of these results, it is possible to confirm that price trends are pushing upward fresh-cut more than the anaelastic fresh counterpart.

Moreover, other independent variables take over, such as seasonality and production of seasonal vegetables, which complicate the interpretation of results and make it difficult synthesis. This interpretation is even more complicated if we take into account that change in life-style that lead to meal substitution phenomena. This result supports the hypothesis that the growth of Italian-cut vegetable market is not due to a price factor stressed by the large distribution companies.

The calculation of price demand elasticity of the different categories belonging to the two vegetables sectors, underlined a similar behavior of the two sectors regarding to the prices increasing in their respective categories, because demand does not appear to be elastic to any of the products under consideration, except for *enriched* salads (but they represent a small portion of the entire market). The cross-elasticity of demand to price in the fresh-cut sector has produced more detailed conclusions, providing information on the substitution or complementarity relationship between the different products. The fresh-cut products are mainly characterized by a complementarity factor, except for the combination *enriched* salads - *baby leaf* salads, which seem to be governed by a replacement ratio. The results of the cross elasticity between the two compartments, reinforce the conclusion that there is not a relation of substitution between different products, with the sole exception of the salads category. The analysis of cross elasticity reveals that fresh products are strongly linked to diet, while the convenience counterpart is more price elastic. It is also possible to state that the fresh-cut represent innovative products to consumers, "well-judged", and they do not replace and do not directly interfere with the fresh product. Therefore, the market boom for fresh-cut products can be considered both quality (convenience) and price driven.

The knowledge of the substitution and complementarity relationship between the different F&V fresh-cut and fresh products, may be exploited directly by the operators of retail sector to manage prices and schedule any offers in the market. Furthermore, the increase in consumption of horticultural products packaged without interfering with the fresh vegetable market, recorded an increase of consumption in the period of reference, can be interpreted as a slight change in the diet of Italian food, the result of an increased focus on health or a change of lifestyle.

This research, in addition to the results discussed, it also offers tips and suggestions for future researches on the same topic. A micro level analysis on more disaggregated data could help to depict more specific phenomena at regional or town level, given that they are by more complex trend. A detailed analysis on motivation and price sensitivity could be performed through the state preferences approach. Finally, longer time series would allow understanding the effect of socio-demographic changes on fresh-cut consumption.

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Expoloring Factors Effecting Willingness-to-pay for Sustainable Wine Through Hypothetical and Non-hypothetical Experimental Auctions

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Abstract
We explored Italian Millennial wine drinkers' willingness to pay for three wines with specific sustainable attributes (roughly, one focused on environment protection, one on social care and one on an ethical issue) through fifth-price auctions. Totally 160 respondents, between 18 and 35 years old, participated in hypothetical and non-hypothetical experiments. Findings reveal that gender (female) and age (older individuals) have a strong and positive effect on WTP of all three auctioned wines. Results should be carefully considered by wine producers and retailers as preferences constructed at a young age might last for a lifetime.
JEL Classification code: D44; C92; Q13
Key words: Willingness-to-pay (WTP); sustainable wines; experimental auctions

Introduction

Recently Christ and Burritt (2013) have identified the main areas of environmental concern that the global wine industry is currently facing: water use and quality issues, the production and management of organic and inorganic solid waste streams, energy use and the generation of greenhouse gas emissions, the use and management of chemicals in the vineyard and winery, land use issues and the impact on ecosystems. Indeed, like other food industries, the wine business has been increasingly impelled by market and regulatory drivers to assess, reduce and communicate environmental and social performances, particularly in certain countries with a shorter tradition in winemaking (Australia, New Zealand, U.S.A. and South-Africa). In addition wine companies have realized that sustainability constitutes a means of differentiation, which is crucial for increasing productivity and competitiveness. Consequently, sustainability has developed into a priority in the wine supply chain (Forbes *et al.*, 2009; Gabzdylova *et al.*, 2009). Despite the above described scenario, the reasons behind consumers' adoption of sustainable practices, the attitudes and intentions to purchase sustainable wines remain largely unexplored (Barber, 2010). Furthermore, many authors believe that consumers will not be willing to trade-off the quality of a wine for environmental/social features (Lockshin & Corsi, 2013) – thus sustainable wines should be sold at the same price as regular wines. Other scholars remark that sustainability will most likely become a relevant competitive advantage in the international arena (Pullman *et al.*, 2010; Forbes *et al.*, 2009). This paper draws on two previous researches that have investigated Italian young adults attitude and willingness to buy (Pomarici & Vecchio, 2013) and willingness to pay for sustainable wines (Vecchio, 2013). In particular, the current study was designed to better frame the importance of social/ethical and environmental attributes for Millennial wine drinkers (i.e. individuals aged between 18 and 35 consuming wine at least once a month).

Material and methods

Following previous scholars (Depositario *et al*., 2009) we recruited participants among undergraduate students in the city of Naples, Southern Italy. The only requirements were to be a wine consumer (at least once a month) and to be aged among 18 and 35. Totally 16 sessions were held, with an average of 10±1 participants in each session (N = 160). Participants in the non-hypothetical auctions were compensated with 10€ cash, for one and a half hours of their time and received an ID number. While subjects involved in the hypothetical auctions did not receive any endowment. Every other procedure was identical for the two type of auctions. In details: *i*) each session started with two training auctions (with potato chips and a chocolate snack) where participants were encouraged to ask questions and expose potential uncertainties; *ii*) respondents were asked to complete a short questionnaire after finishing the auction; *iii*) participants were asked to bid on 3 different products: a wine with a carbon footprint logo showing a green footprint with the writing CO_2, a wine including a Libera Terra logo and a wine with the Wine for Life logo (hereon respectively named CF, LT and WFL, see Figure 1). Each bottle of wine (standard 0,75 liter) with the sustainable logo carried a brief explanation of its meaning and purpose, all four wines had the same general information: geographical indication (PGI Sicily), vintage (2011), and type (red). No additional information on brand, varietal grapes used, sensory characteristics or actual market price were given to respondents. This decision was taken as previous scholars have demonstrated that provision of reference or field price information influences bid values in experimental auctions (Drichoutis *et al*., 2008; Corrigan & Rousu, 2006). The full bidding approach was used as several studies agree that subjects tend to value the auctioned products more in the endowment procedure (Lusk *et al*., 2004; Corrigan & Rousu, 2006; Gracia *et al*., 2011). Finally, ordering effect was resolved through randomization. In the training auctions we posted prices to explain the auction mechanism, but during the wine auctions we did not reveal any bidding information. Based on the second-price Vickrey auction methodology (Vickrey, 1961), an experimental valuation process using a fifth-price auction was developed. The choice of the fifth highest bid makes it possible to increase the number of participants in the transaction hence increase the degree of involvement in the auction of those individuals who attribute low values to the products on sale. As noted by Lusk and colleagues (2004), this type of auction combines the advantages of second-price and random *n*th-price auctions. Furthermore, Lusk, Alexander and Rousu (2007) demonstrated that if the number of participants who could purchase the product is approximately half the session all bidders would generally be more engaged. We made it clear to the subjects participating in the real auctions that only one round and one product will be binding, to avoid demand reductions and wealth effects (Shogren *et al*., 1994). Due to the specific features of our sample (only undergraduate students) we did not collect several common socio-demographic characteristics that would not add useful insights of respondents profile (marital status, average annual income, responsibility in everyday food shopping, etc.).

To analyze the factors that influence behavior in both type of auctions we estimated Tobit models to account for zero bids, where the dependent variable is the individual's auction bid in Euro cents. As our interest is in terms of the main effects we have ignored possible interactions. In particular, the independent variables are participants'

Figure 1. Labels used in hypothetical and non-hypothetical experimental auctions.

basic socio-demographic and lifestyle characteristics, wine and other alcoholic beverages consumption frequency and modalities, sustainability concern and knowledge of the specific labels (Table 1).

Results

Table 1 provides a summary of socio-demographic and auction-related survey variables. Most data has been collected through Likert-scales, subsequently variables were transformed (i.e. from level 1 to 5 into low/high) to be applied in the econometric models as dummies.

As reported in Table 2 mean bids for the 3 wines vary quite widely. Not surprising WTP in the hypothetical auctions range from 58% (CF and WFL) to 63% (LT) more than WTP in non-hypothetical auctions. Overall averages reveal that WFL (€ 5.07) receives a premium of 21% on the CF counterpart (€ 4.18) and 25% compared to LT wine (€ 4.05).

Table 3 reports derived marginal effects, calculated at the sample means. Marginal effects correspond in significance and direction to the parameter estimates (Log likelihoods are, respectively -321.6, -313.4 and -330.3). These effects are computed using all data, i.e. since there are 160 respondents and each

Table 1 (right). Socio-demographic and auction-related survey variables (*N* =160).

Variables		%
Age	Range 18-26	81
	Range 27-35	19
Gender	Female	61
	Male	39
Area of residence	Urban	64
	Rural	36
Wine consumption frequency per week	Low	18
	High	82
Wine consumption location (main)	Home	40
	Out of home	60
Beer consumption frequency per week	Low	56
	High	44
Spirits consumption frequency per week	Low	82
	High	18
Alcopops consumption frequency per week	Low	66
	High	34
Care for sustainability in everyday food shopping	Low	37
	High	63
Care for sustainability in everyday non-food shopping	Low	74
	High	26
Care for environmental sustainability in wine shopping	Low	61
	High	39
Care for social sustainability in wine shopping	Low	88
	High	22
Knowledge of CF label	No	69
	Yes	31
Knowledge of LT label	No	79
	Yes	21
Knowledge of WFL label	No	66
	Yes	34

	Mean bid	Std dev.	Min	Max
CF non-hypothetical	3.24	2.39	0	13
CF hypothetical	5.13	3.92	0	18
LT non-hypothetical	3.08	2.29	0	11
LT hypothetical	5.02	4.83	0	15
WFL non-hypothetical	3.93	2.49	0	13
WFL hypothetical	6.21	4.15	0	20

Table 2. Bids in Euros in auctions (per bottle).

of them bided in five rounds, regressions are based on 800 observations. For the CF wine, the Tobit results in the second column show that age, gender, care for sustainability in everyday food shopping, care for sustainability in wine shopping and knowledge of the CF label positively impact WTP (and are statistically significant). In particular, female and the older age cohort exert a strong increase in bids, respectively €2.15 and €2.32. These two variables have a predominant influence also on WTP for the LT label, however for this product the variable "care for social sustainability in wine shopping" is almost as important (€1.94). No other variables included in the research has a statistically significant impact on LT bids. Turning attention on the WFL product, we can notice that again female gender and older age cohort influence WTP of € 2.06 and €2.22, together with care for social sustainability in wine shopping (€ 2.01) and knowledge of the WFL label (€ 1.85). Wine consumption frequency, together with consumption of other alcoholic beverages, does not significantly affect WTP of all 3 types of sustainable wines.

Variables	Carbon Footprint (CN)	Libera Terra (LT)	Wine For Life (WFL)
Age	215.12***	205.64***	268.91***
Gender	232.41***	221.76***	283.25***
Urban	180.60	172.05	167.83
Wine consumption frequency	237.16	212.58	301.22
Wine consumption location	194.29	187.32	201.03
Beer consumption frequency	46.87	70.14	91.08
Spirits consumption frequency	32.95	47.17	39.44
Alcopops consumption frequency	98.06	84.13	104.62
Care for sustainability in everyday food shopping	108.63*	120.25	145.21
Care for environmental sustainability in wine shopping	201.72***	108.04	279.10
Care for social sustainability in wine shopping	182.45	193.64**	201.42*
Knowledge of CF label	166.91*	41.74	112.76
Knowledge of LT label	24.09	192.06	31.19
Knowledge of WFL label	23.59	69.01	184.90***
Number of observations	800	800	800

Table 3. Tobit estimates for the 3 auctioned wines
Note: Dependent variable is the bid for wine in Euro cents. *,**,*** significant at 10%, 5% and 1% level respectively.

Discussion and conclusion

As noted by Schmit and colleagues (2013), at present wine industry's sentiment is that eco-certifications might grant broad benefits that go beyond price premium. Indeed several studies seem to substantiate this idea, as Loureiro (2003) estimated that Colorado environmentally friendly wines receive a small premium compared to conventional wines. Similarly, Bazoche and colleagues (2008) proved that wines with environmental characteristics do not seem to be valued more highly than traditional Bordeaux. Moreover Delmas and Grant (2010) show that eco-labeling has a negative impact on prices for organic California wines, while there is a price premium associated with eco-certification. Furthermore, previous papers have also revealed that consumers' environmental knowledge level influences willingness to purchase more environmentally friendly wines (Barber *et al.*, 2009), whereas other scholars (Brugarolas *et al.*, 2005) show that consumers with more healthy lifestyles tend to pay higher prices for organic wines. Recent findings of Mueller and Remaud (2013) reveal that marginal willingness to pay (WTP) for environmentally responsible claims is about three times as high as for the specific socially responsible claim; and while the WTP for environmental responsibility is non-negative across all the investigated markets, it is negative for the socially responsible claim in France and Francophone Canada. Indeed, wineries located in the New World seem to be more sensitive to environmental and social issues connected to wine production processes. Previous research has shown that consumers positively value sustainability attributes of wine (Mueller & Remaud, 2013; Vecchio, 2013). Our findings reveal that gender (female) and age (older cohort) significantly and strongly affect willingness to pay for all the auctioned sustainable wines. Results of current paper should be carefully considered by wine producers and retailers as preferences constructed at a young age might last for a lifetime. In addition, the Millennial cohort is currently an attractive segment for multinational firms across the globe, particularly in emerging markets (Douglas & Craig, 2006; Kjeldgaard & Askegaard, 2006; Thach & Olsen, 2006). Findings also contribute to the growing literature on consumer valuation of sustainable labels for foods (e.g. McCluskey *et al.*, 2009; Annunziata *et al.*, 2011; Vecchio & Annunziata, 2013). However several limitations are inherent to this type of study. Briefly we mention the major ones. First there are strong social desirability issues (Fisher & Katz, 2000), as respondents often seek to satisfy social norms rather than reveal their true preferences. Moreover the specific characteristics of the auction protocol, including a hypothetical and non-hypothetical elicitation context (e.g. Lusk & Fox, 2003), together with intrinsic bias due to the experimental design (e.g. Vecchio & Pomarici, 2013) have surely effected overall outcomes. Furthermore the research involved only 3 wines with particular social, ethical or environmental features probably influencing specific WTP. Therefore future research should try to expand our experiment using other mechanisms to test robustness of our findings, particularly when other cues are included in the valuation scenario (such as specific sustainability certifications, information shocks, point of purchase influence). Finally, integrating in this type of experiment sensory evaluation of the products appears particularly important since previous research has demonstrated that quality matters and sensory evaluation dominate all other extrinsic environmental factors (Schmit *et al.*, 2013).

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Wines from Lazio Region: an Evaluation from Three Major Italian Wine Guides

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Abstract
The paper is a first attempt of evaluating the perceived quality and consumers' appreciation of the main wines of Lazio Region. This is done through the analysis of data on experts' evaluation on these wines and on consumers' prices as released in 3 major Italian wine guides: Gambero Rosso, l'Espresso and AIS (Italian Sommelier Association). Results show that market visibility, positioning and reputation of these products, overall, are facing some difficulties. However, is also show that the efforts made so far by the more dynamic components of these chains are starting to produce some positive results.
We also built a simple hedonic price model in order to evaluate to what extent experts' evaluation affects consumers' price the originality of our contribution is to refer to 3 guides and to test for the effect of being reviewed by more than one guide. Results show that the Oenologists' evaluation significantly raises prices and that this effect is larger for red wines than for white ones. Furthermore, the model confirms that the reputation of many DOC certifications from Lazio Region is not still very much appreciated by the market, as for consumers' they add a negative price premium when compared to other typologies.
JEL Classification code: *D400*
Keywords: Hedonic Price, Certifications of Origin, Wine of Lazio region, Wine Guide

Introduction

Wines from Lazio Region represent about 2,5% of Italian production, some of them had been traditionally well traded in both national and international markets such as UK, USA, Canada and Germany. Nevertheless, the regional wine sector has undergone a long period of decline. Many wines, including those with Designation of Origin, have been facing a decrease in (real) prices and in quantity sold, both in the domestic and world market, even in traditional client countries. In addition, land devoted to vineyards has reduced dramatically over the last 15 years, well beyond the steady rate of reduction registered at national level. A recent study on the supply side has pinpointed the major causes of this loss of competitiveness and overall decline (Carbone et al. 2010). These may be shortly summarized as follows. Production is highly fragmented, both at farm and at processing plant level, including the coops. Fragmentation, in turn, influences the level of production costs, innovation and investments, the distribution of market power along the chain, and the possibility to build a strong reputation in an increasingly vast and global arena. Consequently, the vicious circle that arose implied, among others, that: i) cultivation techniques and vine varieties are frequently not updated and not well suited to provide the quality consumers' are looking for; ii) logistics is highly fragmented, insufficient and not efficient; iii) the management of Designation of Origins has been addressed as being lacking and poor in terms of collectively organizing common strategies among all the involved stakeholders. Nevertheless, it is worth to pinpoint that in recent years a few attempts to foster quality and catch-up

with other Italian Regions that have formerly undergone a renovation process, are experienced and there are meaningful, though still few, producers that are committed in improving quality and reputation.
On the demand side, a comprehensive study aimed at analyzing the position in the market and the products' reputation of Lazio wines is still lacking. Thus, the paper is a first contribution to assess the quality judgments and consumers' appreciation of the main wines of Lazio Region. The analysis is based on data from experts' evaluation and on consumers' prices as released in 3 major Italian wine guides: *Gambero Rosso* (2010), l'*Espresso* (2011) and *AIS* (Italian Sommelier Association, 2010).
More in details, the paper seeks at providing some preliminary insights on the different factors that may influence consumers' price for these wines. In order to meet this goal, a first specification of a hedonic price model is suggested by referring to the literature and considering available data. In fact, this kind of analysis is well established in the literature (Landon and Smith 1998, Oczkowski 2001, Schamel 2006, Costanigro et al. 2007, Brentari et al. 2011), even in more rich and sophisticated forms. In this paper we included only few variables, represented by wine color, sub-regional area of origin, kind of certification of origin for each wine (DOCG, DOC and IGT) and the experts' evaluation. Nevertheless, the study innovates due to inclusion of evaluations from three guides. This allows for a, somehow, more *objective*, less erratic judgment of the wines. Furthermore, considering more than one guide allows investigating the value brought to a wine by the additional visibility obtained in case it is reviewed not only in one guide but in two or even three guides.
The paper is organized as follows. Section 2 briefly roots our exercise in the literature of hedonic price with a focus on contributions on wine. Section 3 describes the logical framework of the analysis, the data and variables used and the hedonic price model that has been built. Results are discussed in Section 4 while last Section concludes.

The hedonic price model in wine literature
According to Lancaster (1966), the good, per se, does not give utility to the consumer while the characteristics embedded in the good does. Under the assumption of perfect competition the theory suggests that consumers' willingness to pay depends on benefit associated with that product and the observed market price is the sum of implicit prices paid for each quality attribute. Hence, in the analysis of differentiated-products markets, a number of studies have adopted hedonic price model in which the price of any particular product is described as a function of its characteristics (Rosen, 1974). In literature a large number of studies have adopted this approach for estimating to what extent wine characteristics affect prices. Many authors have focused on the perceived value of reputation linked to region and country of origin (Panzone and Simões 2009, Schamel 2006, Schamel and Anderson 2003) as well as to the wine producer (Ling and Lockshin 2003, Landon and Smith 1998) that appear to play an important role in the composition of price. In addition, also grape variety (Steiner 2004, Schamel and Anderson 2003) and sensory quality ratings (Costanigro et al. 2007, Schamel and Anderson 2003, Oczkowski 2001) have been taken into account in implicit price estimates, given that consumers evaluate these factors when making a purchasing decision.
Hedonic price approach has been often adopted separately for sub-markets, in order to assess if they differ in their pricing structure. For instance, it is expected that wines

from the "old wine world" (Italy, France and Spain) which has focused its production on regional characteristics present a quite different pricing structure compared to the "new wine world" such as US where grape variety is the main factor in product labeling and marketing (Mueller Loose and Szolnoki 2012, Goodman 2009). Other factors like the presence of different wine price segments (Costanigro et al., 2007), several retail formats (Brentari et al., 2011) and wine colour[1] (Schamel, 2000) may lead to consider different pricing structures in the estimates.

Methodology

The hedonic price model for Lazio Region wines

Given necessary cautions, the hedonic price model still represents a valid empirical methodology (Thrane, 2004); despite in the literature, in particular in wine context, it has received some critics, both from an econometric and a theoretical point of view (Unwin, 1999)[2]. The selection of variables to be included in the hedonic price modeling is based on careful examination of both theoretical and empirical issues also related to the type of data available.

The variables included in this first hedonic price model for Lazio Region wines are: the rating obtained in the guides and the number of reviews obtained by each wine; the kind of certification of origin to which it belongs (DOCG, DOC and IGT); its (sub-regional) area of origin; and, last but not least, the color of the wine. Hereafter, we discuss more in details the role of each selected variable in our framework and the kind of impact we expect it can have on price.

First, quality ratings in the selected enological guides and the number of reviews received by each wine were considered as wine guides represent a key factor that affects the market price mechanism (Oczkowski, 2001).These are considered proxies for quality as it is communicated along the chains to stakeholders and the final consumer.

In considering whether quality ratings are given by more than one guide, we are able to work on assessments that could be called most established, following a number of studies assessing that experts may differ in their opinion (Cliff and King 1997, Hodgson 2008, Castriota et al. 2012). Furthermore, it is hence possible to evaluate the existence of an additive effect in the greater visibility that a wine can achieve when present in two or three guides[3].

Second, the kind of Certification of Origin was considered in this study as place of origin is (increasingly) important in consumers' eyes and, as this is a credence attribute, the information is mainly conveyed by certification schemes. Alike those of different countries, the Italian System forms the so called Quality Pyramid (Chiodo, 2008). Table wines (VdTs) lay at the very bottom of the Pyramid, with no possibility to indicate vintage and varieties blended. IGTs (Typical Geographi-

1. Schamel (2000) has proceeded to an estimate and a comparison between a white wine (Chardonnay) and a red wine (Cabernet Sauvignon), for sensory quality ratings, individual wine quality and regional reputation variables. The results suggested that U.S. consumers were willing to pay a higher quality premium for white compared to red wine while certification of regional origin was more important in red wine market rather than in white wine context.

2. In a review, Unwin (1999) noted that the main problems in this research are related to data-driven research, lack of justified theory between model predictions and consumer behavior, multicollinearity among the explanatory variables and, finally, the use of wine quality judgments as independent variables.

3. The present analysis relies on the implicit assumption that each guide has the same impact on the market. This could be relaxed in future research by introducing additional measures of each guide impact (e.g. in terms of number of copies sold).

cal Indications) embody the second floor of the pyramid; these are characterized, compared to the higher steps, by looser roots in the place of origin, relatively more freedom in production rules and in blending vine varieties (including international ones). DOCs (Controlled Denominations of Origin) represent the third floor of the pyramid; this requires strict definition of production area, more stringent production rules and blending. Finally, on the top of the Italian quality ranking, there are DOCGs (Designations of Origin Controlled and Guaranteed) that are restricted only to very high quality and long reputed wines with outstanding traditional roots in the place of origin and are much controlled by the national controlling bodies[4].

One additional factor that, in principle, may deeply affect prices of wines in Lazio region is the Province where the wine is produced. Actually, the territories of the region are highly heterogeneous with respect to climate, soil and other natural factors, and also with respect to skills, know how, traditions, reputation and so forth.

Lastly, the color of the wine has been regarded as an important variable to be considered due to different reasons. First, the production process is different for white and red wines. There are differences in technology, length of the process and subsequent ageing, and so forth; everything considered production costs tend to be, on average, higher for red wines. Second and more specific, in Lazio Region white wines represent by far the larger share of the production (about three quarters) and these are better known and more reputed. Nevertheless, things seem to be changing. In the last years, a production switch in favor of red wines took place and new red wines appeared much varied in typologies and overall targeted at relatively higher quality market segments. Thus, it seems interesting to verify whether enological guides are playing a different role on consumers' willingness to pay depending also on the color of the wine.

Data and model specification

The analysis is based on a dataset constructed by referring to the evaluations given by three major Italian wine guides: *Gambero Rosso*, *Espresso* and *AIS*, which overall refer to 444 wines from Lazio Region. More in details, *Gambero Rosso* and *AIS*, both report on 251 wines from Lazio, while *Espresso* reports on 158. Among these 444 wines we find that 289 appear only in one guide, 94 appear in 2 guides and 61 are present in all three.

The evaluation is done by panels of experts (2-3 persons) that blindly test the wine at least once, or more times when required. The tests took place in institutional settings during the period May-August. As the three guides here considered use different but very close scoring systems, in order to make them fully comparable the different scales have been converted into a unique scale with four scores and then we used the average score. In the new scale, 1 means appreciable, 2 means good, 3 means very good and 4 means excellent[5].

The prices reported in the guides are final consumers' prices and have been observed in dif-

4. The CE Regulation 479/2008, that reformed the Common Market Organization for the wine sector, introduced the European system that includes only two different certifications: PDO and PGI. Member States are, altogether free to use either, both separately and in conjunction. However, DOCG, DOC and IGT are widely used in the Italian market at the present moment and were the only one present when the data were collected.

5. Experts' evaluation can be reasonably assumed to be exogenous as tasting must occur blindly and an explorative analysis, which is available from the Authors upon request, did not detect association between the subjective evaluation of wine quality and the objective characteristics considered (e.g. wine color, certification of origin).

ferent retailers. The three guides use different criteria: *AIS* report a value while *Espresso* and *Gambero Rosso* report an interval of values so that we calculated the mean. The resulting values are not always perfectly aligned so that the average of the three values has been considered for the regression analysis.

It is worth noticing that in the sample there are 287 IGT belonging to two different IGT schemes: *Lazio* and *Frusinate*; 107 DOC wines belonging to 19 different DOC schemes; and 37 wines belonging to the brand new regional DOCG *Cesanese del Piglio*[6]; last, there were 13 VdT (Table wines) that were reviewed in the guides.

Furthermore, meaningful information is that 229 red wines and 215 white ones were reported. This is not at all trivial when compared to the importance for the two kinds of production within Lazio Region where white wines, as already recalled, are far more traditional and important in volumes.

Coming to the evaluation, the average score obtained by the 444 wine of Lazio region altogether is 1.87; this, on the 1 to 4 scale, means fully appreciable/almost good, or in other words, more (but not so much) than the basic score that allows a wine to be present in the guides.

On average, DOCG wines are evaluated slightly better with 2.06. The other categories gain, on average quite close scores with 1.87 for DOC, 1.86 for GI and 1.6 for Vdt. In line with the traditional inclination of the Region, white wines get slightly higher average score than the red ones in all the categories, with an average of 1.875 versus 1.866[7].

6. There is another new DOCG now that is linked to *Frascati* DOC but at the moment of the analysis production was still sold under the DOC.

7. VdT wines are not aligned, however, due to their small number (only 13 Vdt wines are reviewed in the guides considered) they have been removed from the dataset for subsequent analysis.

With regard to prices, the overall mean is 11.1 Euros per bottle (0.75 Liters), with a minimum of 1.8 Euros and a maximum value of 38.5 (standard deviation is 5.8). Red wines are priced more, on average, with 12.9 Euros per bottle versus 9.1 Euros per bottle for the white wines. Somehow surprisingly, DOC wines get the lower price with an average value of 8.8 Euros, while Vdt get 10.6 Euros, IGT 11.6 and DOCG 13.7 (for comments on this issue, see next section and the concluding remarks).

wine typologies	n of wines reviewed	scores 1-4 scale	final price (Euro)
Docg (only red)	37	2.05	13.7
Doc	107	1.87	8.8
-white	73	1.87	7.8
-red	34	1.85	10.9
Igt	287	1.86	11.6
-white	137	1.89	9.9
-red	150	1.84	13.1
Vdt	13	1.60	10.6
-white	5	1.60	7.9
-red	8	1.60	12.2
Total	444	1.87	11.1
-white	215	1.88	9.2
-red	229	1.87	12.9

Table 1. Evaluations and prices: general. Source: our elaborations on data from the Guides

The exploratory analysis of price distribution shows that wine price varies across the kind of Certification of Origin as well as across wine color. This is a first indication that these variables might play a potentially significant role in shaping price distribution.

Figure 1a reports the box plot[8] of the wine distribution by color while Figure 1b shows the box plot of the DOC wines divided by color in order to visualize the different patterns related to these groups. Red wines, as compared with white wines, show not only a higher median price level (10.3 against 8.95) but also a higher variability of prices. By considering the group of doc wines, figure 2b) shows that the distribution of price is quite different for red and white wines. This suggests that the effects of the various attributes, including experts' evaluation, on wine prices may not be similar for red and white wines.
The model specification was carried out by referring to literature on this subject and considering the results obtained from preliminary analyses.
As the choice of the functional form of the hedonic model is essential because it determines how the marginal prices will be functionally related to the attributes, we explored a series of possible transformations of the dependent variable (e.g. log, inverse square root) as well as transformations of experts' evaluation to allow for nonlinear relationships[9].
The analysis is conducted separately for red and white wines since a likelihood ratio test for the equality of coefficients for this data set easily rejects the hypothesis of no differences by wine color.

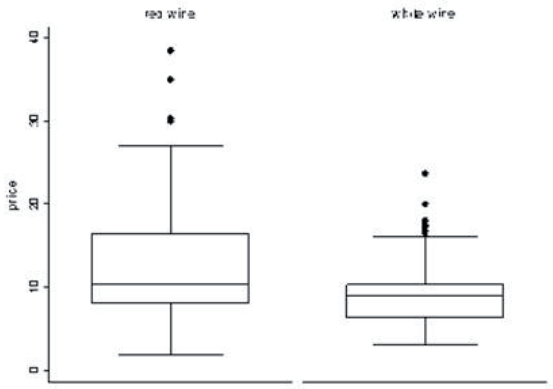

Figure 1a. Box-plot of wine distribution by color for all wines.

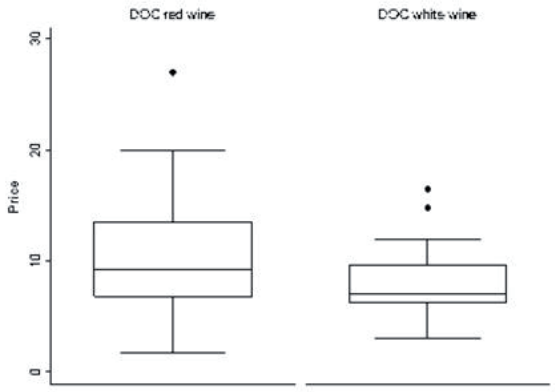

Figure 1b. Box-plot of wine distribution by color for DOC wines.

The functional form finally selected is the following:

Function $\log P = f(S, NG, Pr, C)$ [1]

Where P is the logarithm of the price of each wine, S represents quality ratings in the guides. NG is the number of guides where wine is reviewed, which is represented by 2 dummies, respectively, for 2 and for 3 guides reviewing the wine, while 1 guide is the benchmark. Pr indicates Provinces of origin that are represented by three dummies (only 4 Provinces are present in the sample as in

8. The box plot shows a box encased by two outer lines known as whiskers. The middle "box" represents the middle 50% of scores for the group. The remaining 50% of the sample is contained within the areas between the box and the whiskers, with some exceptions represented by the outliers. Inside the box, there is a single line that represents the median, which is the middle value of the entire sample. The location of the median line can also suggest skewness in the distribution if it is noticeably shifted away from the center.
9. In particular, we used the Goldfeldt–Quandt test to detect heteroskedasticity proportional to predicted values and the RESET test for misspecification. Stata 11.0 was used

the fifth there is practically no wine production at all. Latina Province is the benchmark). Finally, C denotes the certification of origin. Two dummy variables represent IGT and DOCG, while DOC is the benchmark (and VdT wines were removed due to lack of observations).

Results

Table 2 reports the results of the selected model. In order to show that log-linear model fits better than other hedonic model specifications, as shown by a misspecification test, Table 2 also presents linear model estimates.

	RED WINE		WHITE WINE	
	Linear	**Log-linear[1]**	**Linear**	**Log-linear**
Average score	3.506*	0.335*	2.011*	0.253*
	(0.876)	(0.064)	(0.424)	(0.045)
DOCG	1.822	0.247***		
	(1.575)	(0.114)		
IGT	2.286***	0.199**	2.052*	
	(1.243)	(0.090)	(0.525)	0.242*
Guide 2	-1.085	-0.025	0.469	(0.055)
	(1.162)	(0.084)	(0.599)	0.101
Guide 3	0.849	0.080	1.025	
	(1.404)	(0.102)		(0.063)
Frosinone			(0.670)	
			1.266	0.146***
Roma			(1.213)	(0.071)
Viterbo			0.786	0.156
Cons			(0.653)	(0.128)
	4.567*	1.725*	1.396	0.073
Adj R2	(1.992)	(0.145)		
Obs	0.0761	0.102	(0.728)	(0.069)
	221		2.983*	
				0.148***
			(1.055)	
			0.163	(0.077)
				1.453*
			210	
				(0.111)
				0.178

Table 2. Estimation results. Source:Our elaborations on data from cited Guides.
1 In log-linear models we reported the coefficients after the exponential transformation. The standard errors are presented in parenthesis.
* Statistically different from zero at level of significance 1%; ** statistically different at level of significance 5% *** statistically different at level of significance 10%.

According to the log-linear model we consider the exponentiated regression coefficients, exp(b) to know what happens on the price for a one-unit increase in x, holding all other variables fixed[10].

Although goodness of fit of the two models, both for white and red wines, is not high – as shown by the adjusted R2: 0.102 for red wines model and 0.178 for the white ones - due to the kind of variables considered, we found interesting results which deserve some comments and can encourage future investigations.

First, experts' evaluation significantly influences prices for both red and white wines. In particular, a point increase in quality ratings causes a price rising of 33.5% for red wines and 25.3% for white ones (both at 1% of significance). Despite the highly significant effect of quality ratings, the model shows that the presence of a wine on more than one guide does not affect consumers' willingness to pay except in the case of white wines reviewed by 3 guides altogether. In this case the impact on price is an increase of 14.6% (at 10% of significance) compared to the white wine the quality of which is assessed in one guide only.

Second, Certifications of Origin also affect final prices. In particular, it is interesting to note that, both for red and white wines, IGT from Lazio Region worth more than regional DOCs, thus confirming what anticipated with the descriptive analysis of Section 3[11]. The effect is higher for the white than for red wines, respectively 24.2% (at 1% of significance) and 19.9% (at 5% of significance). DOCG is also significant as it adds 24.7% (at 10% of significance) on the price of DOC red wines; whilst, as already mentioned, any Regional DOCG was present in the market for white wines at the moment of the analysis.

For white wines model the production area (i.e. the Province) is positively affecting price in the case of Viterbo, when compared with Latina province. Differently, neither Frosinone (see also footnote 12) nor Roma proved to have a significant impact. In particular, it is worth saying that Roma accounts for almost half of the reviewed wines and these present quite a large variability of prices, so that it should not be surprising that the coefficients are not significant[12].

Summing up, the results show that white and red wines from Lazio Region follow two quite different price patterns, both with regard to the variables that do play a role and with regard to the extent of their impact.

In the case of white wines, the guides evaluations and the IGT are the variables most affecting prices and have a similar impact around 25%. Besides, also the presence in three guides has a significant positive impact around 15%. Last, being produced in the Viterbo province is associated with a similar price premium around 15% when compared with the benchmark province of Latina.

The pricing model for red wines is different: here, guides evaluation is by far the most important factor, with an impact of about 33%, even though the presence on more than one guide proved not to be effective in pushing-up price level. Besides, there is a meaningful influence of Certification of Origin, both in the case of DOCG (that is *Cesanese del*

10. In a log-linear model the interpretation of regression coefficients is as follows: the dependent variable changes by $100*(e^{Coef}-1)$ percent for a one-unit increase in x, holding all other variables fixed.

11. The coefficients of the dummy variables are to be interpreted as a price premium compared to the reference groups, all other variables fixed.

12. Area of production (i.e. the Province) was removed from the red wines version of the model due to multicollinearity problems probably caused by a strong association between red wine, DOCG and Frosinone as in this province there are almost only red DOCG wines.

Piglio DOCG from Frosinone province that is worth an addition of 24.7% on red DOCs), and in the case of IGTs that is associated with a price premium of about 20% compared with red DOCs.

Conclusions

The paper discusses the quality ratings of wines from Lazio region and their impact on prices together with other variables. In order to estimate the impact of the experts' evaluation on the consumers' price for these wines a hedonic price model was built. Although a number of variables that may influence prices (e.g. alcoholic content, grape variety, year of the vintage) are not considered, this simple model specification is able to provide a few interesting insights in different directions that are relevant for future analysis of the wine supply chains in Lazio region.

Results show that 3 major Italian wine guides act as effective quality clues that increase consumers' willingness to pay. Experts' evaluation, as found in literature[13] (Schamel 2006, Schamel and Anderson 2003), proved to significantly affect prices where the impact is larger for red wines than for white ones (33.5% versus 23.5%). Our interpretation is that red wines being relatively new to the area, they have a less established reputation so that guides are more needed by consumers that lack information. Hence, the guides are more effective in fostering prices for red wines.

On the contrary, visibility on more than one guide has a statistical impact on prices only in the case of white wines when they are reviewed by 3 guides (14%). Further analysis on more detailed data on this point is needed in order to better understand the underlying reasons. A first hypothesis is that consumers that are seeking a high quality wine from Lazio region should, somehow, overcome a negative bias that surrounds its reputation and are thus willing to gather more information from many guides. More insights on the issue could come, for example, from a quantile regression that allows distinguishing different behaviors among different market segments[14].

The role of the place of origin and its certification is also assessed. The model produces, in particular, an interesting result on the role played by the different Certification of Origin. Besides the obvious findings about the higher value associated to DOCG with respect to DOC, a less trivial evidence is that IGT are more valued by Consumers than DOC. The differences are quite high with +24% for white wines and +20% for the red ones. In other words, on average, DOCs from Lazio are not able to hold their position in the so-called quality pyramid

In Italy, the ranking formed by this certification system has been given as granted for a long period but afterwards it has been largely objected, especially with respect to the relative positioning of IGT (Albisinni, 2008, Lechermere, 2006). These, in many cases, have taken advantage of the flexibility they enjoyed in terms of variety, image, and geographical identity and so on. Doing so, they could better adjust (or anticipate, in some cases) to changes in consumers' preferences, fashion trends and strategies of competitors around the world. Furthermore, in the case of the DOCs, the reputation associated to the collective name (the DOC name) is usually

13. With respect to sensory expert evaluations, Schamel (2006) found a higher elasticity for red wines than white ones. The results of Schamel and Anderson (2003) show analogous values for Australia wines compared to Lazio wines.

14. First results of a quantile regression seem promising. They are not presented in this context due to necessity of further investigations as well as due to space limits.

quite strong with respect to the name of the producer and his labels, thus implying that when the DOC reputation fades or disrupts it is more difficult to recover due to the need of proper coordination mechanism for collective actions that are complex and require time to be set (Carbone, 2003, Castriota and Delmastro, 2012). This is the reason why more and more producers that seek to target at high quality segments of the market prefer to use IGT rather than DOC.

Coming back to the case of Lazio Region wines, it is important to say that former analysis (Carbone et al. 2010) showed that many regional DOCs are declining in reputation and market shares due to different reasons. Here it is relevant to recall the inadequate management of the DOC itself by the collective governing body (the Consortium). This implied, among others, that procedure for updating the production rules in order to remove/reduce the presence of old varieties that are no more aligned with market trends have never been carried out nor promoted. This has given room to IGT certifications that have somehow filled the gap even to a larger extent than in other regional areas.

Further extensions of the research may shed light in different directions i) In order to be able to assess the positioning of wines from Lazio Region in comparison with different Regions, the analysis should expand in widening the data set. This goal seems to be worthwhile especially when recalling the average score obtained by the regional wines (1.1 out of 4), just the minimum level of quality for a wine to be included in the guides. ii) In order to get a more detailed picture of regional supply, a deeper analysis at single DOC level would provide important insights also on which of those are declining and probably hopeless, which are making efforts to find an exit strategy from decline and which are well alive and competitive. iii) A different specification of the impact of each guide when more than one guide are taken into account, could also represent a relevant contribution to understand their influence on consumers and markets behavior.

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Market Strategies in the Beef Sector: a Discrete Choice Experiment for the Segmentation of Consumer Preferences

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Abstract
The research aims to identify different types of consumers of beef. This objective is intended to develop specific strategies to make market more efficient by limiting the waste of a product that has a high impact on the environment such as beef. The research, from a methodological point of view, is based on the development of a choice experiment. Data are elaborated according with a Latent Class approach. Results show that consumers have different preferences with respect to the attributes considered and beef cut represents a crucial variable for a significant portion of the demand.
JEL Classification Code: D12; Q11; Q13.
Keywords: Consumer preferences; Latent Class Analysis; Beef; Discrete choice experiment; Market strategies

Introduction

Meat is one of the main foods in our diet (Grunert, 2006) and globally there is an increase in its demand resulting from higher incomes, from the expansion of the population, especially in urban areas, and from the preferences of choice regarding this food (Slingo et al., 2005). However, its production causes a number of negative environmental impacts. Breeding is in fact considered one of the activities that contribute significantly to global warming (McMichael et al., 2007). The proteins of animal origin, compared to those of vegetables, require a quantity equal to eleven times more fossil fuels and one hundred times more water, making the diet based on meat consumption untenable from the point of view of environmental impacts. Environmental effects associated with different consumer food choices have been analyzed by Baroni et al. (2007). The authors demonstrate that the vegan diet is the most environmentally sustainable, that organic farming is less impact than in the conventional one and that, as regards the analysis on individual foods, beef is the most impactful, followed by fish, cheese and milk. Similar searches have shown that not vegetarian diets have higher environmental costs, and how these costs are particularly high in the case of the production of beef (Ogino et al. 2007). In the light of these considerations, it is extremely important that a product environmentally and economically as expensive as beef goes to waste. In fact, a significant contribution to the level of sustainability of food systems, in addition to the gradual change of eating habits in order to decrease the animal components in the meal, can also be given by a more efficient allocation of the product associated with the reduction of wastes. From a commercial point of view, the main issues related to the sale of beef are those related to the multiplicity of cuts obtainable from each animal, whose appreciation and market price are evidently varied. In particular, while the market seems to have no declines for the finest cuts such as steak, we highlight increasing complications in allocating the less valuable portion of the animal, the fourth front, which is transformed mainly into minced meat with different levels of fat.
The optimization of marketing campaigns, sales strategies as well as those of production must necessarily take into account the characteristics of demand and, in particular, the preferences of consumers (Grunert et al.,

2004). The deeper understanding of the aspects related to the choice of the consumer can in fact be exploited for a more efficient trade policy whose aim is above all to prevent a part of the final product is not absorbed by the market.
This research fits into this context and aims to analyze the behavior of beef consumers in order to improve business strategies, marketing and communication in this sector. The purpose is to test the existence of consumer segments that are distinguished by different preferences in relation to the various cuts of beef. In this framework a discrete choice experiment was conducted and a latent class model (Campbell et al. 2011, Scarpa et al. 2009, Cicia et al. 2012) was developed.

Methodology
Discrete choice model was used in order to understand consumer preferences about beef. These models represent a valid approach for the analysis of consumers preferences as they offer the opportunity to investigate many aspects that influence consumer behaviour, especially if applied in the field of food demand researches (Louviere et al. 2000, Adamowicz and Swait, 2011). DCEs make it possible to overcome many limitations of contingent valuation and enable to derive willingness to pay highlighting the trade-off that each individual makes between attributes. If one of the attributes is the money that a person would have to pay to secure the change, it is possible to generate estimates of the marginal value of changes in each attribute. Moreover a single DCE application can be used to generate estimates of compensating surpluses for an array of specific environmental qualitative or quantitative changes relative to the "business-as-usual" situation (Hanley et al, 2001). DCEs are consistent with random utility model (RUM) (Thurstone, 1927; McFadden, 1973). The theoretical model of reference implies that for each individual *i*, a given level of utility is associated to each alternative *j*. The alternative *j* will be chosen if and only if the relative utility, in the group of choices, is higher. This utility can depend on the characteristics (attributes) of the product and on the socioeconomic characteristics of the individuals. Multinomial Logit Models (MNL) are widely used for the estimation of utility function parameters. Nevertheless, MNL approach shows some weaknesses. The most well-known disadvantages with the MNL model are that the parameters have to be considered fixed in the population (the assumption of homogenous population, which is ignoring taste variations of individuals) and its inherent assumption of independence from irrelevant alternative (IIA). Various alternative formulations have been suggested to relieve the inherent assumption of the MNL model. One of the most significant of these extensions is the mixed logit (MXL) model that allows model parameters to vary over individuals. Some parameters of the MXL models are assumed as random values with distribution. Another approach is the latent class (LC) model. In this approach, each latent class consists of a number of individuals that are assumed to be homogeneous with respect to their preferences for alternatives as well as their sensitivity to alternative variables (Scarpa et al. 2007).

Case study and results
The study was conducted by processing the answers to a questionnaire administered on line in November 2011 to a representative sample of the Italian population for sex, age and residence according to the statistics provided by ISTAT. Consumers who do not buy meat were excluded from the analysis. Data

were gathered by an international online panel provider (Toluna) that guaranties representativeness and validity of the process: 1650 questionnaires were completed and 150 of them excluded by Toluna because not full. The final effective number of valid and useful questionnaires for the analysis is 1500.

The questionnaire was structured in several sections. The first section consisted of filter questions to select the subjects to exclude such as, for example, people who do not eat beef. The second section was made up of questions concerning the means of purchase, preparation and level of beef consumption, while the third section concerned the familiarity with the main protected quality certifications in the animal farming sector. The fourth part of the questionnaire was dedicated to the discrete choice experiment proper which made it possible to evaluate the preferences of Italian consumers of beef with respect to a series of intrinsic and extrinsic characteristics (attributes) of this product. In determining the attributes, both literature and a specific focus group were used as reference.

The analysis of the studies in literature (Verbeke et al. 2010) point out that certifications of origin (Tonsor et al. 2005, Schnettler et al. 2008), production technique (Grunert 2005, Alfnes 2004), price, information on traceability (Banterle and Stranieri 2008, Lusk et al. 2003, Roosen et al. 2003) and intrinsic traits such as tenderness, amount of fat and colour (Louriero et al. 2004, Umberger 2010), prove to be among the most important attributes considered in choosing beef. Parallel to the bibliographic study, a specific focus group was formed, involving five producers of beef, the director of a slaughterhouse, the administrator of a centre of production, distribution and sale of beef, and five consumers selected by the same centre. With respect to existing literature, the results point out that the cut and breed can also play a role of primary importance in influencing consumers' preferences for beef. These two elements could indeed constitute an element of differentiation among consumers, and could be utilised to expand and better direct the operations of product marketing and sale.

In light of these considerations, each respondent had to choose between five beef cuts, plus a no-choice option that makes the experiment more realistic (Train 2009), characterized by different levels of the following attributes: price, certification of origin, breed and production technique (see figure 1)

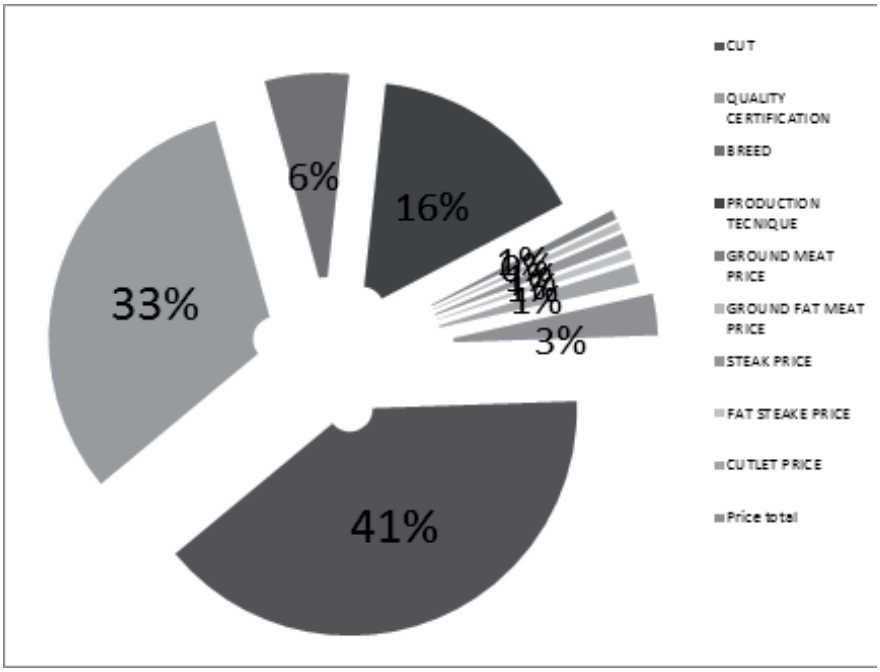
Respondent had the option to choose The five cuts considered are ground beef, ground fat beef, steak, marbled steak and small cutlets. This selection was made in consideration of the invoiced sales of the first three cuts sold in the year 2011 (Nielsen data). Moreover, two different levels of fat were considered for ground beef and steak (respectively an increase of 30% of fat in ground beef and an increase of 30% of marbling in steak).

Figure 1. Example of the visual choice set. Source: Our elaboration

The production technique considers the aspects most commonly present in the market of Italian meat, and has been distinguished as conventional, biological, and without the use of genetically modified organisms. As far as breed is concerned, the principal breeds of meat present on the Italian market were considered, two Italian and two foreign, that is Chianina, Romagnola, Limousine, and Charolaise, also neglecting information about this aspect. As far as certifications of origin are concerned, it was decided to use the following levels: PGI (Protected Geographical Indication), Italian Origin and European Origin, which were joined by two specific and local origins: Tuscan and Mugello Caf. As each cut presents a different average price, the price attribute is specific for each portion (alternative), and its levels are represented by percentage variations with respect to the average market price as surveyed by ISMEA (Institute of services for the agriculture and food market) in November 2011.

The experimental design consists of 125 sets resulting from a D-optimal 5 ^ 4 x 5 ^ 4 x 5 ^ 4 x 5 ^ 4 x 5 ^ 4 orthogonal main effects plan (OMEP) (Street & Burgess, 2007). The 125 sets were divided into eight blocks of 14 choice sets each plus one from 13 and respondents were randomly facing one of the nine blocks.

The first elaboration performed concerns the hypothesis of a single class, which reduces the LC approach to that of the conditional multinomial logit model. This primary step permits a broad analysis, describing the behaviour of the "average" Italian consumer (Casini et al. 2013). Graph. 1 shows the effective importance (Louviere 2008) of the various attributes in the final choice of the general Italian consumer of beef.



Graph 1. Relative importance of the entire sample. Source: our elaboration.

The cut represents the most important attribute (41%), the indications on the certifications of origin represent the second most important aspect (33%), followed by the indications on the production technique (16%). Though as demonstrated by Viegas et al. (2010), breed greatly influences the intrinsic qualitative characteristics, it is not considered a very important attribute in choice (6%), just as price, which represents only 3% of the total importance. Excluding the effect of the cut, this result seems to draw the general structure of preference (importance) of the Italian consumers in line with that of the French and Germans. According to Lusk et al. (2004) and Roosen et al. (2003), who were among the first to utilise a DCE to estimate consumers' WTP for certain attributes of beef, the French and Germans display particular attention to the indication of origin, which is considered the most important attribute of them all, including trademark, price or visible fat. The preferences of Italian consumers seem overall distant from those shown by the British who, instead indicate price, colour and fat content as the most important attributes. The breed is marginal but, in any case, more important than the prices as a whole. Though useful for a general description, defining a behavioural scale referred to the average Italian consumer does not permit us to distinguish the possible different typologies of consumers who could instead characterise the Italian population. It is precisely for this reason that the multinomial approach is replaced by the latent class models approach.
The overall analysis, including the study on the variation of the BIC value from one model to another, seems to incline our choice towards models with 5 classes (plus the random class). The numeric consistence of the five classes plus the random class is reported in Table 1:

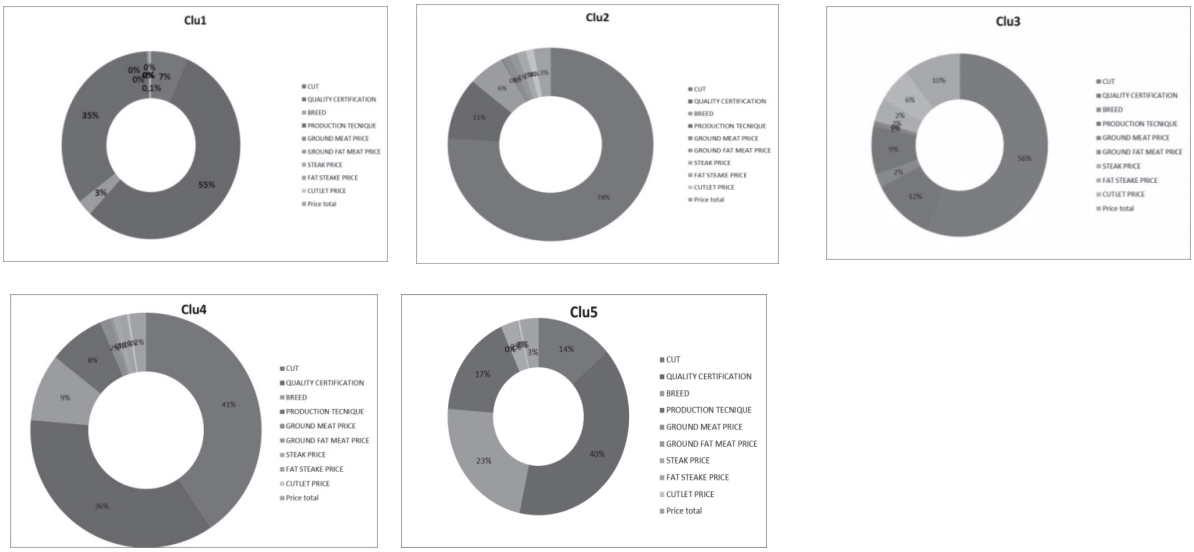
Cluster	N°	%
1	495	33
2	405	27
3	195	13
4	210	14
5	105	7
Random Class	90	6

Table 1. Numeric consistence of the latent classes identified. Source: our elaboration.

Analysing the relative importance (calculated as aforementioned in function of the product effect on the level of LL) of the different attributes for each of the five classes makes it possible to describe and differentiate the preferences of Italian consumers. It is possible, first of all, to divide the sample analysed into two well-defined macro groups of consumers which differ with respect to identifying the attribute considered most important. In the case in point, for the consumers of classes 1 and 5 (who represent 40% of the sample), certification of origin is a fundamental element in the final choice. The other typologies of Italian consumers of beef (60% of the sample) – classes 2, 3 and 4 – instead assume a different overall behaviour characterised by placing cut as the first element in the scale of importance for their final choice. This first differentiation seems to underline the existence of two quite diversified choice behaviours towards beef.
In the first case, in fact, greater preferences are expressed for aspects other than the typology of cut purchased (the consumer is not necessarily oriented and decided on the cut but instead evaluates the purchase based on additional parameters). The second consumer typology is instead characterised by a greater motivation and preference tied

more to the portion he wants to purchase than to the other descriptive elements, and thus proves less conditioned by aspects other than the cut of meat. In this sense, the consumer less mindful of and concentrated on the cut can be more effectively intercepted by across-the-board marketing operations which are not aimed at promoting a specific portion (i.e. a promotional offer tied to the general sale of beef with a trademark of origin). The second typology is instead more mindful of the portion and less of the other characteristics, and could therefore be more interested in operations of marketing and packaging that, first of all, showcase the portion foremost, relegating the other product characteristics to a secondary level (i.e. a promotional offer tied specifically to steak, small cuts or ground beef). To attract the first consumer's attention, it could therefore be more useful to highlight the beef's general characteristics, while for the second, it would appear better indicated to specifically highlight the portion.

The analysis, however, cannot be limited to this initial macro differentiation of Italian consumers because, as clearly shown in graph 2, evident differences characterise the behaviour of the identified five groups. In detail, it clearly emerges how each class is characterised by specific preferences concerning the importance held by the attributes other than cut and certification of origin.



Graph 2. Relative importance of the five clusters. Source: our elaboration.

Initially concentrating our attention on groups 1 and 5, where the most important attribute is certification of origin, we note first of all how this draws 55% of importance for the consumer of class 1, while only 40% for class 5. In parallel, while the information on the production technique of animal breeding represents the second most impor-

tant attribute for the consumer of cluster 1, cattle breed (23%) is considered the second element for the consumer of class 5. Finally, for the latter consumer typology, the price of steak assumes an important role (3%) be it with respect to the other cuts, be it for its importance for class 1 (0%).

Moving on to consider the other classes, characterised by the shared habit of considering cut as the first attribute of choice, class 2 emerges as the one particularly oriented towards this aspect (78%). Class 3 is the one for which price is the main consideration in the final choice, compared to all the other consumer typologies, with this attribute attaining a quota of 10%.

It must be noted, in any event, that for all the consumers of these typologies, the certification of origin always represents the second most important attribute, that is except for class 3 for which certification of origin (12%) and price (10%) play very similar roles.

The interpretation of data performed thus far, associated with the analysis of the socio-demographic and behavioural information characteristic of each class, has permitted us to identify five figures of Italian consumers of beef: *Quality Seekers, Ground Meat Eaters, Cutlet Eaters, Steak Eaters, Sporadic Consumers*. In particular, while the quality seeker class and the sporadic beef consumers are less mindful of the specific cut of meat, the ground meat seekers, cutlet eaters and steak eaters are characterised by a marked preference for the specific typology of beef purchased.

Quality seekers are people looking for a product with a high content of services and of a very high quality, guaranteed by certifications, who mostly make their purchases at the butcher's shop. They are, for the most part, married, aged 25 to 44, and have a middle to high income level. They do not show a clear preference for a specific cut of meat, though it is interesting to note a slight preference for small cuts and ground beef with a high rate of fat, as long as these are associated with a trademark of guarantee.

It becomes essential for Ground meat eaters to be able to base their choice depending on the cut of meat available. They in fact mainly go to supermarkets, where the offer is wider and more varied; they have a high level of education, and eat beef at 5-6 meals per week. They show a preference for ground beef without fat.

Cutlet eaters consumers are mainly women with a low income level and middle to high level of education; they are usually single, and have a slight preference for supermarket purchasing. Their preferred cut is the small cut of meat, while the worst one is ground beef with a high fat content.

The typical consumers we call steak eaters are male, over 55, with a middle to low level of education and average income, mostly located in the northeast; their exclusive preference is for steak, especially with marbling.

Finally, the sporadic consumers are mainly women who eat very little beef. The income level is not decisive in defining this typology of consumer who purchases both at the supermarket and the butcher's shop. When these consumers decide to eat beef, they find satisfaction only in steak without marbling. This is the only group characterised by having a positive value of the no-choice option, see table 2 (No_choice = 1.37 with z-values = 3.58).

As regards the evaluation of coefficients, as we wanted to estimate overall consumer's behaviour, we did not model a status quo option; consequently, all the values of coefficient are absolute and not relative to a generic status quo option.

Attributes/ Levels	Class1	z-value	Class2	z-value	Class3	z-value	Class4	z-value	Class5	z-value
CUT										
Ground Meat	0,29	1,22	1,18	5,55**	0,29	0,69	-2,98	-3,18**	-0,38	-0,52
Fat Ground Meat	0,63	2,50**	0,54	2,04**	-1,38	-1,64	0,09	0,09	-0,63	-0,79
Steak	0,17	0,73	0,36	1,14	0,26	0,46	2,05	5,33**	0,86	1,76*
Marbled Steak	0,32	1,31	0,27	1,12	0,71	1,12	2,45	6,33**	-0,19	-0,24
Cutlet	0,61	2,73**	0,68	2,68**	2,72	7,26**	-0,37	-0,72	-1,03	-1,55
No_choice	-2,03	-15,78**	-3,02	-15,58**	-2,60	-9,11**	-1,24	-3,62**	1,37	3,58**
QUALITY CERTIFICATION										
Mugello Caf	0,99	27,38**	0,08	1,97**	0,17	2,55**	0,37	6,41**	0,15	1,38*
Tuscany	-0,20	-4,93**	0,05	1,47*	0,07	1,16	0,08	1,45*	0,23	1,88**
Italia IGP	1,10	30,02**	0,13	3,47**	0,25	3,63**	0,36	5,94**	0,60	6,31**
Italia	-0,61	-13,25**	0,03	0,83	-0,05	-0,83	-0,15	-2,60**	-0,12	-1,01
Unione Europea	-1,28	-22,89**	-0,29	-6,99**	-0,44	-6,05**	-0,66	-9,75**	-0,87	-5,93**
BREED										
Charolaise	-0,07	-1,87**	-0,12	-3,26**	-0,06	-0,99	-0,15	-2,67**	-0,03	-0,30
Limousine	-0,11	-3,03**	-0,13	-3,49**	-0,10	-1,62*	-0,17	-3,01**	-0,43	-3,47**
Chianina	0,35	9,63**	0,06	1,65**	0,08	1,13	0,32	5,51**	0,58	5,10**
Romagnola	0,04	1,14	0,15	4,36**	0,17	2,72**	0,07	1,13	0,05	0,43
No breed	-0,22	-5,66**	0,03	0,89	-0,09	-1,33*	-0,06	-1,09	-0,16	-1,33*
PRODUCTION TECNIQUE										
Organic	0,50	17,06**	0,03	0,88	0,17	3,13**	0,06	1,27*	0,09	1,03
Conventio-nal	-0,95	-30,66**	-0,02	-0,60	-0,27	-5,83**	-0,23	-5,20**	-0,38	-4,73**
OGM free	0,45	14,55**	-0,01	-0,35	0,10	1,76*	0,16	3,30**	0,29	3,14**
P1-Ground Meat Price	-0,09	-1,72**	-0,13	-2,83**	-0,15	-1,76*	0,42	2,10**	-0,03	-0,21
P2-Fat Ground Meat Price	-0,21	-3,65**	-0,16	-2,80**	-0,20	-1,01	-0,30	-1,25*	-0,08	-0,43
P3-Steak Price	-0,04	-1,17	-0,12	-2,85**	-0,21	-2,75**	-0,07	-1,87*	-0,24	-2,12*
P4-Marbled Steak Price	-0,06	-1,77*	-0,03	-0,96	-0,29	-3,24**	-0,09	-2,38**	-0,10	-0,88
P5-Cutlet Price	-0,07	-1,89*	-0,11	-2,65**	-0,26	-5,45**	0,09	1,22	0,08	0,77

Table 2. Estimate of the coefficients of the model with five latent classes plus the random class. Source: Our elaboration (* = significance with an error of 10% ** = significance with an error lower than 5%).

For a better understanding of the results, table 3 summarizes the principal characteristics of the five groups of beef consumers.

		CUT IS VERY IMPORTANT			
	1 - Quality Seekers				5 - Sporadics
		2 – Ground Meat eaters	3 – Cutlet eaters	4 – Steak eaters	
SEX	---	---	Mainly woman	Mainly man	Mainly woman
AGE	50% are 25-44	Mainly under 44	---	26% over 55	48% over 44
RESIDENCE	Not in North East of Italy	22% In Centre of Italy	Mainly South Italy	26% In North East of Italy	50% In North Italy
FREQUENCE OF BEEF CONSUMPTION	3-4 meals a week	Highest value of 5-6 meals a week	4-8 meals a week	---	1-2 meals a week
WHERE PURCHASE	Supermarket and Butchers	Mainly Supermarket	---	---	Supermarket and Butchers
MARITAL STATUS	Mainly married	Single or Married	Highest value of single	Highest value of widowers	---
NUMBER OF FAMILY MEMBERS	Large families	Usually 4 members	Mainly less then 3 people	Highest value of one member only	Mainly less then 3 people
EDUCATION	Medium-Low	Medium-High	Medium-High	Medium	Medium-Low
INCOME	Medium-Low Income	Medium Income	Low Income	High Income	Low-High Income

Table 3. Identification of five behavioural figures of Italian consumer of beef.

Comments

The research allows to define the preferences of Italian beef consumers and to highlight the importance of understanding how consumers process information when making food choices.

Only very few studies have explored the relative importance of such a wide variety of both intrinsic and extrinsic attributes both conjointly and visually. As a matter of fact, visual presentation is particular important and allows a better definition of consumer preferences (Mueller et al., 2012). In general, what comes out from our study is a consumer primarily focused on the meat-cut he is willing to buy. This important aspect has never been analysed as normally similar

studies are focused on the interpretation of consumer preferences of a specific cut, with the result of overestimating the importance of other attributes such as the Country of Origin Labelling (COOL), even if this attribute still plays a very important role also for Italians. In this framework it is interesting to note that the relative willingness to pay changes deeply respect to the portion (beef cut) and respect to the fat level of the same cut. This aspect allows and leads producers and traders to differentiate their production and commercial policies. The Italian beef consumer can be defined as an "Ethnocentric consumer" as he strongly prefers certified and local Italian origin (PGI or local brands) and he dislikes foreign breeds, even if their organoleptic characteristics are usually very high. With the range of values that we used in this research, prices play a marginal role in interfering consumer choices. Furthermore, Italian consumer prefers that he is provided with some information rather than buying a beef package with a minimal label. This behaviour suggest to improve both the quality of the label information and a more attention in the design of the marks (logo). In light of this considerations, bearing in mind also the low level of awareness respect to the brands and certification, it seems that the Italian consumer makes his choices more for "emotional" reasons than in relation to his real knowledge. He also always shows a higher preference and willingness to pay for those elements that have a logo in the label (PGI, Mugello CAF, Organic, GMO free), even if the very consumer claims not to know their meaning. This aspect highlights on one side the opportunity for a greater product differentiation, but on the other it emphasizes the need of improving informative campaigns and underlines the potential risk of fraudulent communications. In this context the role of public bodies is crucial to ensure and monitor the appropriateness of the information contained on the label. Going deeper in the analysis of consumer behaviour, the study showed how is possible to split beef consumers into five different segments. The existence of five clusters of consumers differentiating respect to their preferences among beef allows producers and traders to develop specific marketing strategies. In particular, as some group shows strong preference for a specific beef cut, it is possible to increase the efficiency of the market in order to reduce the quota of unsold product or in order to optimize the allocation of each beef cut. Moreover, it would be possible to increase the coherence between the needs of the demand and supply of beef. For example, while targeting group 1 means to focus on the communication of quality standard improvements in the beef productions, for group 2 seems very important to focus on the beef cut variety and on sponsoring promotions on specific cuts.

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Consumer Propensity for Organic Wine: a Field Study Using a Discrete Choice-Experiment in Friuli Venezia Giulia

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Abstract

The aim of this study is to investigate the behavior of consumers regarding the organic wine. In Italy the production of organic wine occupies a position of great importance, nevertheless the consumption of this type of wine is not so strong. Several reasons have diverted consumers' interest, such as the unflattering reputation that has marked the first wines produced using organic grapes, the perception of wine as an unnecessary and unhealthy drink, as well as the confusion arising from the presence of different types of wine labels. There have not been many studies regarding consumer attitudes toward organic wine. In this study we aim to help fill this gap by conducting a survey on the case study of the Friuli Venezia Giulia Region in Italy. To understand what factors may affect the propensity to buy wine a discrete choice experiment was carried out. The results of this research help to understand the differentiation between organic and local food products.

JEL: Q11; Q13.

Key words: Organic wine, consumer preferences, choice experiments.

Introduction

The aim of this study is to investigate the behavior of consumers regarding a specific type of food product: organic wine. From August 2012 entered into force the Reg. (EC) 213/2012 implementing rules laid down in Reg. (EC) 889/2008, which adopted rules for organic wine. This legislation provides the right to use the term "organic" for wine stimulating growth in this sector and providing consumers with organic wine bearing the European Union logo they trust.

In Italy the production of organic wine occupies a position of great importance since the organic vineyards are about 8% of the total Italian surface (Sinab, 2012). Nevertheless the consumption of this type of wine is not so strong. Several reasons have diverted consumers' interest, such as the unflattering reputation that has marked the first wines produced using organic grapes and the perception of wine as an unnecessary and unhealthy drink, as well as the confusion arising from the simultaneous presence of different types of wine labels (sustainable, natural, biodynamic wine, etc.). Compared to other goods produced with organic commodities, the wine seems to respond to unexpected consumer motivations (Aertsens *et al*., 2009; Orwine, 2009). There have not been many studies regarding consumer attitudes toward organic wine around the world (Brugarolas Mollá-Bauzá *et al*., 2005; Corsi and Steiner, 2013; Crescimanno *et al*, 2002; Fotopoulos *et al*., 2003; Lockshin, 2009; Mann *et al*., 2012; Misso and Catullo, 2012; Platania and Privitera, 2010; Schmit *et al*., 2012). In this study we aim to help fill this gap by conducting a survey on the case study of the Friuli Venezia Giulia Region in Italy. To understand what factors may affect the propensity to buy wine a discrete choice experiment was carried out. This method has been widely employing in this type of research. In particular, it proved to be useful for understanding the heterogeneity of consumer preferences.

Methodology

The choice experiment (CE) methodology (also known as discrete choice or choice based conjoint analysis) has become a commonly used instrument in evaluating consumers' preferences concerning several goods or services in economic terms (Batsell and Louviere, 1991; Hensher *et al*., 2005; Louviere *et al*., 2000). This technique is an attribute-based measure of benefit, based on the assumptions that goods or services can be described by their attributes and that an individual's valuation depends upon the levels of these attributes. A choice experiment is comprised of several choice sets. A choice set presents a purchase situation to a respondent with a menu of product options. Choice sets typically include two or more products each with varying combinations of attributes and price. In detail, the respondents are asked to choose between two or more alternatives.

Resulting choices reveal an underlying utility function. The methodology combines random utility theory, consumer theory, experimental design theory and econometric analysis (Lancaster, 1966; Luce, 1959; McFadden, 1974; Thurstone, 1927).

In a discrete choice modeling framework all alternatives must satisfy some criteria. In detail: alternatives are exhaustive, mutually exclusive and their number is finite. The respondents are assumed to maximize their expected utility facing a choice among different alternatives that give back different levels of utility. The observer is not able to directly observe respondent utility, nevertheless the attributes about competing alternatives can be observed.

The CE was constructed from alternative groups of five attributes with different levels after a focus group screening. Respondents had to choose wines that differed in: landscape features (modern and traditional), production method (organic or conventional), price (€ 4, 8 and 12), region of origin (Collio area, remaining part of the Friuli Venezia Giulia Region and other Italian Regions), and wine certification (table wine, Protected Designation of Origin - PDO, Protected and Guaranteed Designation of Origin - PGDO); so that there were several possible combinations of wine options that could be created for each choice option.

A fractional factorial orthogonal design has been generated using SPSS software (Hensher *et al*., 2005); 18 profiles have been selected that has been organized into six choice situations. Each respondent had to face six choice situations with three profiles each plus the opt-out alternative ("none of these"). To simulate a realistic choice scenario, attributes were combined graphically into wine labels. In detail, the respondents were asked to choose among three bottles of wine (Fig. 1).

The data used for this analysis were gathered in a 2012 regional face-to-face survey of 200 subjects. The interviews were conducted in the province of Udine in Friuli Venezia Giulia Region (North-Eastern Italy) in places where people can drink and buy wine (pub/bar and restaurant). No financial incentives were offered to the interviewees.

Results

Of the 200 respondents, 36% were women and 64% male. Each relevant age group was represented (from 18 to 72 years old). Regarding the educational level, 49% of the respondents had successfully completed high school and 20% held a University or post-graduate degree. More than half of the respondents (60%) were employed, 23% were housewives or students and 9% pensioners ("other" 8%). As for their habits in terms of consumption and purchase, most members

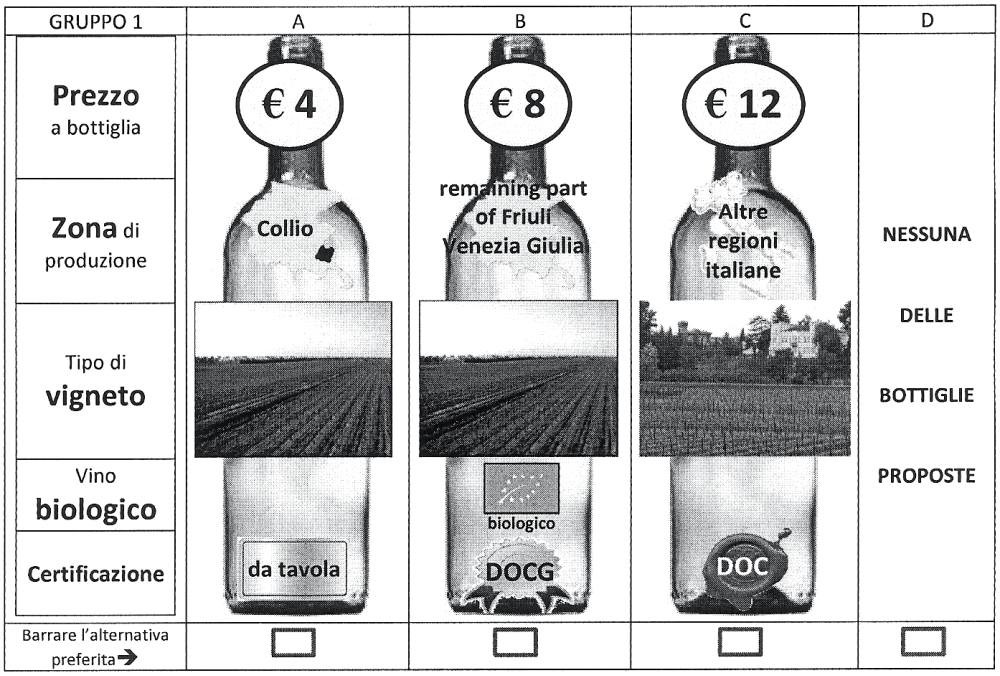

Figure 1. An example of choice set.

of the sample drink wine usually (??) (44%), or occasionally (50%) and 29% of them buy wine by producers while 22.5% never buy wine.
45.5% of the sample know organic wines and 51,6% drink them only occasionally. 14% of the sample knows biodynamic wines.
By means the program NLogit4 a random parameter logit model (Tab. 1) was estimated. For dummy variables a triangular distribution was assumed and to estimate the coefficients were carried out 400 iterations. The utility function considered is illustrated as follows:

Function 1:

$$U(x_i) = b_1 * Collio_i + b_2 * Friuli_i + b_3 * PDO_i + b_4 * PGDO_i + b_5 * Landscape_i + b_6 * Organic_i + b_7 * PRICE_i$$

where: Collio = dummy for origin Collio area; Friuli = dummy for origin remaining part of Friuli Venezia Giulia Region; PDO = dummy for protected designation of origin; PGDO = dummy for protected and guaranteed designation of origin; Landscape = dummy variable for traditional landscape; PRICE = price in €/bottle.
The b_s coefficients can be considered as the marginal utilities of each attribute of the utility function.
All the coefficients of the model have the expected sign and are significant at 0.95 level. The model highlights the presence of a moderate heterogeneity of respondents' preferences for 4 out of 6 attributes considered (Collio and remaining Friuli Venezia Giulia region area of production; Protected and Guaranteed Designation of Origin and Protected

Designation of Origin). The model has an acceptable ability to interpret the phenomenon in question since the pseudo r-squared is reasonably good for this kind of model (0.16). The factors that seem to have a greater impact on the propensity to buy are the production in the Collio area and PGDO label. The organic production has the lower marginal utility of the model. Quite interesting the interviewees seem to consider the presence of a traditional landscape as an important feature of the wine production. In other words the preservation of the traditional vineyards seems to have an important evocative effect on the consumers that could be favorably utilized to design the marketing strategies of the wine sector (Tempesta *et al*., 2010).

Conclusions

The results of this research help to understand the potential differentiation between organic and local food products.

These results are similar to the results derived from other studies carried out both in Italy and abroad, which show that consumers seem to give more importance to local production than to low environmental impact production methods like the organic one (Corsi and Steiner, 2013; Tempesta *et al*., 2010; Tempesta and Vecchiato, 2013; Verlegh and Steenkamp, 1999).

In the case of wine this behavior can be attributed primarily to the fact that its organic production has still not an established tradition.

	Coeff.	Std. Error	t-value	p-value
Random parameters (latent heterogeneity)				
Collio	0.843	0.143	5.884	0.000
Friuli	0.767	0.169	4.546	0.000
PGDO	1.075	0.172	6.264	0.000
PDO	0.933	0.156	5.984	0.000
Non Random Parameters				
Price	-0.061	0.012	-5.127	0.000
Traditional landscape	0.325	0.101	3.201	0.001
Organic	0.161	0.082	1.977	0.048
Standard deviations of random parameters distributions				
Collio	2.910	0.382	7.612	0.000
Friuli	3.930	0.418	9.395	0.000
PGDO	4.094	0.422	9.689	0.000
PDO	3.891	0.411	9.476	0.000

N	1200
Pseudo r quadro	0.16
Loglikelihood	-1401.7
Replications	400

Table 1. The RPL model.

Moreover, we can also assume that in the case of this beverage, the consumer does not associate any improvement in the quality of wine by consuming organic products.
The propensity to purchase goods of local origin may have a plurality of explanations (Chung *et al*., 2009; Ehmke, 2006; Linder *et al*., 2010; Marangon *et al*., 2011). Firstly, it could be assumed that local food products are considered especially by environmentally-conscious consumers to be of higher quality because they are more environmentally benign (Louriero and Umberger, 2007). Secondly, they are generally produced by local producers respecting local traditions. Moreover, it could be also assumed the presence of an altruistic component regarding the opportunity to empower local socio-economic system through the purchase of local products (Marangon *et al*., 2008 and 2009).
As from a strictly point of view, organic wine is a way to differentiate wine production, on one hand these results should help wine producers to improve their differentiation strategy establishing appropriate commercial strategies, in order to increase profits. In fact some studies stated that organic wines might constitute a market opportunity for wine companies and generate increases in profits (Stasi *et al*., 2010). On the other hand the results help also to understand the opportunity posed by the local marketing trend to organic food companies by integrating local and traditional heritage and landscape resources into their brand value (Costanigro *et al*., 2010; Troiano and Marangon, 2011). Nevertheless, in order to be able to conclude that indication of the place of origin besides the organic label can be a successful marketing strategy for wine products, it will be necessary to proceed to further field experiments to improve the knowledge of the real behavior of consumers in order to be able to suit their preferences by adapted products.

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Consumer Preferences for Pasta with Multiple Quality Attributes: a Choice Experiment with a Real-Life Setting Approach

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Abstract
In recent years we are witnessing an increasing food products differentiation. This phenomenon also involves those products that can be defined as mature. An example is the pasta, a product well-integrated in the daily consumption of the Italian population. In this case, product differentiation is focusing more and more on extrinsic attributes. In our study we therefore analyze the WTP of consumers towards the attributes that define the pasta product. We used a choice model experiment to elicit consumer preferences on the basis of actual choices and not hypothetical ones as it is usually done. The analysis led to three considerations: firstly, our choice of real choices led to results of WTPs consistent with the market price of the products; secondly, brand and label emerged to be the most important attributes in the choice, instead of what people stated in the interviews where they said that the most important ones are the intrinsic ones; finally, a consistent share of consumers is willing to pay a premium price for products perceived as quality products. It implies that further market opportunities exist for well-advertised pasta products.
JEL: C25, M31
Keywords: choice model, revealed preferences, pasta preferences

Introduction

In the last two decades, food demand undergone profound changes while food producers implement a wide range of technological innovations and marketing strategies related to increasing consumers' interest towards products with a larger array of attributes. This differentiation process involves both experiential eating quality and credence attributes related to environmental and other social outcomes. Consumers' perception of quality is increasingly influenced by the product's extrinsic indicators and cues provided by the product (Caswell *et al*. 2002). Many of these aspects are classified into credence attributes. Due to the well-known difficulties to ascertain related information directly by consumers even after food consumption (Nelson, 1970; Grunert *et al*. 2004), credence attributes require a judgment or a certification by an authority figure such as a governmental agency, or organizations that consumers trust to lend information on them (Caswell, 1996). Actually, current consumer needs result in an increasing demand for more articulated credence attributes which include a wide range of intangible and connected characteristics, such as public health, environmental conservation, origin, creation of employment, supporting small scale agriculture and local rural communities, and workers' rights (Moser *et al*., 2011). Therefore, new certifications, both public and private, proliferated within the food market. To illustrate, modern processors and retailers created and adopted private standards in order to establish themselves as main market standards, which could work better than some missing, or inadequate public standards. In addition, food companies could reduce costs and risks in their supply chains by standardizing products across suppliers;

and they could increase competitiveness and profit thanks to product differentiation as well. In particular, firms could use their own standards as a strategic tool for market penetration and segmentation. In this way, consumers might perceive higher quality products because of quality or labor and environmental standards certification (Henson and Reardon, 2005; Gereffi and Lee, 2009, De Magistris *et al*., 2012).

This evolution involves all food categories, from the deeply traditional food, as dry pasta, to innovative products.

In particular, the pasta market is characterized by maturity stages in the product life cycle (Di Monaco *et al*. 2004). Thanks to its low price positioning, any price change has minor effects on purchases compared to what happens to more expensive products. We can, therefore, focused on quality, because in this case the price, in consumer choice, can sometimes be secondary to quality parameters such as hedonistic and socio-cultural ones.

In addition, since this is a traditional product of the Italian diet, and then well known by consumers, regarding the intrinsic characteristics, the latest marketing strategies are based on extrinsic attributes such as origin or some specific characteristics of the production process.

The aim of this study is to analyze the effect of these extrinsic attributes on consumer's WTPs. Furthermore, our approach to the subject is innovative for the content and for the specific empirical methodology used for the elicitation of consumer preferences.

A real-life setting approach was used for structuring the choice experiment and to examine effective consumer's choice of pasta and to estimate trade-off among concrete extrinsic cues.

Methods

The choice experiment: a real-life setting approach

Usually econometric models belonging to the Choice Model family are used to elicit consumer preferences on the bases of hypothetical choices. Interviewees indicate their preferences by choosing from a controlled set of hypothetical products. Being each product a combination of several a priori fixed attributes, respondents are forced to trade-off between levels of the studied variables. Conjoint analysis quantifies the trade-offs among several attributes and their importance in terms of WTP in consumers' choices (Hanemann and Kanninen, 1999). Main limit of hypothetical choices is, as well known in the scientific literature on this topic, the lack of realism in simulated task implying differences between the hypothetical and real willingness to pay. The extent to which individuals might behave inconsistently, when they do not have to back up their choices with real commitments, is linked to the notion of hypothetical bias (Hensher, 2010). Moreover, Hawthorne effects may bias choice experiments' results. The recent variants of choice experiment represent the most advanced methods to analyze preferences. Many limits shown by classical approaches have been exceeded. One example is the one of overcoming the homogeneity of preferences through the Random Parameters Logit able to model the taste heterogeneity of the target population.

The only limit still unsolved, however, lies in the lack of competitive value possessed by the hypothetical choice sets submitted to respondents. Although there are recent techniques to implement experimental design that allow to obtain a more realistic choice set, the representation of products belonging to different competitive groups as perceived

by consumers on the shelf of the modern distribution is still far. In this paper we tried to merge the typical approach of experimental economics with the classical implementation of the choice model. This methodology differs from other reported in the literature where the attempt to mitigate the hypothetical bias of choice experiment is achieved through an auction approach. In most studies reported in the literature (Lusk and Schroeder, 2004; Johansson-Stenman and Svedsäter, 2008; Alfnes et al., 2006: Moser et al., 2010), respondents are informed before starting the survey about the rules of the auction. At the end of the choice experiment, one of the choice cards is randomly selected and they have to buy the product chosen (Hensher, 2010).

Our study differs from other real choice experiment reported in the literature because we chose the respondents directly at the shelf of a large hypermarket. With the same approach applied by Thiene et al. (2013), consumers interviewed had chosen a box of pasta on the store shelf. Only after the choose of the box of pasta, we interviewed the consumer. Therefore, in this case we studied hypothetical choices, using actual prices, the likelihood of consumer choice is then maximum whereas products and purchases are extremely real.

Econometric model

In order to obtain point estimates of the consumers' willingness to pay for several attributes in pasta market, a conditional logistic regression model (McFadden 1974; Chamberlain, 1980) is applied to the real choices of pasta (163 respondents) from a large grocery retailer.

Given a number 1, 2, ..., J (in our case J= 10) of a pasta consumption alternative available on the shelf to the *i*th consumer, the outcome of the choice experiment, the purchases decision for the alternative *j* by the *i*th individual interviewed, is represented by y_{ij}. It indicates that alternative *j* was purchased, $y_{ij} = 1$, or not $y_{ij} = 0$, by the *i-th* individual interviewed, with *j* ÎJ alternatives.

We may represent each observed purchase decision, y_{ij} ,as the outcome of an income-constrained utility maximization exercise: Being U_{ij} is the utility associated by the *i-th* individual to the alternative *j*, we state that $U_{ij} \geq U_{ik}$ when $y_{ij} > y_{ik.}$, for each alternative *j* in the choice set J, with the utility U_{ij} be the sum of an observable component μ_{ij} and a stochastic component ε_{ij}.

Function 1 $\quad U_{ij} = \mu_{ij} + \varepsilon_{ij}$

This theoretical framework is conducive to the classic well-known random utility maximization analysis: McFadden (1974) in his seminal paper, has shown that under the assumption that an unobservable utility component ε_{ij} or error term is assumed to have a type one extreme value distribution, observed discrete choices may be modeled using the conditional logit model consistently with the assumption of utility maximization. Commonly (Train, 2009; Cicia *et al.*, 2002) the observable component μ_{ij} is decomposed into a linear function of explicative variables; in the specific case we assume the observable component μ_{ij} function of *p* specific variables so that x_{ij} constitutes a $(1 \times p)$ vector of pasta attributes, including CSR certifications, that vary only over the *j* alternatives. Therefore the equation 1 can be represented as:

Function 2 $\quad U_{ij} = x_{ij}'\beta + \varepsilon_{ij}$

Where β is the conformable $(p \times 1)$ vector of parameters for the alternative specific variables.

To maximize his/her utility the consumer is assumed to choose the alternative with the most desired set of attributes. The probability that the individual purchases alternative *j*, y_{ij} = 1, across the set of other possible alternatives J is defined by the probability that the utility of alternative *j* is greater or equal to the utility accruing on each and every other alternative within the choice set:

Function 3 $\Pr(U_{ij}) = \Pr\{U_{ij} > \max(U_{ik},...,U_{ij})\}$

According to McFadden (1974) if ε_{ij} are *iid* Gumbel distributed, then the probability of choosing alternative *j* is logit:

Function 4 $$\Pr(U_{ij}) = \frac{e^{x_{ij}'\beta}}{\sum_{j=1}^{J} e^{x_{ij}'\beta}} \quad j = 1,..., J$$

Empirically, the model can be estimated using maximum likelihood estimation, providing estimates of the parameters of vectors x_{ij}, ensuring that $0 < \Pr(U_{ij}) < 1$ and $\sum_{j=1}^{J} \Pr(U_{ij}) = 1$.

Data

The data have been gathered in a large grocery retailer in Naples area. The interviewed were only real buyers of pasta available on the shelf. Only after the pasta was put into the cart we submitted the questionnaire to the respondents. The questionnaire was structured in different informative areas. The first part was dedicated to record purchase choices and motivations. The second part of the questionnaire was focused on the evaluation of the pasta attributes. More precisely, were asked to rate, for each attribute, a likert scale from 1 to 7 , where 1 is "completely unimportant " and 7 "extremely important". The attributes considered are intrinsic (such as size, color, roughness , etc e.) and extrinsic ones (such as production region packaging , advertising operated by the brand, experience of the product, etc.). Finally, the third part was focused on socio-demographic variables.

Choice set

We considered, in the experimental design, the complete assortment of pasta boxes on the shelf as the choice set. Pasta brands in the assortment were Divella, Garofalo, Baronia, De Cecco, Voiello and Barilla (table 1).

To define attributes, we referred to what was displayed on labels. They are:

- Protein quantity: this parameter is correlated with the good cooking performance. It is a proxy of technological quality of products;
- Bronze die: in general, this type of drawing identifies quality products as this pasta can better hold the seasonings;
- Price;
- Discount price: products characterized by lowest price in the assortment;
- Nutritional label: nutritional properties of pasta and information about certification and traceability;
- Campania production;
- Gragnano production;
- Handicraft production;
- Certifications: they can ensure the right execution of the production process, but they can also deal with ethical issues, as when they certify the respect towards the environment or towards employees;
- Packaging: Plastic packaging or cardboard;
- Traceability;
- Brand: Identifies the products of companies, which operate a strong brand policy. The table 1 shows how characteristics have been coded for each product in the choice set.

	Barilla	Divella	Garofalo	Baronia	Voiello	De Cecco
Price (€/500gr)	0.65	0.55	1.15	0.89	0.99	1.15
Protein (g/100g)	13	12	14	13.5	14	13
Detailed labelling	0	0	1	1	0	0
Brand	0	0	1	0	0	1
Bronze die	0	0	0	1	1	1
Organic	0	0	0	1	0	0
Campania origin	0	0	1	1	0	0
Packaging	Plastic	Plastic	Plastic	Cardboard	Plastic	Plastic
Handicraft production	0	0	1	1	0	0

Table 1. Brands and attributes.

Results and discussion

In this work we tried to merge revealed preferences with the classic choice model approach. We used the price as displayed on the shelf. The attributes and levels were defined ex-post on the base of the available information on the packaging and according to their importance in the choice as expressed by consumers. Using the real competitive scenario for consumers' choices allowed to obtain results with less hypothetical bias particularly relevant for evaluating WTP for extrinsic intangible attributes.

Importance of the attribute as reported by consumers	Mean	Standard Deviation	Included in the choice model as:
Resistance to overcook *"al dente"*	6.49	1.22	Protein Quality
Roughness	6.2	2.17	Bronze Die Dummy
Local Origin	5.96	1.27	Compania Origin Dummy
Price	5.64	2.28	Revealed Price
Handicraft production	5.16	1.45	Handicraft production Dummy
Labelling	5.03	1.5	Presence of Detailed Label
Color	4.64	2.23	
Packaging	4.6	2.25	Cardboard Dummy
Organic Certification	3.81	1.88	Organic Dummy
Advertisement	3.18	2.09	Brand Dummy

Table 2. Evaluation of the attributes (Likert scale 1-7).

The evaluation of the attributes (Table 2) showed that the most important features for pasta consumers are the intrinsic ones, because of its traditional consume preferences are strongly influenced by the experience. Furthermore some influence is due to extrinsic characteristics such as origin or some specific characteristics of the production process on which are based most of latest marketing strategies. Price is not an attribute of primary importance because price competitiveness has minor effects on purchases being pasta a traditional product of the Italian diet.

	FPL		RPL		WTP
Log-L	-313.962		-312.196		
Pseudo R^2	0.17		0.18		
	Coefficient	**p-value**	**Coefficient**	**p-value**	
Label	1.092	0.045	1.46	0.026	0.194 €/kg**
Brand	1.925	0.000	2.189	0.000	0.307 €/kg***
Campania origin	-1.692	0.000	-2.033	0.000	-0.270€/kg***
Protein	0.708	0.000	0.798	0.000	0.113€/kg***
Price μ	-6.263	0.000	-7.618	0.000	
Price σ			3.32	0.007	

Table 3. Fixed parameters logit (FPL) and Random parameter logit (RPL).

Estimation results (Table 3) provide information about consumers preferences for different attributes of the pasta. We choose only significant characteristics among the attributes analyzed before. Model results show quite clearly that brand attributes, price and label characteristics (information showed in the label about different aspects of sustainability) positively affect the consumers' preferences. The protein content is the only statistically significant intrinsic attribute. Finally, Campania origin negatively affects the preferences.
The willingness to pay was indirectly estimated by calculating the implicit prices of the different attributes (Table 3). The highest WTP (0.307€) is related to the "Brand". The second WTP is related to the "label" and the lowest implicit price to the "Protein". Estimated WTP for each attribute are consistent with the market price of each product.
We tried to adopt a log-normal distribution by the inverse of the price attribute price, assuming a quadratic trend of the utility function, in this case, however, the convergence is reached. Regarding the interpretation of results, it is clear from the final model that none of the attributes is distributed, which means that there is no taste heterogeneity for the attributes in the sample. Price is the only distributed attribute. This implies that consumers, in line with the theory, prefer to pay as less as possible for a product. However

there is a small percentage of respondents who use the price as an indicator of quality. Consumers who are willing to pay more for a quality product are 2.2% of the total.

Conclusions

The analysis carried out in the paper was aimed to evaluate the capacity of different pasta attributes to contribute to the perception of quality.

The attributes that affect consumers' preferences are extrinsic attributes such as brand and label; intrinsic attributes of the product, such as pasta proteins are well evaluated too. Consumers perceive protein content like a proxy for intrinsic quality of pasta. Its importance is due to repeated purchases after experiencing the product.

Results allow three important considerations. The first one is correlated with the approach adopted in the experiment. Through the real competitive scenario for consumers' choices we obtained results with less hypothetical bias and the estimated WTP for each attribute was consistent with the market price of each product.

The other considerations refer with operative implications of the results. In general, the attributes that affect consumers' choices are represented by brand and label. A low influence seems to show intrinsic attributes of the product, such as protein content. The origin has a negative influence on the real choices. Consumers ranked intrinsic attributes as the most important features. Real choices reveal that the guiding attribute was brand. For a specific segment (2,2% of the total), the price had a positive coefficient; it means that consumers are willing to pay more for quality products. We can conclude that the developing strategies for pasta must necessarily consider advertising and image as key elements, this is also valid in a public enhancement product scenario.

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Consumer Behaviour between Convenience and Environmental Sustainability: the Case of 'Canestrato di Moliterno' Cheese

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Abstract

The purpose of this study is to investigate the potential relationship between shelf life and environmental sustainability from a micro-economic perspective. In particular, we aimed at: (i) estimating the value that consumers attribute to shelf life and environmental sustainability through the use of a Choice Model (e.g. Conditional Logit) and (ii) identifying the efficient trade-off between shelf life and environmental sustainability. We applied our analysis to the case of the 'Canestrato di Moliterno' cheese. Our choice experiment was carried out through a survey submitted to 757 consumers across Southern Italy. Results provided indications on how much consumers are willing to pay for a longer shelf life compared to environmental sustainability of a product and on the trade-off value between these two attributes. Estimated results suggest that the presence of an environmental and PGI certification as product attributes is highly perceived by consumers. A high willingness to pay (WTP) would translate for a high premium price for both of these attributes. Although the WTP for an extended shelf life is lower than that of an environmental and PGI certification, its positive value shows that consumers would prefer traditional products with a longer 'expiration date'. Under a firm's perspective, the obtained results can encourage food companies oriented to invest in this product innovation. Finally, given the coexistence of a premium price for environmental sustainability and IGP certification, there exists the possibility to develop synergies between environmental and food product quality policies.

JEL Classification code: D12, C35, Q18

Key words: Canestrato di Moliterno cheese, Consumer Behaviour, Environmental Sustainability, Choice Models, Shelf Life.

Introduction

In modern societies, characterized by dynamic lifestyles, food consumption patterns see consumers unwilling to prepare meals at home, having little or no time for food shopping, and inclined to purchase and consume convenience foods (De Boer *et al*. 2004; Scholderer and Grunert, 2005;Marie *et al*., 2007;). These considerations shape the idea for which the extension of a shelf life of a product becomes the main objective of innovation in the food sector (Conte *et al*., 2011; Mastromatteo *et al*., 2012; No *et al*., 2007). An increased shelf life allows consumers to plan their food shopping and preparation of meals over a longer period of time (reducing the frequency of provisions), raise food safety and reduce waste.

Positive effects can also be seen in terms of more efficient production planning strategies and logistics management in the whole food chain. Manufacturers would be able to reach markets geographically more distant from the place of production, increase their mar-

ket share, promote new products and create new synergies across cultures.
Nevertheless the aforementioned positive effects, production and packaging technologies oriented to extend the shelf life of food products would negatively affect the environment. Recent literature shows the existence of a direct relationship between the extension of shelf life of a product and the use of unsustainable material and methods of production and packaging (Boye *et al*., 2013; Mensitieri *et al*., 2011).
Similarly, on consumer side, people seem to have changed their attitudes towards a safer environment and this influence their lifestyle and consumption patterns (Smith and Paladino, 2010). Shelf life extension of a product influences agents' behaviour and this is in turn affected by a series of events based on product life cycle such as production, packaging, transportation modes, distribution chain and final consumption. The way how these events react to an extended shelf life may impact directly or indirectly on the environment and vice versa. Several studies, trough Life Cycle Analysis (LCA), studied these effects (Notarnicola *et al*. 2012; Menses et al. 2012; Pardo and Zufia 2011; Pereira and Vicente 2010).
Shelf life is also strictly linked to climatic conditions, seasonality and storage and transportation methods. Storage temperature must be kept constant over the entire period of conservation of a product to avoid adverse effects due to the growth of microbial flora (Tromph *et al*. 2012). For this reason, shelf life is generally determined with caution although this causes tremendous food loss and frequent stock turn-over for final consumption and distribution centers. Tromph *et al* estimate that varying the shelf life for certain products, food loss decrease by almost 80 per cent.
Furthermore, food losses are strictly influenced by consumer and producer behaviours. Lundqvist (2009) argues that wasted food is around 1/4 and 1/3 of purchased food. Environmental quality would then be notably affected considering that in industrialised countries these figures may arise over the next years. The potential environmental damage costs to society would be quite high if producers' attitude will remain the same, i.e selling three-for-two or providing misinformation to consumers on the shelf life of a product.
On this background, we find relevant to evaluate consumer behaviour strategies and link these to a shelf life of a product. In particular, this paper is an attempt to investigate the potential relationships between the shelf life a product and environmental sustainability from a micro-economic perspective by means of consumer preference analysis.
The study focuses on the "Canestrato di Moliterno" cheese. This is a high fat dry cheese with Protected Geographical Indication (PGI) certification. It is made from raw milk of specific sheep and goats mainly bred to graze in rural areas of Basilicata in southern Italy.
In particular, the objectives of this paper are the following:
(i) Measuring consumers' willingness to pay (WTP) for a longer shelf life of a product compared to environmental sustainability; and (ii) Identifying the efficient trade-off between shelf life and environmental sustainability.
The present paper is structured as follows. Section 2 briefly illustrates the theoretical model and the methodology used (experimental design and survey analysis); Section 3 describes the obtained results; and finally, Section 4 concludes.

Model and methodology

Theory

The model considered in this study is based on the theory of value (Lancaster, 1966) and the random utiliy model proposed by McFadden (1974). *Choice experiments* (CE) tools combine the two theories to assess consumer preferences. These are valuable instruments largely used in literature to estimate the economic value of food products, non-market goods (i.e public goods) and their attributes (Alfnes, 2004; Scarpa *et al.*, 2008; Nocella and Kennedy, 2012; Campbell *et al.*, 2012; Day *et al.*, 2012). Consumer choices generally respond to the questions of what goods to choose and how much to consume of the chosen goods. Formally, each individual solves the following maximization problem:

Function (1) $\mathrm{Max}_{c,x} U\left[c_1(A_1)....c_N(A_N); z\right]$

subject to:

Function (2)

1. $y = \sum_{i=1}^{N} p_i c_i(A_i) + z$
2. $c_i c_j \geq 0, \quad \forall i \neq j$
3. $z > 0, \; c_i(A_i) \geq 0$ for at least an element i

where *U[…]* is a quasi-concave utility function defined over $x_1...x_N$ commodities; $c_i A_i$ is the alternative choice *i* (profile *i*) which is a function of the alternative specific attribute vector A_i; p_i is the price of each choice profile; z is a composite good with a price normalised to 1 and y is income.

The econometric model used in current literature is the Multinomial Logit Model (MNL). This model is characterised by three or more choice alternatives. In our case study we opt for a MNL such as the Conditional Logit model, where no correlation exists in the error term among the alternatives.

Experimental design and survey analysis

The set of attributes chosen in this study derived from an exploratory survey carried out using current literature review (GfK-Eurisko, 2011; Ippolito, 2008) and interviews with experts and stakeholders in the dairy sector. In our analysis the choice of attributes was the result of studying traditional (i.e. presence of DOP/IGP, cheese ageing) *vs* innovative consumption aspects (i.e consumers' preference for less mature cheese, reduced frequency of grocery purchases and preference for a longer shelf life of products, small packaging size, consumers' attitude towards environmental protection) of the investigated product.

The attributes of "Canestrato di Moliterno" cheese used for the analysis and their levels, are shown in Table 1.

Attributes	Levels
PGI indication	0 (absent); 1 (present)
Shelf life	1.5 months; 3 months; 6 months
Environmental certification*	0 (absent); 1 (present)
Cheese Ageing	1-2 months; 4-6 months
Packaging size	125g; 250g
Price	1.20€/100g; 2.50€/100g; 3.50€/100g

*The term 'environmental certification' refers to food product certification with reduced environmental impact. To date, this type of certification still does not exist. Therefore, in our analysis, the term environmental certification is used to refer to EMAS and ISO 14000 certifications given that these ones are most known to consumers. We should also point out that a firm with an EMAS or ISO 14000 certification does not necessarily pollute less. However, given that these types of certifications pose some forms of environmental control on firms (as described in the guidance manuals) we argue in favour of a willingness of firms to act for a certain degree of environmental protection to efficiently improve their production activities.

Table 1. Attributes and attribute levels.

The combination of attributes and their levels provided 144 hypothetical alternatives. Efficient choice sets were created using a fractional orthogonal experimental design (main effects only design) and the fold-over technique (de Bekker-Grob, 2009; De Salvo *et al.*, 2012). By doing so, we obtained 12 choice sets, each of them formed by two alternatives and the base case. For this case study we considered as the base alternative a goat cheese matured to 4-6 months, with 3 months of shelf life, purchased at a price of 1.20 €/100g for a 250g package, with no PGI indication and the absence of an environmental certification.
The choice sets were subsequently divided into four to create as much different versions of the questionnaire used in interviews.
The questionnaire proposed to consumers was structured into four sections. The first part was designed to assess socio-demographic, lifestyles and environmental attitudes of the respondents. The second part aimed to detect eating habits and purchasing behaviours of consumers. The third part of the questionnaire investigated the purchasing behaviours towards goat cheese. The last part of the questionnaire dealt with the choice sets. Following a pre-test carried out over 25 respondents, the survey was focused on a random sample of 757 consumers living in Southern Italy. Data collection was conducted through the compilation of an on-line questionnaire during the period April-July 2013. At completion of the survey a total sample of 471 respondents was achieved.

Results

Descriptive statistics of the sample

The sample size is characterized, on average, by consumers of 40 years old and predominantly women (54.5%). Education is an important aspect of the sample. 36.5% of respondents have a secondary school degree; while almost 20% achieved a higher education or post-graduate degree. The remaining figure (46.5%) is representative of consumers with primary school education. Income (gross) ranges between 12,001 and 40,000 (65%) Euros, while only 4.5% of respondents declare to earn more than 75,000 Euros per year.
In terms of food purchases, more than 75% of the total sample is responsible for food shopping, on average, three days a week. Generally, shopping habit is predominant in big department stores. The weekly food bill ranges between 51,00 and 100,00 Euros, whereas only 8% of respondents is willing to spend more than 150,00 Euros.
One of the main aims of the survey analysis was to capture information on sustainable behavior initiatives and environmental protection. Although the majority of respondents declared to act towards the environment through various initiatives (i.e. recycling, use of public transport, water and energy saving, etc), the purchase of organic food and similar (i.e. product with environmental certification, products with recycled packaging, etc) was limited. More than 40% of respondents declared to purchase organic food less than once per month, against 19.7% arguing that this type of products do not appear in their shopping list. In terms of consumption of goat cheese, more than 50% of respondents purchase this type of cheese mainly in department stores[1], 68.3% of consumers generally spend between 1,21 and 2,00 Euros/100 g, against 13.6% which argue to pay more than 2.00 Euros/100 g.
Finally, in terms of the attributes of the goat cheese, it is relevant to note that the place of origin of the product and PGI certification are declared to be the most important

1. The term 'department stores' refers to local supermarket, supermarket chain and discount stores.

elements which characterizes consumer's choice (these attributes was important for 70.1% and 58.0 % of consumers surveyed, respectively). The visual appearance is also a relevant attribute (it is significant for the 57.7% of the sample), while price and longer shelf life seem to be important only for almost 25.3% of respondents. The presence of an environmental certification is an important element for almost half of respondents (45.6%), as well as, product availability in stores or shops where consumers generally purchase their grocery (45.9%), the biological certification (47.3%) and the presence of nutritional information (51,8%).

Estimation and discussion

To answer to the objectives of our research, a conditional logit model was used. The utility function was considered in an additive form (Mazzanti, 2001) as follows:

Function (3)

$$V_{ij} = \beta_0(PGI) + \beta_1(Shelflife) + \beta_2(Env) + \beta_3$$
$$\beta_3(CheeseAge) + \beta_4(Packaging) + \beta_5(Price)$$

where V_{ij} is the utility function in monetary terms across individuals *i* and attributes *j*, and the independent variables are the attributes, as specified in Table 1.

Table 2 shows the estimates obtained from the conditional logit model. The estimated coefficients appear to be statistically significant at 95% C.I. but *CheeseAge* and *Packaging*.

The analysis also shows relevant results (Table 3) in terms of the estimated marginal effects which can be summarised as follows: i) a *PGI* certification increases the probability to purchase the cheese by 30%; ii) a month increase in the shelf life increases the probability by 2.6%; iii) an environmental certification increases the probability by 17.5%; and iv) one Euro increase in the price decreases the probability to purchase the cheese by 6.5%. This follows general competitive markets rules.

Variable	Coefficient	P-value	St. error
PGI	1.343	0.000	0.088
Shelflife	0.106	0.003	0.036
Env	0.745	0.000	0.080
CheeseAge	-0.781	0.409	0.094
Packaging	0.001	0.065	0.001
Price	-0.266	0.000	0.050
Log-Likelihood	-1864		
Obs.	4239		
LR Chi²(6)	444.30		
Prob>Chi²	0.0000		

Table 2. Conditional logit model estimates.

Variable	dy/dx	P-value	St. error	MWTP (Δ price in Euros)	MRS
*PGI**	0.299	0.000	0.024	4.60	
Shelflife	0.026	0.003	0.008	0.40	
*Env**	0.175	0.000	0.021	2.70	0.14
CheeseAge	-0.019	0.414	0.023		
Packaging	0.000	0.055	0.000		
Price	-0.065	0.000	0.014		
*dy/dx is for discrete change of dummy variable from 0 to 1					

Table 3. Marginal effects, MWTP and Marginal Rate of Substitution (MRS).

Furthermore, the marginal willingness to pay shows us that consumers are willing to pay a premium price (compared to the status quo) of 4.60, 2.70 and 0.40 Euros for a PGI certification, an environmental certification and a longer shelf life, respectively.
Finally, the marginal rate of substitution between a longer shelf life and the possibility to have an environmental certification as cheese attributes is given by the following equation:

Function (4)

$$MWTP(Shelflife) = \frac{\beta_1(Shelflife)}{\beta_2(Env)} =$$

$$\frac{0.175}{0.026} = 6.73 \text{ months}$$

This value indicates the marginal trade-off between shelf life and environmental sustainability. Should consumers give up to environmental concerns and attitudes, the 'Canestrato di Moliterno' cheese would have a longer shelf life of 202 days (=6.73*30days) compared to the status quo (3 months equal to 90 days).
It is important to point out that this value should be considered with caution because it lies outside the range of the shelf life levels (e.g. 1.5; 3 and 6 months). Hence, this result represents only the magnitude of the phenomenon under consideration and should not be considered in absolute terms.
The findings of this work highlight the existence of a high premium price for PGI certification and a positive and strong attitude of consumers for sustainability issues are. This would suggest a relevant insight to producers for the implementation of sustainable practices and traditional process in their production. Also, the WTP values of the shelf life, though lower than that of the PGI and environmental certification, would indicate that shelf life extension can be considered as an attribute of product differentiation for which consumers are willing to pay a premium price. This represents a positive signal for producers oriented to adopt these innovations. Shelf life extension to traditional products represents, to the best of our knowledge, the sole type of technology innovation that can be used in production processes. Therefore, mostly to producers of typical products who deal with season-related and/or highly perishable commodities and intend to reach geographically distant markets, the premium price for shelf life extension can be seen as a real business and investment opportunity. In this regard, future research designed to verify if this estimated premium price cover the additional costs to implement such innovations in production process would be desirable.
Finally, the results of this study offer some points to reflect on policy implications. In particular, the existence of high premium prices for IGP and environmental certification offer the possibility to develop synergies across environmental and product quality policies. In fact, a number of policies, in particular at European level such as the integrated product policy (European Commission, 2009) and the agricultural quality product policy (European Commission, 2012) provide a clear signal from the decision making process to integrate innovation in the light of the EU commitments on sustainability issues.

Conclusions

The present paper was an attempt to analyse the relationships between the shelf life of a product and environmental sustainability from a micro-economic perspective by means of consumer preference analysis.
The proposed case study can be considered a pilot case for similar research topics. The

idea is based on the changes of attitudes of modern consumers in industrialised countries, characterized by growing interest in environmental issues and affected by lifestyles where no or little time is devoted to food shopping or to purchase convenience foods. Consequently shelf life extension and environmental certification of food products can be considered preference attributes. Since production and packaging technologies oriented to extend the shelf life of a product would seem to have negative impacts on the environment, in this study we attempted to evaluate if sustainable consumer behaviours can be linked to the needs of longer shelf life of food products.

Estimated results suggest that the presence of an environmental and PGI certification as product attributes is highly perceived by consumers. Under a firm's perspective an extended shelf life can therefore be seen as a real business and investment opportunity.

Finally, the co-existence of shelf life extension seen as innovation in traditional products and environmental issues provides the development of synergies across environmental and product quality policies. This is relevant at EU level where a number of policies (i.e integrated product policy, agricultural quality product policy, food waste resolution) already give a clear signal to the market to ensure environmental protection, product quality and innovation in production processes.

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ENVIRONMENTAL SUSTAINABILITY IN AGRI-FOOD PRODUCTION

Economic and Environmental Sustainability Assessment of Clementine Crops Scenarios in Calabria

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Abstract

The aim of this paper is to analyse the Clementine crops in Calabria, from an environmental and economic point of view. Using the same data inventory, different scenarios of Clementine production were analysed, evaluated and compared. Life Cycle Assessment (LCA) and Life Cycle Costing (LCC) methodologies have been useful to assess nine scenarios resulting by data that refer a group of 50 farms, representing the three main production areas (in the provinces of Cosenza, Catanzaro and Reggio Calabria) and the three most common cropping systems (conventional, integrated and organic). Results have allowed to make comparisons and to rank performances of each scenario for every field of study. Findings of this study highlighted the possible effectiveness of the joint use of LCA and LCC, and that they can be a useful decision making instrument for both public and private deciders.

JEL Classification code: Q01; Q12.

Key words:

Environmental and economic sustainability; Life Cycle Assessment (LCA); Life Cycle Cost (LCC); Clementine crops.

Introduction

Anthropic activities are the principal responsible for the depletion of natural resources, because exploitations are carried out faster than the ability of ecosystems to regenerate themselves. The assessment of environmental and economic sustainability relating to a product or a process is a high concern for many stakeholders, e.g. public deciders, farmers, entrepreneurs and consumers. According to Gaillard and Nemecek (2009), agriculture and food production are one of the principal responsible for environmental impacts and natural resources overexploitation. Today more than ever, new methodological approaches are required for management and decision making to meet consumers' needs for high quality and healthy products, and entrepreneurs' necessity of economic viability, using natural resources rationally. Many methodological tools have been developed - in a new conceptual model: the Life Cycle Thinking (LCT) - to achieve this goal, such as Life Cycle Assessment (LCA) and Life Cycle Costing (LCC) for environmental and economic sustainability assessment. They belong to a toolbox named Life Cycle Management (LCM), which is the methodological framework that can help public deciders, entrepreneurs and managers addressing their activities in a more sustainable way. The LCM multidisciplinary approach have been successfully used in food production, a sector that notoriously has a strong environmental impact and often a low profitability (SETAC, 1991; De Gennaro et al., 2012). The purpose of this study is to make a sustainability analysis in order to measure the impacts of different citrus production systems in Calabria re-

gion (Southern Italy). In particular, Clementine crop systems - conventional, integrated and organic - has been analyzed from both an economic and environmental standpoint through a joint use of LCA and LCC. Results have allowed to make comparisons and to rank performances of each scenario for every field of study. Findings of this study highlighted the possible effectiveness of an integrated use of LCA and LCC, and that they can be a useful decision making instrument for both public and private deciders also in order to achieve green marketing strategies.

Methodology

According to the Brundtland Report (WCED, 1987), sustainability is achieved through the integration of three interrelated features such as social equity, economic viability and environmental protection. A new conceptual model - the Life Cycle Thinking (LCT) - and its methodological framework - the Life Cycle Management (LCM) - have arisen from the necessity to deepen the knowledge about all the impacts (i.e. environmental impacts, economic and social ones) that products and services generate during every stage of their life cycle, "from cradle to grave", or rather, from planning to disposal, taking into account all inputs and outputs of resources and energy (Guinée, 2002; Rebitzer, 2003; Hunkeler et al., 2004; Saling et al., 2010; De Gennaro et al., 2012). Many methodological tools have been developed to achieve this goal, such as Life Cycle Assessment (LCA) and Life Cycle Costing (LCC) for environmental and economic sustainability assessment. LCA is defined as "an objective process to evaluate the environmental burdens associated to a product, a process, or an activity by identifying energy and materials usage and environmental releases, and to evaluate opportunities to achieve environmental improvements" (SETAC, 1991). These improvements can be measured in order to understand which useful changes should be adopted during the life cycle of a product (good or service). The International Organization for Standardization (ISO) has published international standards ISO 14040-14044 about principles, framework and requirements for a correct use of LCA (ISO, 2006a, 2006b).

LCC was, in origins, an instrument of management accountability to assess investments that did not take into account environmental costs (Gluch et al., 2004; Notarnicola et al., 2009); now, and ever more, it is a methodology based on the assessment of all kind of costs during life cycle afforded by every involved actor, including long run externalities (Rebitzer et al., 2003; Huppes et al., 2004). According to White et al. (1996), three conditions have to be defined before starting a LCC analysis: life cycle phases, inventory elements for each phase, environmental effects connected to different impacts. Applying LCC allows to achieve two main goals: adapting costs estimation approaches to relate environmental costs to specific processes and products, and facilitating the identification of best practices to prevent pollution and to reduce wastes.

However, to be effective, LCC has to be developed jointly with a LCA, taking into account the same product system, boundaries, and functional unit, in order to obtain a complete assessment of environmental impacts and production costs. It does not exist a specific standard for the joint implementation of LCA and LCC, therefore, for this study, the methodological frameworks of the ISO guidelines (2006a; 2006b) and of Lichtenvort et al. (2008) have been used. Regarding the application of LCA and LCC to food farming, some examples in literature are available (Notarnicola et al., 2003; Sanjuan et al.,

2005; Mila' i Canals et al., 2006; Petti et al., 2006, 2010; Pizzigallo et al., 2008; Poritosh et al., 2009; Cerrutti et al., 2012) and the present study moves in the same direction.

Materials and methods

For the whole regional context, a statistical analysis has been conducted and the most significant production areas of Clementine have been identified, as well as the most common cropping systems (fig. 1). Specifically, the study focused on three main agricultural areas (Piana di Sibari in the province of Cosenza, Piana di Lamezia in the province of Catanzaro, and Piana di Gioia Tauro in the province of Reggio Calabria) where three principal techniques of cultivation (conventional, integrated and organic) are widespread; therefore, nine production scenarios have been identified[1]. The analysis focused on a group of 50 farms, representing the nine production scenarios. The selection of farm units has been carried out through a procedure of non-probability sampling with reasoned choice (Fraire and Rizzi, 1993) with an allocation in stratified sampling (Bailey, 1994; Girone and Salvemini, 2001), that has been allowed to define a sample distributed, proportionally, within the total population. The survey conducted has highlight that there are two principal layouts of citrus orchards in the areas studied: the first layout (with an average of 400 trees/ha) is related to the province of Cosenza that is characterised by an innovative and more mechanized citriculture; the second layout (with an average of 540 trees/ha) is common in the other two production areas.

1. C-CS, I-CS, O-CS; C-CZ, I-CZ, O-CZ; C-RC, I-RC, O-RC. Where: C = Conventional; I = Integrated; O = organic; CS = Cosenza; CZ = Catanzaro; RC = Reggio Calabria.

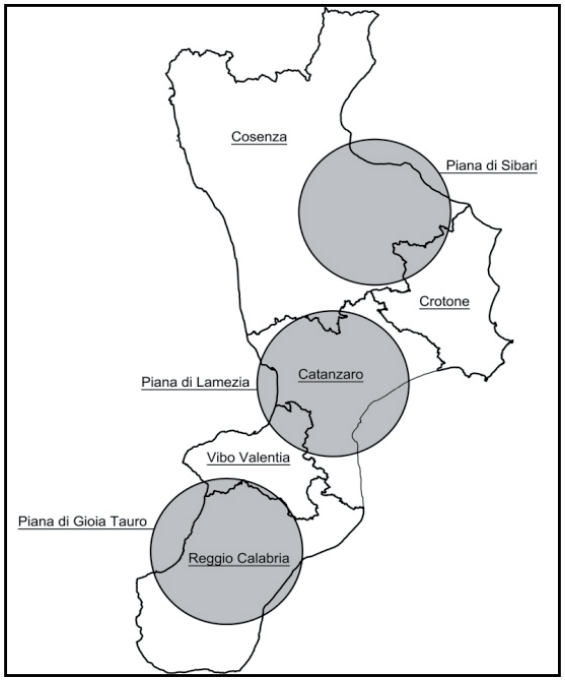

Figure 1. Study areas in Calabria.

Application of LCA method to the case study

The first phase of the analysis, according to LCA guidelines (ISO, 2006a, 2006b), has been the identification and definition of the above-mentioned scenarios. In a second phase, 1 ha of planted surface has been chosen as a "functional unit", and then system limits have been defined considering production phases "from cradle to gate", or rather from plantation to clementine harvesting, excluding processing, distribution and consumption (fig. 2). Therefore, the considered life cycle goes from Clementine plantation to disposal (40 years). The same life cycle has been object of an economic assessment through the LCC methodology. Inputs and outputs data related to production have been directly collected from the field. Data on emissions of fuel consumptions have been obtained from secondary sources; the

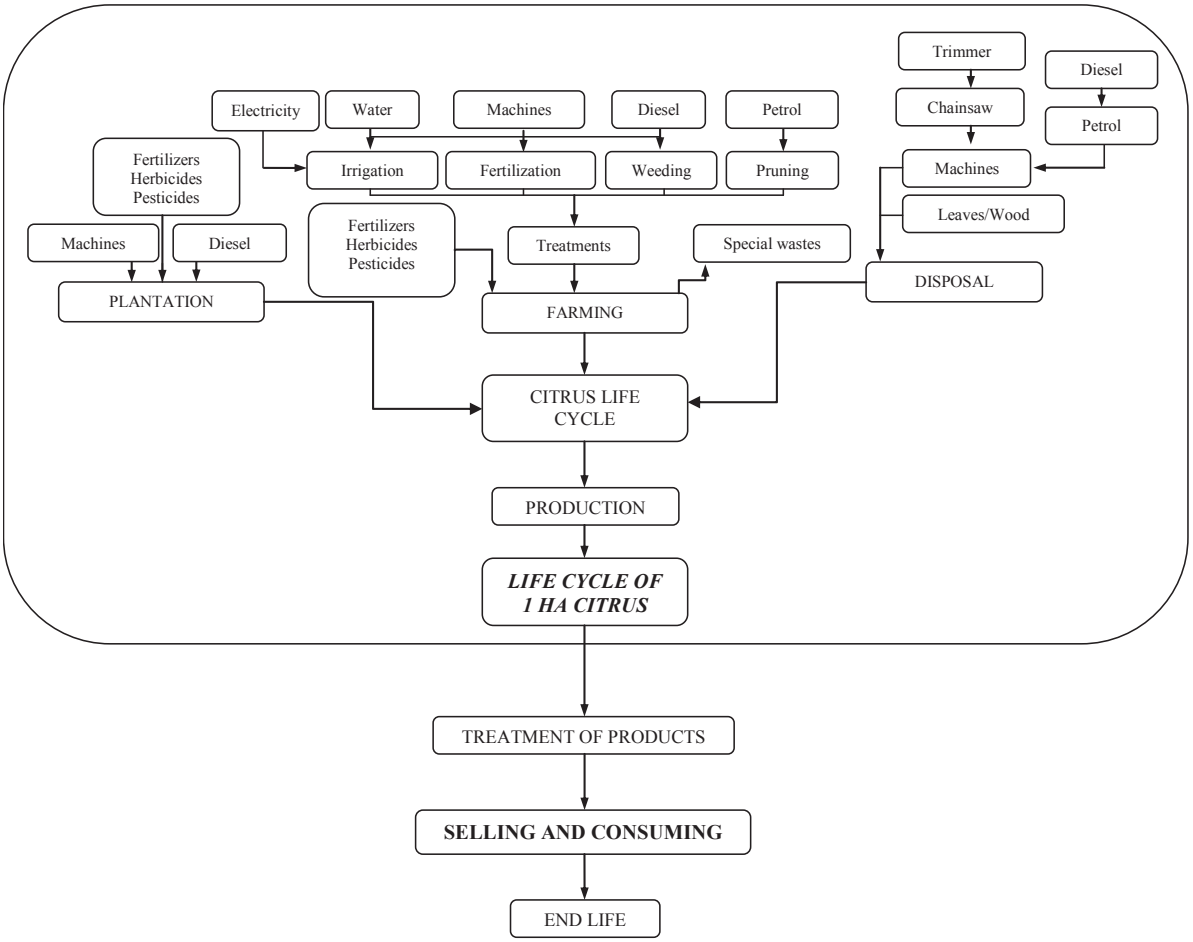

Figure 2. Flowchart of the life cycle for Clementine crop analysed.

emissions related to the use of pesticides and fertilizers not have been considered because this analysis would require the use of specific models[2] to calculate the dispersion of these substances in soil, water and air (Birkved and Hauschild, 2006; Salomone et al., 2010). However, for this study, the approach used allow to make systematic the possible errors and did not affect on comparison results.

The 50 ordinary farms have been selected with an average surface of about 10-15 ha, because of their significance among others. Techno-economic data of five growing seasons - from 2005 to 2010 - have been collected and considered in order to reduce the uncertainty degree connected to seasonality and subjectivity of farms management, but also to attenuate production fluctuations

2. Moreover, the complexity of the dispersion modelling analysis is due to the strong influence that the pedo-climatic conditions have on the fate of chemicals and on their effects in the environment; thus, specific skills and additional data (e.g., soil properties, rain average quantity and wind intensity) must be available, as well as it is important pay attention to the implementation of these approaches in comparative studies, according to Cerutti et al. (2012).

and other external factors that could have influenced plants productivity. Therefore, for each farm, average values per hectare have been processed. To identify analytically all inputs and outputs, both environmental and economic ones, a specific questionnaire has been arranged. In addition to general questions about the farm, it has also included specific questions on inputs quantities and prices, as well as the obtained yields.
For the analyzed five-year period, the following factors have been considered: fuel consumption, for each technical operation; water consumption required for rescue irrigation; modality of water distribution and related energy consumptions; quantity, type, period and distribution modality of pesticides; wastes disposal modality. In order to adopt the LCA method, collected data have been processed and grouped into macro categories as shown in table 1. Inventory data were processed using SimaPro 7.3 software (PRé-Product Ecology Consultants, 2010a), Ecoinvent V. 2.2 database (Ecoinvent, 2007, 2009) and Eco-Indicator 99 method (PRé-Product Ecology Consultants, 2010b) to elaborate each scenario.

Considered elements	Measurement unit	Description
Fuel consumption	l/ha/year	Fuel consumptions per single farming operation
Water consumption	m3/ha/ year	Water consumptions per irrigation operation and pesticides distribution
Fertilisation	kg/ha/year	Quantities of fertilizers take into account titrations of nutritive elements distributed
Pesticides treatments	kg/ha/year	Active principles distributed
Electricity	kW/ha/year	Energy consumption per farming operation
Wastes	kg/ha/year	Wastes per farming cycle in terms of High-density polyethylene (HDPE) disposal (crates, packaging materials, bottles)
Production	t/ha/year	Average of clementines produced

Table 1. Scheme for LCA data collection.

Application of LCC method to the case study
In order to implement an economic analysis the LCC method has been used, considering farm labour remuneration, land and working capital (Falcone et al., 2012; Pirilli et al., 2012; Stillitano et al., 2012; Strano et al., 2013). In this way, it has been possible to realize an inventory costs complementary to LCA inventory (Notarnicola et al., 2009) as established in ISO (2006a).
The same parameters and life cycle described in the previous paragraph has been considered for LCC implementation. Each input and output considered in LCA analysis (i.e. inventory data) has been transformed in monetary values by multiplying the average quantity (of the three-year period) by the unit price related to the last year of production.
In order to reach the total cost of every single process, all other costs associated to the inputs (e.g. those costs afforded for labour, disposal, etc.) have been considered. Further-

more, fixed costs linked to the overall production process (e.g., shares of insurance, taxes, etc.) have been considered for each production phase.
Obtained data have been used to perform an investments analysis, and so assessing the overall life cycle cost through appropriate financial indices: the Net Present Value (NPV) and the Internal Rate of Return (IRR). These parameters take into account the economic and financial trend of investment during the whole life cycle.

A discounting rate of 1.8% has been applied, considering the low risk and long-lasting nature of agricultural investments.
The economic trends does not allow to estimate a reliable average inflation rate during the overall period considered, therefore a coefficient not inflation-adjusted has been considered, in order to reduce the degree of results uncertainty. The discounted costs were obtained through the following equations Eq. 1 (cf. legend in tab. 2):

Equation 1

$$Pl^{0}_{TH}C = Pl_0DsC + Pl_0InC + \sum_{j=1}^{m1}\frac{StPl_jC}{(1+r)^j} + \sum_{j=1}^{m2}\frac{PgrPl_jC}{(1+r)^j} + \sum_{j=1}^{m3}\frac{PkPl_jC}{(1+r)^j} + \sum_{j=1}^{m4}\frac{PdcPl_jC}{(1+r)^j} + \frac{UdPl_{40}}{(1+r)^{40}}$$

TH	=	Time Horizon (40 years);
Pl_0C	=	Discounted total Cost of Planting;
Pl_0DsC	=	Planting Design Cost;
Pl_0InC	=	Planting Installation Cost;
$\sum_{j=1}^{m1}\frac{StPl_jC}{(1+r)^j}$	=	Discounted Starting System Cost (from the 1st to the 4rd year);
$\sum_{j=1}^{m2}\frac{PgrPl_jC}{(1+r)^j}$	=	Discounted Production Cost - growing phase (from the 5th to the 10th year);
$\sum_{j=1}^{m3}\frac{PkPl_jC}{(1+r)^j}$	=	Discounted Production Cost - constant phase (from the 11st to the 30th year);
$\sum_{j=1}^{m4}\frac{PdcPl_jC}{(1+r)^j}$	=	Discounted Production Cost - decreasing phase (from the 31st to the 40th year);
$\frac{UdPl_{40}}{(1+r)^{40}}$	=	Discounted Useful for disposal (40th year).

Table 2. Equation 1 legend.

All cash flows have been discounted through the following equations (Eq. 2 and Eq. 3):

Equation 2 $NPV = B_0 - C_0$

Equation 3 $IRR = B_0 - C_0 = 0$

where:

$B_0 = \sum_{j=0}^{n}\frac{b_j}{(1+r)^j}$ = Value of actual benefits;

$C_0 = \sum_{j=0}^{n}\frac{c_j}{(1+r)^j}$ = Value of actual costs;

$n = TH =$ 40 years.

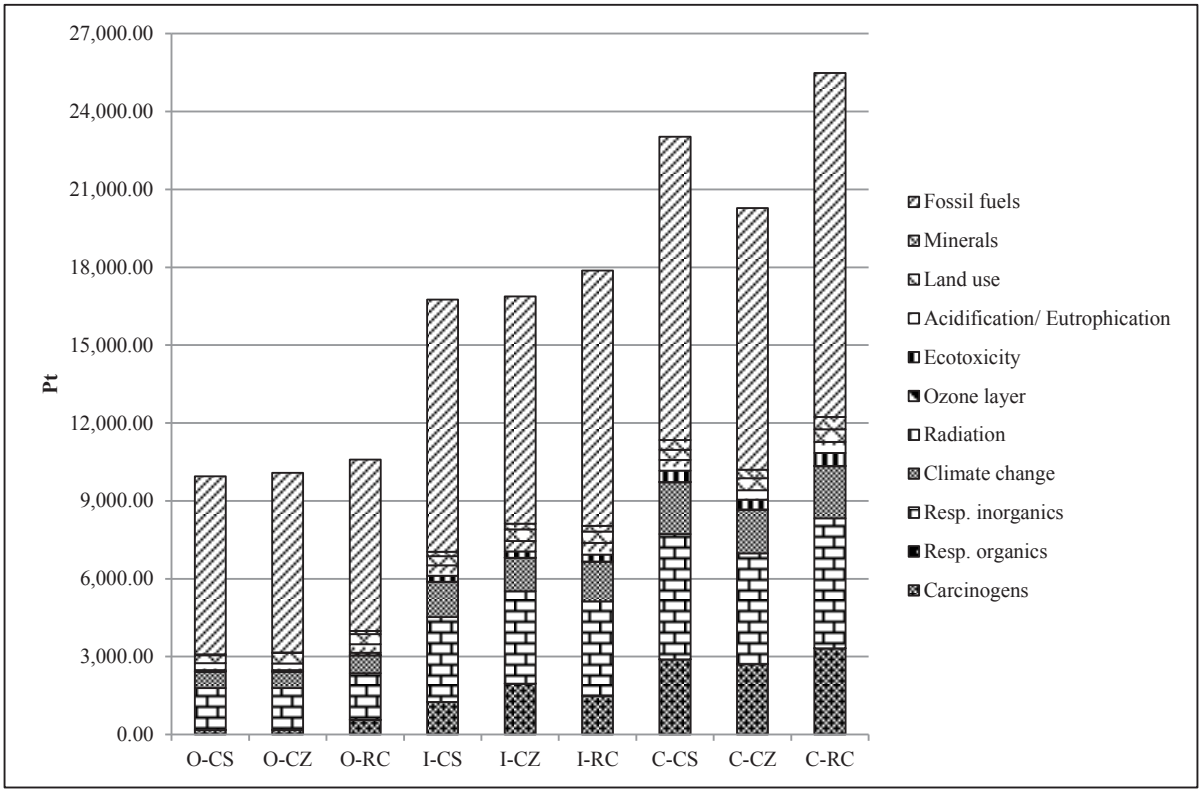

Figure 3. LCA Results - Eco-Indicator 99 Single score per impact categories.

LCA and LCC results have been compared in performances rankings in order to assess the environmental and economic sustainability of each scenario.

Discussion of results and conclusions

Results did not enable authors asserting which is, in absolute, the most sustainable scenario among those assessed, but they allow to make comparisons. Through the implementation of LCA, Eco-Indicator 99 method has allowed modelling inventory data into impacts categories and then evaluating impacts - as balance of positive and negative ones.

Results (fig. 3) has shown that, in average, the most sustainable scenario is "O-CS" with 9,944.05 Eco-points, and the worst performing one is "C-RC" scenario with 25,482.81 Ecopoints. The gap between them amount to 156.2%. Regarding life cycle phases, and taking into account the duration of each one, in all cases the most affecting ones are the "constant phase" (from the 11st to the 30th year) and the "decreasing production" phase (from the 31st to the 40th year), imputable to "fossil fuels", "resp. inorganics", "carcinogens" and "climate change" categories, because of the use of fertilizers and pesticides.

Concerning the implementation of LCC methodology to assess economic performances, figure 4 shows the life cycle discounted costs: "O-CZ" is the best performing scenario, amounting to 210,943.99 Euro, while the worse one is the "C-RC" scenario with an amount of 275,087.59 Euro, with a gap

of 30,4% more than the first one. Financial indicators to analyze profitability of investments, i.e. NPV and the IRR, have been calculated for each scenario; they have shown that "O-CS" (with a NPV of 79,586.96 € and an IRR of 9.4%) and "C-CS" (with a NPV of 78,028.01 and an IRR of 9.5%) scenarios are the most economically advantageous ones, followed by "I-CZ" and "I-CS" scenarios in terms of NPV and IRR. The difference between "O-CS" and "O-RC" (the worse one economically) scenarios amount to 98.4% in terms of NPV and to 73.4 % in terms of IRR. The relative gaps (in percentage) between each scenario performances are shown in figure 5, allowing a visualization of both environmental and economical results. A percentage of 100% has been given to the best performing scenario, or rather, the most sustainable among the others.

Greater performance differences between scenarios are evident, above all, in Eco-Indicator 99, in NPV and IRR values. "C-RC" and "C-CS" scenarios are the worst performing in terms of environmental damages, instead, in terms of discounted costs, the worst scenarios are "C-RC", "I-RC" and "C-CZ". "O-RC" is the worst scenario in terms of NPV and IRR; the relative gap between it and the best performing scenario "O-CS" is about a 95.1% for the first indicator and about a 72.6%, for IRR values in comparison with "C-CS". In spite of the impossibility of an integrated assessment, the comparisons realized, in terms of "percentage distance" of each scenario from the best one, have highlighted some valuable information.

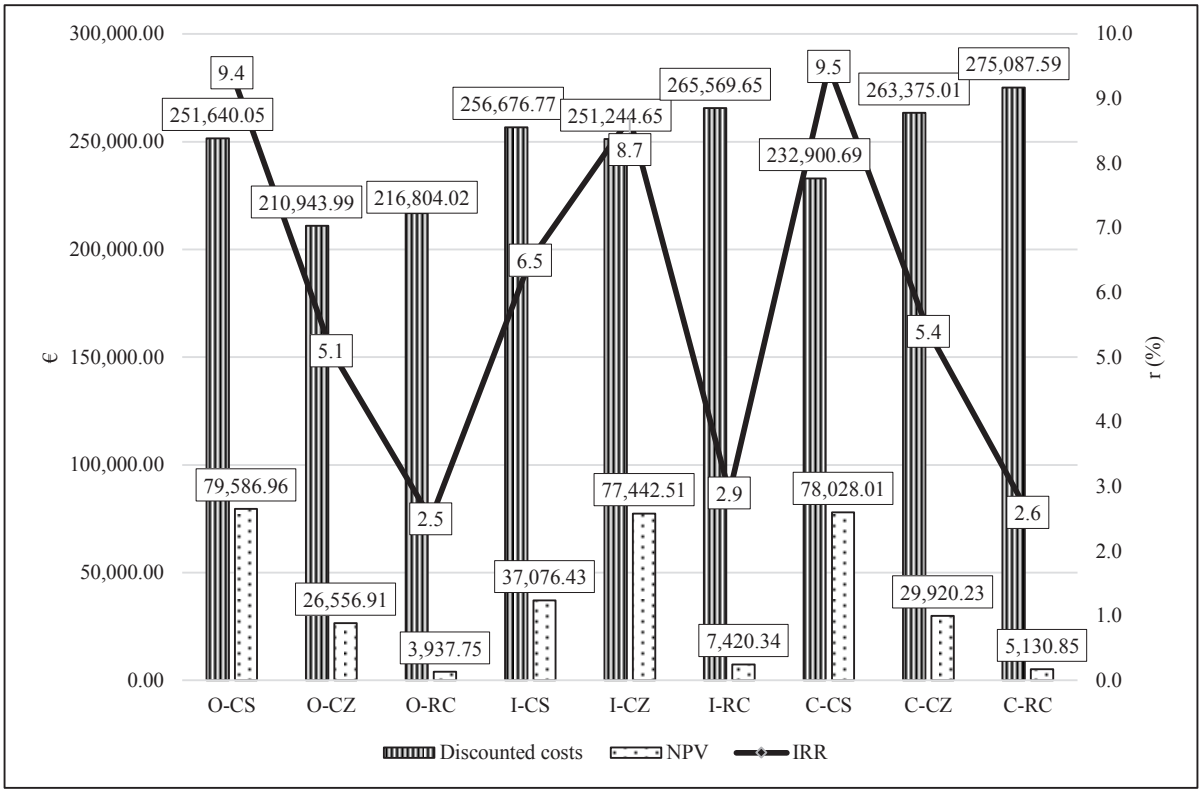

Figure 4. LCC Results - Discounted costs and financial indicators.

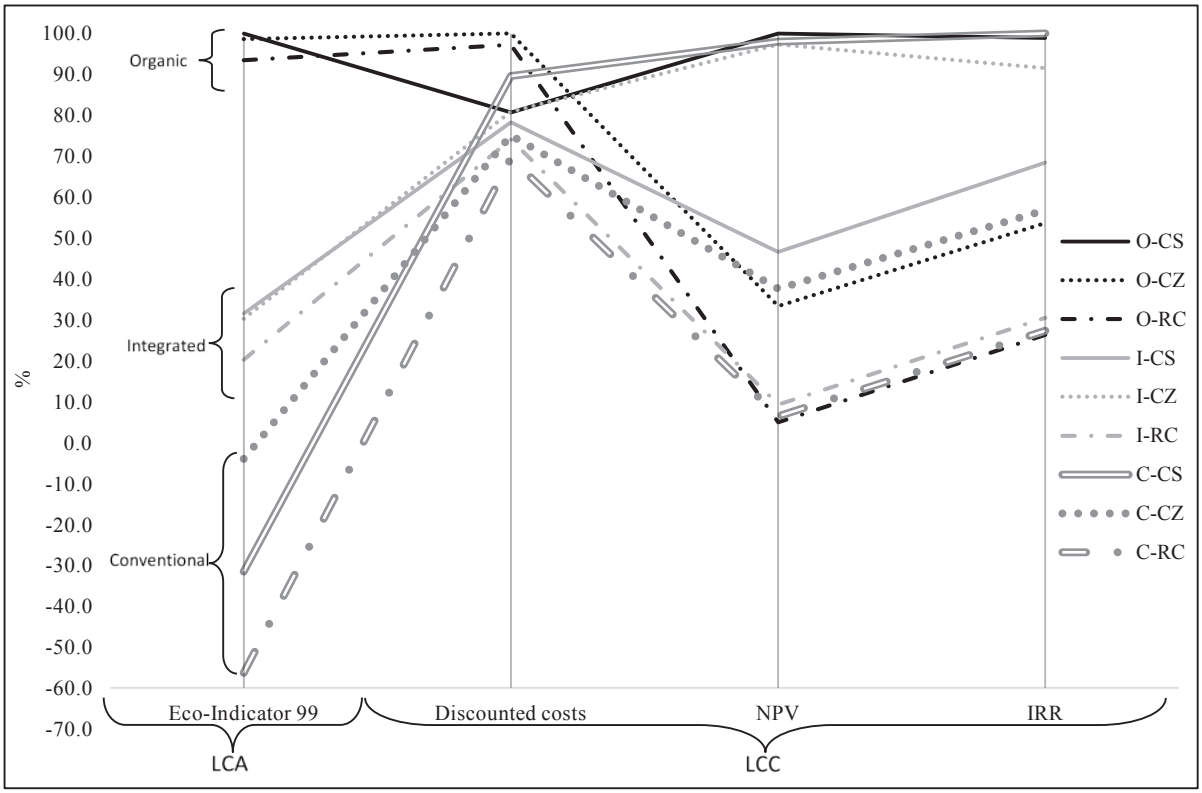

Figure 5. Comparison of gaps between scenarios.

As might be expected, the scenarios "Organic" have recorded the best performing environmental results, however, the analysis has allowed us to quantify exactly the offsets with the other two growing systems ("Integrated" and "Conventional"); in particular, there are very significant differences on gaps' averages that are equal to 70% between Organic and Integrated and to 127.9% between Organic and Conventional. LCC results have shown that the "Piana di Sibari" scenarios are the most economically viable, with a difference between gaps' average of 61.4 percentage points (p.p.) between "C-CS" (the best in terms of average results' LCC) and "C-RC" scenario that is the worst.

Results did not allow to assert which is the best sustainable scenario in absolute, because further analysis should be necessary in order to assess trade-offs between all concerns, considering also social ones. However, LCA and LCC methodologies are useful tools for decision-making, as they can help deciders (farmers, politicians and consumers) to understand what they are choosing within their actions, how to identify hot points of their operation phases and where interventions on processes are necessary. This deepened knowledge about the consequences of human activities permits to focus possible improvements on sustainability performances, reducing impacts on the environment and make farming more economically viable.

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Sustainability and Typical Products. The Case of the Water Footprint of "PDO Umbria" Olive Oil

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Abstract

Environmental sustainability of agricultural production has become an essential element for all the agri-food chains. It is also fundamental for the typical or traditional products, which have a strong connection with territory and are rather present in food daily consumption. Umbria region is the eighth Italian producer of olive oil. The objective of the present study was to assess the environmental impact of olive oil production using Water Footprint (WF), calculated for the Protected Designation of Origin (PDO) Umbria olive oil. The estimation of WF did not produce a single value, but a range of values. Results showed that, to be more sustainable, the production of PDO Umbria olive oil has to reduce the blue and the grey water.

JEL: Q25, Q51, Q57

Keywords: Water Footprint, PDO, olive oil food chain, water resources

Introduction

Environmental sustainability of agricultural productions has become an essential element for all the agri-food chains. It is also fundamental for typical or traditional products. The marketing strategy for these typologies of goods is often focused on their strong connection with territory, but also on their lower environmental impact (Cerutti *et al.*, 2013). However, the studies reporting the effective environmental advantages connected to these types of products, in comparison with the not traditional ones, are still rare (Cerutti *et al.*, 2013).

Italy is one of the largest global producers and major consumers of olive oil. According to a recent report of Ismea (2012), concerning the national and international market of olive oil, Italy is the second largest producer in the world after Spain (15.1%), and the first consumer (22.1%). In terms of import-export, despite being the second largest exporter (24.7% of worldwide export), Italy fails to meet domestic demand; for this reason, it is also the first importing country in the world (13.9% of worldwide import) (Ismea, 2012). The oil production in Italy is mainly located in central and southern regions, with the latter predominant over the others. Between 2009 and 2011 Puglia, Calabria, Sicilia and Campania covered around 80% of the total production of olive oil in Italy (Picciotti, 2012).

Despite its small territorial size, Umbria region is the eighth Italian producer of olive oil. The olive oil production accounts for about 6% of the regional Gross Production Value (GPV) and it is also an important sector for export. In 2011 Umbria was the fourth exporting region in Italy, as absolute value (Picciotti, 2012). Food Exports are essential for Umbria, more than for the other central regions: between 2005 and 2011 they have been increasing of 50% (Picciotti, 2012). Umbrian olive oil sector provides more than

40% of all regional exports (Picciotti, 2012). The objective of this study was to assess the environmental impact of olive oil production using Water Footprint (WF), calculated for the Protected Designation of Origin (PDO) Umbria olive oil. Thanks to WF, we were able to analyze both qualitative and quantitative aspects related to water, in order to monitor the use of this fundamental natural resource in an agri-food chain, as that of olive oil, which is very important for the economic and territorial system of Umbria.

In this context, we used this particular method and not other evaluation methods based on global environmental impacts, as for example Life Cycle Assessment (LCA), because only the WF allows a complete knowledge of products chains impacts on water.

Life cycle assessment (LCA) indicators analyze the environmental impacts that a product creates by considering its whole life cycle and by quantifying the resources involved and emissions produced. (Castellini *et al.*, 2012). Therefore, it can be considered a very useful instrument to evaluate the main environmental impacts caused by the system investigated. However, in relation to water, in general only qualitative impacts[1] are considered. Moreover, in LCA there is no standard approach for evaluating water use impacts (Chapagain and Orr, 2009).

The importance to combine LCA with WF was underlined at the last Swiss Discussion Forum on Life Cycle Assessment (Tendall *et al.*, 2013) and some authors proposed new methods for calculating a single score "LCA-based Water Footprint" (Ridoutt and Pfister, 2013) or proposed to revise the approach (Ridoutt and Pfister, 2010). Usually in LCA studies water use is included in an unsophisticated way (Chapagain and Orr, 2009), although for some products water could be one of the major impact categories (Chapagain and Orr, 2009).

Analyzing the WF of PDO Umbria olive oil is particular interesting, in our opinion, for several reasons. First of all, the local nature of the production allows to control in a precise manner the process of production. This allows to exclude the purchase of olive material for further processing (transformation), that would create assessment problems in this context (see the data on import of crude oil (Picciotti, 2012)). In addition, the high-quality olive oil is one of the leading productions for Umbria, also in terms of visibility and promotion of the regional territory. Concerning the climatic change in Umbria, Todisco and Vergni (2008) proved a decrease of rainfall from 1951 to 2004, while temperature has unchanged or increased, depending on the area. In this context, a monitoring of resource water in a key agri-food chain as that of olive oil appears to be important. Given the strong relationship of the indicator chosen with the concepts of virtual water and the issue of exports, the Umbrian oil sector, and the production of high-quality oil in particular, seems to be particularly suitable for this type of analysis.

Materials and method

The concept of water footprint (WF) is relatively new, having been introduced by Hoekstra at the end of 2002 (Hoekstra, 2003). The water footprint is the amount of water (freshwater) used for producing a certain good, measured over the whole supply chain (Hoekstra, 2003; Hoekstra *et al.*, 2011). Therefore, it is an indicator connected to the actual and overall consumption, whether di-

1. E.g.: the impact assessment method Ecoindicator99, which is one of the most common methods used in LCA, takes into account the "Ecotoxicity" impact category, representing all the emissions to water, air and soil, which cause toxic stress for the ecosystem.

rect or indirect, of water resources (Hoekstra *et al.*, 2011), taking into account not only the mere water extracted during production, but allowing to assess the volumes consumed by type of source and the volumes of water polluted during production. With reference to water withdrawal, it should also be pointed out that WF focuses on volumes actually consumed in the production process, and not on those employed.

WF is a composite indicator, made up of three different components (Hoekstra, 2003; Hoekstra *et al.*, 2011). The three units are: the *Blue water*, which includes surface water and groundwater consumed along the supply chain; the *Green water*, which is the water resulting from precipitation and directly used; the *Grey water*, which is the volume of water required to assimilate the load of pollutants, in order to achieve the quality standards set by law.

An interesting feature of WF concerns its spatial and temporal connotation (Hoekstra *et al.*, 2011). It is possible to assess the WF for a process or a single phase of a process; a consumer, a producer, or an entire manufacturing sector; a nation, or any other defined geographical area (Hoekstra *et al.*, 2011). If assessing the WF of a certain area, such as a region or a country, the value of WF may be expressed either in absolute terms or using a functional unit (Salmoral *et al.*, 2011).

This study is a case of WF for a product. The calculation of the WF of products is the first step for the calculation of any other type of water footprint, such as, for example, the WF of a nation or of a consumer. Sometimes, the water footprint of a product is confused with the virtual water content, which is, however, a more limited concept (Chapagain and Hoekstra, 2008; Hoekstra *et al.*, 2011), as it considers neither the origin and use of water, nor the time and space variables.

The *Blue water footprint* (BWF) is the quantity of surface or ground water consumed for the production of a good (Mekonnnen and Hoekstra, 2010). Consumption refers to the volume of water used and evaporated, included directly into the product or extracted in a catchment and returned to another one (Hoekstra *et al.*, 2011). It is then calculated as follows:

$$BWF_{prod} = BW_{evaporated} + BW_{incorporated} + Lost\ flows_{time/space} \quad (1)$$

In calculating the BWF_{prod}, it would be interesting to differentiate the sources of water used (surface, surface aquifer, deep aquifer), although in many cases it is difficult to do (Hoekstra *et al.*, 2011). BWF_{prod} includes also the collection of rainwater in basins and artificial lakes. Sometimes the BWF_{prod} is confused with the water taken for irrigation (Hoekstra *et al.*, 2011). The assessment of the Blue Water is easier for the no agricultural phases, as it can be better controlled. For the agricultural products some overlapping with the Green Water Footprint may happen.

The second component of WF is the *Green water footprint* (GWF). Green water is the amount of precipitation on land that is stored in the soil or that temporarily stays on top of the soil or vegetation. It does not include the amount that runs on or recharges the groundwater (Hoekstra *et al.*, 2011). The GWF_{prod} is the amount of Green water consumed during the production process (2). Clearly, GWF_{prod} is very relevant for agricultural and forestry productions.

$$GWF_{prod} = GW_{evaporated} + GW_{incorporated} \quad (2)$$

About the difference between BWF and GWF and their impact in term of social, hydrologic and environmental effects, the literature is

quite rich (Falkenmark e Rockström, 2006; Chapagain and Hoekstra, 2008).
The last component is the *Grey water footprint* (GrWF), which allows to consider the question of pollution. It is defined as the volume of freshwater that is required to assimilate the load of pollutants referring to the natural background concentrations and to existing water quality standards (Mekonnnen and Hoekstra, 2010). In some papers it is indicated as dilution water (Chapagain *et al.*, 2006).
It is calculated by dividing the pollutant load by the difference between the maximum acceptable level of pollution by law (c_{max}) and the level naturally present (c_{nat}) in the water for each substance present (3).

$$GrWF_{prod} = L/(c_{max}-c_{nat}) \quad (3)$$

Sometimes, c_{nat} is considered equal to zero, to make the calculation easier, but this is no the praxis (Hoekstra *et al.*, 2011). GrWF may vary greatly, depending from the level chosen for c_{max} and c_{nat}, because the former depends on the country, while the latter could be equal to zero or based on scientific data. In our application it is very important the matter of the wastewater.
The WF_{prod} is given by the sum of the three components (4). WF_{prod} is high in case of forestry and agricultural goods because of irrigation. However, for these goods the values of $GrWF_{prod}$ are lower than for the industrial ones.

$$WF_{prod} = BWF_{prod} + GWF_{prod} + GrWF_{prod} \quad (4)$$

In case of multi-stage production, as the case of olive oil, WF_{prod} is made up by the sum of the single steps. In particular, WF_{prod} of olive oil is given by (Salmoral *et al.*, 2011):

$$WF_{prod} = WF_{supply\ chain} + WF_{operational} \quad (5)$$

Where $WF_{supply\ chain}$ represents WF directly connected to raw materials, i.e. olives, bottles, labels and cups, while $WF_{operational}$ refers to the transformation of olive in oil.

Case study
The evaluation of WF of high quality olive oil in Umbria involved the regional PDO. Other studies on the olive oil (Amicarelli *et a*l., 2011; Salmoral *et al.*, 2011) concentrated their attention on an "industrial" product, while we studied a traditional one, with all the production phases made in a single farm.
The PDO Umbria olive oil includes five different sub-areas: Colli del Trasimeno, Colli Martani, Colli Assisi-Spoleto, Colli Amerini and Colli Orvietani. In each area different cultivar are allowed and the climatic characteristics differ, although slightly (see Table 1). The largest production is in the first three sub-areas (Ceccacci and Rocchi, 2012). Recently, it has been allowed to make transformation in all the region and not only in the same sub-area of the olive production.
We estimated the WF of the olive production and then the WF of the transformation process. As in Salmoral *et al*. (2011) we used (5) for assessing the PDO olive oil WF. The output is expressed in mc of water for ton of olive oil produced.
We estimated BWF and GWF of olive production using CROPWAT 8.0 (FAO, 2009). The software required as input several data and parameters about soil, climate and crops. Data about soil were deduced by Corine Land Cover 2006 and the regional map of soil. Data about climate were integrated using several networks, to cover the whole region surface. Crops data were taken from literature on olive tree production in Umbria (Tombesi, 2002). The year considered for all the elaboration was 2012.

Sub-area	Colli Assisi-Spoleto	Colli Martani	Colli Amerini	Colli del Trasimeno	Colli Orvietani
Cultivar	Moraiolo (min. 60%); Leccino; Frantoio	Moraiolo (min. 20%), San Felice, Leccino, Frantoio	Moraiolo (min. 15%), Rajo, Leccino, Frantoio	Moraiolo and Dolce Agocia (min. 15%); Leccino and Frantoio (min.65%)	Moraiolo and Dolce Agocia (min. 15%); Leccino (max 60%), Frantoio (max.30%)
Main Spacing (mxm)	6x6; 6x5	6x6; 5x5; 5x4	6x6; 6x3; 6x5	6x6; 6x3	6x6; 4x5
Average oil yield (%)	16	15	15	17	16
Max. oil yield allowed (%)	21	19	17	17	17
Temp. Min (°C-annual)	-6	-5.4	-5.6	-5.7	-5.5
Temp. Max (°C-annual)	13.4	14	14.4	12.9	14.1
Average Rain (mm- annual)	981	892	927	873	850

Table 1. Main climatic and crop parameters by subarea.

Moreover, to estimate BWF and GWF, information on irrigation are required (Salmoral *et al.*, 2011). In case of no irrigation, Blue water footprint for olive production is equal to zero, while the Green is equal to the actual evapotranspiration simulated by the model, calculated over the entire vegetative period. If irrigation is applied, first of all we have to calculate the net Blue water evaporated, considering the effective irrigation volume. Subsequently, the value is subtracted from the global actual evapotranspiration: the result is the GW.

Finally, the Grey water for this phase was calculated considering only the ammonia nitrogen and assuming negligible its natural presence (c_{nat}=0 in (3)).

All the data on the olive oil transformation were based on real farms. In particular, we used a representative sample of the PDO olive oil producers, formerly used in a recent work on the production of high quality olive oil in Umbria (Calzati, 2012). All the farmers produce oil using two-phase centrifuges for separating the wet paste. For the "packing" (bottle, cup and label), we used values present in literature, considering also their little importance in percentage. Previous studies about olive oil (Amicarelli *et al.*, 2011; Salmoral *et al.*, 2011), made in different contexts, showed that the bigger part of its WF is due to the production of oil itself, and just a residual part is linked to the packing elements.

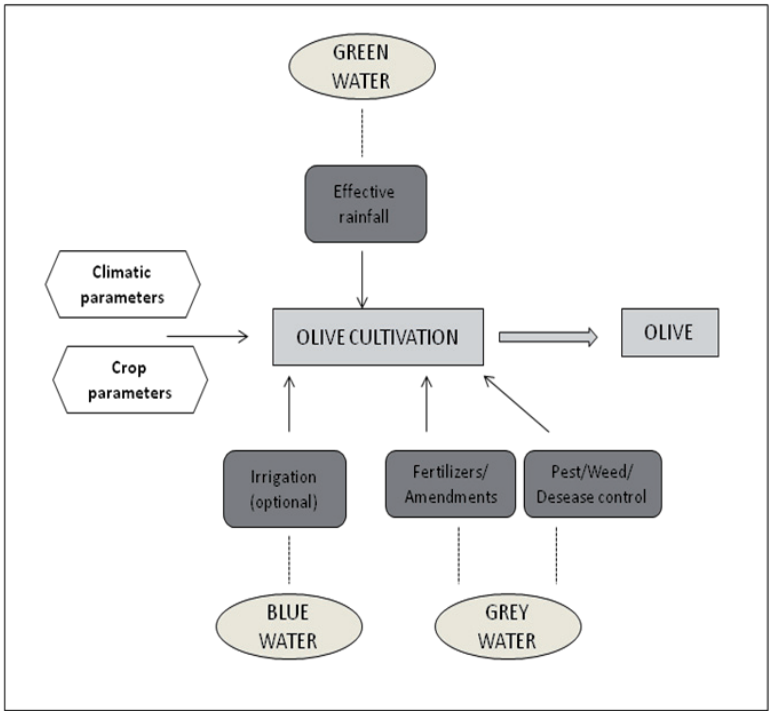

Figure 1. Olive cultivation phase.

Figure 1 and figure 2 report the main steps of cultivation and transformation phases, with the related different types of water involved.

Results

When the analysis is based on real data instead of standard ones, estimation of WF does not produce a single value, but a range of values. In their paper on Italian olive oil production, Amicarelli *et al*. (2011) found a wide range of values for the three components of WF. In our case the range is narrow, but anyway present. In particular, the range of GWF value for the PDO Umbria olive oil is 257-3000 mc per ton (average value: 1418 mc/ton), in case of rainfed cultivation and 100-1305 mc/ton (average 688) for irrigated cultivations. The average BWF is equal to 1245 cubic meters per ton of oil produced. The range of BWF value is quite large (150-1852 mc/ton), and it is greater than the range estimated for the Italian oil (Amicarelli *et al*. 2011). This great range can be explained by the different methods used for irrigation (for instance: just one farm has a drop irrigation system) but also by the number of irrigations applied. Moreover, few farms in our application use irrigation (in the last 5 years several farms abandoned irrigation), and this can affect the final results. The GrWF oscillates between 1400 and 1650 mc/ton. The range for Italian oil is 1450-2350 mc/ton (Amicarelli *et al*., 2011).

The sum of GWF, BWF and GrWF gives a WF of 1660-4650 mc/ton, in a rainfed scenario, and of 1800-6000 mc/ton in an irrigated one. The values are lower than those estimated from Amicarelli *et al*. (2011) in case of rainfed scenario, while they are higher in the irrigated one.

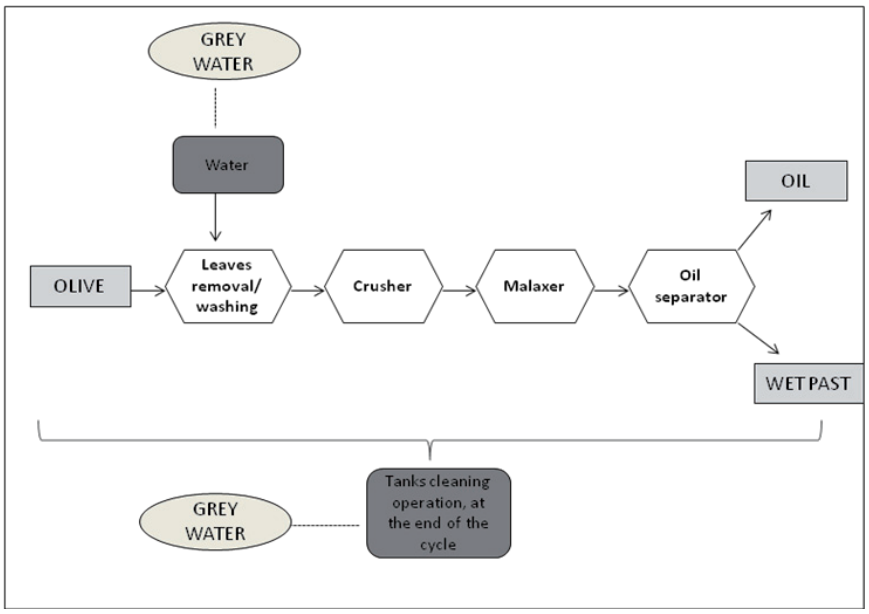

Figure 2. Transformation phase from olive to oil.

Discussion and main conclusions

Water Footprint is a very useful tool to have information about qualitative and quantitative, direct and indirect, use of water. Its importance is underlined by the number of papers dedicated to the theme, but also by the development of the ISO Standard 14046 for water footprinting, expected to be available in 2014.

The assessment of the WF is a valuable tool for analyzing the sustainability of PDO products, and to make a comparison with the industrial ones. Usually, productions having geographic denomination are considered more sustainable than the industrial ones, because of their strong connection with territory and because they are based on traditional methods. The use of indicators such as WF can allow to better evaluate the real sustainability of such products. The WF, in particular, can be used to understand the impact of typical production on water resources.

In our case study, the results of the rainfed scenario were quite good, while in the irrigated one the value found was higher than in the national scenario. Therefore, to be more sustainable, the production of PDO Umbria olive oil would have to reduce the blue and the grey water. In relation to the issue of blue water reduction, it is quite interesting and it could be a first starting point the recent decision to reduce irrigation taken by several farmers, in particular considering the rising of drought in the Mediterranean areas.

Certainly, further elaborations are required. WF has shown to be a useful tool in this evaluation context; however, the only use of WF is not enough to better understand the global impact of such production. The WF gives useful information from a water-resource management perspective, but it does not take into account the potential environmental and social impacts of its use, as its availability for other uses (Jeswani and Azapagic, 2011; Ridoutt and Pfister, 2010). Moreover, it

does not consider all the other environmental impacts involved in the system investigated. At the same time, these aspects are very important in the LCA perspective.
For the future, it could be useful to integrate the results we obtained with other methods, concerning the economic aspects and different environmental impacts (the global economic and environmental impacts of olive oil were for example indagated in De Gennaro *et al*. (2012), where Life Cycle Costing and Life Cycle Assessment were applied to two innovative olive-growing systems: the High Density and the Super High Density olive orchards). An example of multidimensional integration of economic, environmental and social aspects, even if made for a different agri-food chain – that of poultry production – is reported in Castellini *et al*., 2012. In this way, a more complete analysis also on typical productions impacts would be performed.

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Life Cycle Assessment (LCA) of Conventional and Organic Milk Production

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Abstract
Following the LCA methodology, this study aims to assess and compare the environmental impact of milk production of some conventional and organic farms in Molise region (Italy). The system was defined by the entire life cycle of cows including the agricultural processes of feedstuffs. The functional unit was one kg of energy corrected milk at the farm gate. Data on conventional farms concern two cases: case A, with two different cow's diets (Conv. A_1 and A_2), and case B (Conv. B). For the organic farms, data of Org. A_1 (study case) are compared with literature data on Org. A_2. Results showed Conv. B as the most environment affecting farm and this can be mainly due to the management of feeds and diets of lactating cows. The use of commercial mixed feeds had the largest impact on all conventional farms. Moreover, the Org. A_2 had the best performance in terms of environmental impact, due to feeding strategy, breeding methodology and milk yield per cow, followed by the Conv. A_1 and A_2 farms.
Keywords: *Life Cycle Assessment (LCA), milk production, organic and conventional farming.*
JEL: Q01; Q12; Q51.

Introduction

The growing awareness of environmental, economic and social problems gives to the agri-food sector the responsibility of achieving the development of a sustainable oriented path. The European Commission, through the Horizon 2020 Strategy, encourages the creation of a "Bioeconomy" able to maintain and sustain the economic growth, by improving the environmental sustainability of primary production.
The reason to focus on the environmental impact of milk production is that milk is the main product of the European dairy sector. Moreover, the dairy industry is the first sector in the context of the Italian food industry, with an increase of +1.4% of turnover (ISMEA, 2012). In the framework of organic food in 2011, the share of milk total sales was of 8.5%, with an increase in consumption of 9.5% from the previous year (BioReport, 2012). Milk production in Molise region has considerable relevance for the local rural development and it contributes approximately to 6% of the National cow's milk production (ISTAT, 2011), despite the small size of region. Even if dairy products constitute a significant source of necessary daily nutrients for human consumption (Weaver, 2010), they could have a high environmental impact (Tukker et al., 2006), especially in terms of resource depletion and greenhouse gas emissions (González-García et al., 2013).
Several studies have addressed the topic of the environmental sustainability of milk production utilizing the "Life Cycle Assessment" (LCA) methodology that, for its holistic perspective, it is often used for the environmental evaluation of agri-food systems (Iribarren et al., 2011). Different studies have concluded that the agricultural phase of milk production was the most critical (Hogaas et al., 2002) mainly due to enteric fermentation,

manure management, fertilizers used (Fantin et al., 2012; González-García et al., 2013), diesel consumption and airborne emissions (Fantin et al., 2012).
The environmental impacts of milk production depends not only on the different feeding strategies, but also on the breeding methodology used (Cederberg et al., 2000, 2004). Some studies have concluded that organic farms have better environmental performances especially on eutrophication potential and energy use (Thomassen et al., 2008), since they reduce the use of pesticides compared to conventional methods; however, organic farming system requires substantially more land use (Cederberg et al., 2004, 2000; de Boer 2003; Flysjö et al., 2012; Thomassen et al., 2008; van der Werf et al., 2009) and implies higher ammonia, methane and dinitrogen monoxide emissions than conventional method (Thomassen et al., 2008). Nevertheless, there are no statistical differences between the two production forms in terms of acidification potential, global warning potential (Thomassen et al., 2008) and greenhouse gas emissions (Cederberg et al., 2004). Purchased feeds have been considered as critical factors for both conventional and organic milk production systems.
Following the LCA methodology, this paper aims to assess and compare the environmental impact of conventional and organic milk production and identify possible improvements of the environmental sustainability of the two different production methods considered. The identification of critical points within the production cycle allows to compare the gap between the two farming methods and to simulate some changes in the feeding management that could reduce the environmental impact of dairy farming by ensuring the welfare of rumen and ruminants.

Materials and methods
The environmental impact analysis has been carried out by comparing a small number of dairy farms, organic and conventional, located in Molise region. The focus on few case studies, also due to the presence of only one dairy organic farm in Molise (BioReport, 2012), is consistent with previous studies (Cederberg et al., 2004, 2000).
Data on conventional farms, located as well in Molise region, concern two cases: case A, with two different sequential cow's diets (Conv. A_1 and A_2), and case B (Conv. B). For the organic farms, data supplied by Org. A_1 (study case) were compared with literature data on Org. A_2. Italian Brown cows were raised only in the organic farm A_1 and Italian Friesian breed was raised in Org. A_2 and in both conventional farms. Comparison among the organic farm (with Italian Brown breed) and the conventional farms (with Italian Friesian breed) has been mediated by another organic scenario, Italian Friesian breed, described in literature (Org. A_2) (Martini et al., 2008).
Data on the life cycle of cows (tab.1), shows comparable milk quality, i.e. fat and protein contents, among farms. It must be considered that the Org. A_1 farm has more cattle and it yields less milk per cow (18 L) than Conv. A_1 and Org. A_2 (both 28 L).
As far as the management of diets and feedstuffs (tab. 1), all the rations fulfil the nutrient requirements of dairy cattle so that animal welfare is satisfied at nutritional level. Besides high nutritive levels, Conv. B farm is characterized by a more intensive management as suggested by 1) the lowest parity of cows that implies a higher replacement rate of dairy cows; and by 2) the longest lactation period. It has also to be noted that male calves are raised for meat production only in organic farms (A_1 and A_2) and in Conv. B

farm. In average, calves were slaughtered at age of 424 days in Org. A_1 farm, while on Conv. B farm 50% of the calves were sold after 17.5 days and the rest were slaughtered at 430 days age. As far as the heifer management is concerned it has to be highlighted that diets in table 1 are reported for pregnant heifer for Org. A and Conv. B (450 kg life weight), while growing diets are reported for Org. A_2 and Conv. A heifers (300 kg life weight).

	Organic farms		Conventional farms		
Data	Org. A_1	Org. A_2 *	Conv. A_1	Conv. A_2	Conv. B
Race	Brown	Friesian	Friesian	Friesian	Friesian
Number of cows	110	110	65	65	65
Dairy replacement calves and heifers, n.	84	84	52	52	52
Number of calves (male)	30	30	16	16	16
Parity	5	5	5	5	4
Days of production/year	240	240	305	305	330
Daily milk yield, L/cow	18.0	28.0	28.0	25.1	26.0
% Fat	3.80	3.90	3.80	3.80	3.78
% Protein	3.57	3.10	3.50	3.50	3.33
Age 1st calving, Years	2.6 - 3	2.6 - 3	2.2	2.2	2.2
Age at heifer weaning (days)	150	150	75	75	120
Males raised as beef cattle, age (days)	424	Calves: 90	Calves: 20	Calves: 20	Calves: 17.5 & 430
Calves' water consumption (L/day)	25	7	10	10	30
Dairy replacement calves' diet	4 L colostrum 6.3 L breast milk	4 L colostrum 6.3 L breast milk	4 L colostrum 7 L milk powd.d 1.5 kg hay 0.300 kg maize	4 L colostrum 7 milk powdered 1.0 kg hay 0.300 kg maize	4 L colostrum 7 L breast milk 0.3 kg mixed feed
Calves total diet, as fed (per day)	6.5 kg	6.5 kg	7.3 kg	7.3 kg	7.3 kg
Calves dietary components (/head x d)	0.82 kg DM 0.22 kg CP 1.25 UFL	0.82 kg DM 0.22 kg CP 1.25 UFL	1.25 kg DM 0.33 kg CP 1.6 UFL	1.25 kg DM 0.33 kg CP 1.6 UFL	1.25 kg DM 0.33 kg CP 1.6 UFL
Males water consumption (L/day)	25	-	-	-	30
Male calves' diet (weaned)	7 kg meadow hay 4.9 kg maize 2.1 kg barley	-	-	-	11 kg maize silage 3 kg meadow hay 2 kg maize 0.3 kg mixed feed 0.2 kg barley
Males total diet, as fed (per day)	14.0 kg 50:50 F:C				16.6 kg 72:28 F:C

Table 1 (see also following page). Synthesis of data from studied cases.

		Organic farms		Conventional farms		
Data		Org. A_1	Org. A_2 *	Conv. A_1	Conv. A_2	Conv. B
Males dietary component (/ head x d)		12.0 kg DM 1410 g CP (11.72% DM) 11.4 UFC (0.99 /kg DM)	-	-	-	7.9 kg DM 885.3 g CP (11.3% DM) 6.5 UFC (0.83/ kg DM)
Heifers' water consumption (L/day)		25	35	35	35	30
Heifers' diet		6 kg meadow hay 1.4 kg maize, 1.1 kg barley, 0.5 kg pea, 0.5 kg triticale, 0.5 kg sorghum	3 kg hay. 1.5 kg maize 0.5 kg pea 0.1 kg mineral feed	3.5 kg haylage 2 kg hay 1.2 kg mixed feed 0.5 kg mineral feed	3.5 kg haylage 2 kg hay 1.2 kg Mixed feed 0.5 kg mineral feed	8 kg maize silage, 8 kg meadow hay 0.8 kg maize 0.2 kg barley
Heifer total diet, as fed (per day)		10.0 kg 60:40 F.C	5.1 kg 60:40 F.C	7.2 kg 70:30 F.C	7.2 kg 70:30 F.C	17.0 kg 90:10 F.C
Heifer dietary components(/ head x d)		8.61 kg DM 1500 g CP (17.6% DM) 8.00 UFL (0.93/ kg DM)	4.4 kg DM 579 g CP (13.2% DM) 4.1 UFL (0.93/ kg DM	4.6 kg DM 639 g CP (15.1% DM) 3.5 UFL (0.75/ kg DM	4.6 kg DM 639 g CP (15.1% DM) 3.5 UFL (0.75/ kg DM	9.98 kg DM 1200 g CP (11.8/ DM) 8.14 UFL (0.82/kg DM)
Cow's water consumption (L/day)		30	70	80	90	50
Cow's diet (kg/head x d)		3 kg meadow hay 7 kg alfalfa hay 2 kg barley 1 kg sorghum 1 kg fava bean 1 kg pea 30 kg sorghum silage	2 kg alfalfa hay 1 kg meadow hay 1st cut 22.5 kg maize silage 5 kg maize ear silage 7.5 kg alfalfa silage 3 kg barley 1 kg wolf bean 3.3 kg horse bean and peas	13 kg triticale silage 6 kg meadow hay 3 kg mixed feed 3 kg maize 2.50 kg sugar beet pulp 1.5 kg soy meal 44% 1.5 kg barley	12 kg meadow hay 3 kg mixed feed 3 kg maize 2.5 kg sugar beet pulp 1.5 kg soy meal 44% 1.5 kg barley	4.5 kg mixed feed 3 kg mixed hay (fava bean 16.6%, clover 16.6%, pea 16.6%, oat 25%, rye-grass 25%) 1 kg barley 3.5 kg maize 5 alfalfa hay 33 kg maize silage
Total diet, kg as fed		45.0 78:22 F:C	45.3 71:29 F:C	30.5 50:50 F:C	23.5 50:50 F:C	50.0 67:33 F:C
Dietary compo-nents (head x d)	Dry matter, kg Net Energy, UFL Crude protein, g	19.8 56.0 % 16.5 0.83/kg DM 3521.1 7.82 % as fed 17.8 % DM	19.6 64.3 % 18.7 0.95/kg DM 3158.7 10.4 % as fed 16.1% DM	19.6 64.3 % 18.7 0.95/kg DM 3158.7 10.4 % as fed 16.1% DM	20.4 86.70 % 19.2 0.94/kg DM 3429.5 14.6 % as fed 16.8% DM	23.9 48 % 22.2 0.93/kg DM 3780.0 7.6 % as fed 15.8% DM

Table 1 (follows from previous page). Synthesis of data from studied cases.
Source: self-elaboration; Source*: Martini et al 2008. Legend: DM= dry matter, CP= crude protein, UFL= forage (energy) units for milk, F:C= forage to concentrate ratio, on DM basis.

The environmental impact analysis was carried out through the LCA methodology and its application follows UNI EN ISO 14040: 2006 and UNI EN ISO 14044: 2006.

Goal definition and Scoping

Main purposes of this LCA study were to assess the environmental performances of different farms, and to critically analyze the

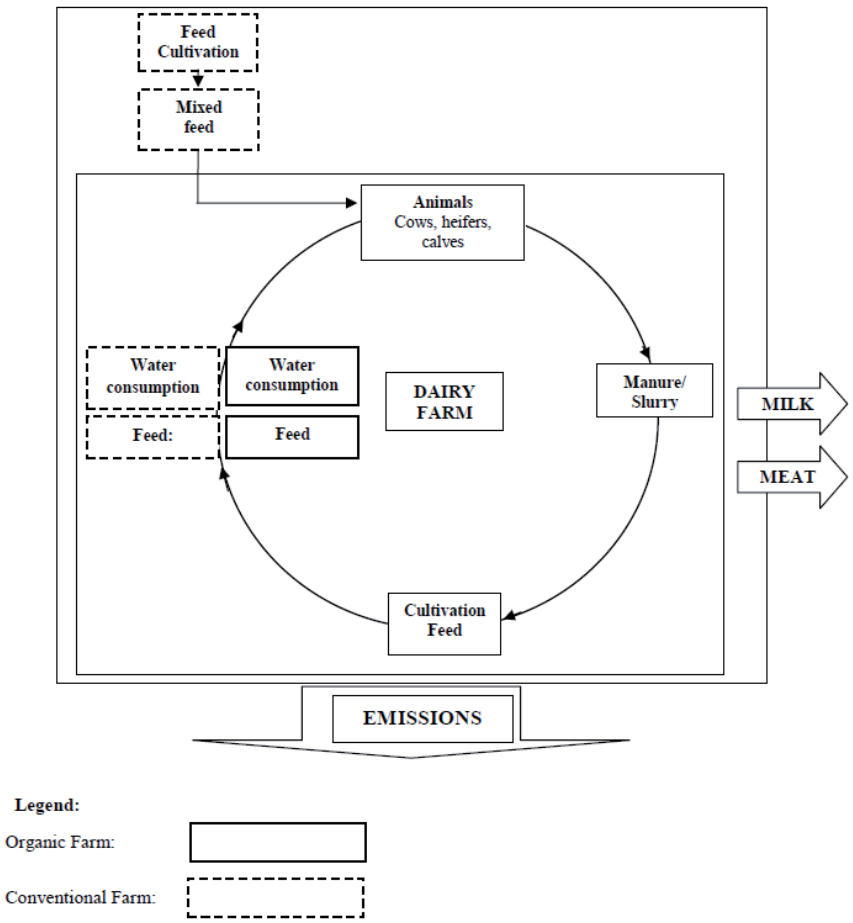

Figure 1. System boundaries.

main impacts in order to suggest some modifications in the cow's diet with respect to animal welfare.

The system boundaries[1] (fig.1) are given by the life cycle stages[2] of milk production to be included in the LCA. All the system was consistent with the perspective *"from a cradle-to-gate"*.

The functional unit (FU) represents the reference unit used to quantify all inputs and outputs from the boundaries of the system (Pari et al., 2012) and it was defined in the study as *"one kg of energy corrected milk (ECM) at the farm gate"* (Cederberg et al., 2004; Yan et al., 2011)[3].

1. The transport of purchased feeds and veterinary products were excluded in the study.
2. In the system boundaries were included the management of calves, heifers and lactating cows.
3. The choice of kg ECM is in agreement with current literature (Bartl et al., 2011; Cederberg et al., 2004, 2000; Flysjö et al., 2012) and it is used generally by the dairy industry because it is a correction factor that considers both the fat and the protein content of the

Allocation describes how "input" and "output" are shared between the product studied and co-products (de Boer et al., 2003; ISO 14044). In the milk production there are usually two outputs: milk and meat (due to calves and culled cow)[4].

Life Cycle Inventory Analysis

Data resulting from a survey and data taken from the literature were utilized for the life cycle inventory analysis (tab. 1). Specifically, data were collected through the use of questionnaires drawn up according to the guidelines for the application of LCA to food and agricultural products (Neri, 2009) and some articles by literature (Cecchini et al., 2004; Falconi et al., 2005). The Simapro code database 7.3.3[5] of Prè Consultants was used for data not identifiable by surveys and by literature. The primary data was relative to the cowshed[6] (number of cattle, years of production, days of production/year, daily milk quantity/cow etc), colostrum, cow milk and water consumption, quality milk achieved, cow diets utilized, manure/slurry[7] produced and stored. The secondary data referred to the production of feeds[8] and mixed feeds[9].

Life Cycle Impact Assessment

In order to evaluate the environmental impact of one kg of energy corrected milk (ECM), the method ReCipe[10] Endpoint (H)/ Europe ReCipe H/A (V1.06) with characterization and weighing factors[11] (the latter refers to the mean values of the hierarchical perspective) and European normalization values, were used. Weighing, normalization and characterization among farm units have been carried out to identify the unit with the highest impact and the categories of impact, at the "midpoint" and the "endpoint" level, mainly involved.

Results and discussion

The analysis of the environmental impact of milk production carried out in Molise dairy farms shows that conventional farms were more impacting than organic farms, and this

milk. In this study, it was calculated following the formula described by Yan et al. (2011) and considering the percentage of fat and protein content of different milk studied.

4. The co-product handling is a crucial issue because it could impact on final LCA results (Flysjö et al., 2012). The mass allocation was used to share the environmental burden between milk and meat; the percentages of allocation were of 87% to milk and 13% to meat for organic farm, and of 88% to milk and 12% to meat for conventional farm (Milani et al., 2011). Since all manure/slurry, in both farms, were used as fertiliser in the crop production these were not an outputs product and therefore it was not necessary their allocation.

5. SimaPro: http://www.pre.nl/content/simapro-lca-software?gclid=CMnxhbqT3K8CFYrP3wodHGzKGA.

6. For the estimation of methane emissions due to enteric fermentation see Kirchgessner et al. (1991).

7. The emissions of methane due to manure and slurry storage were estimated by applying the model of IPCC (1997) and following Cederberg et al. (2004). The emissions (to water and soil) provoked by loading and spreading manure/slurry were estimated by following Falconi et al. (2005).

8. The agricultural processes were extrapolated from the SimaPro database. It has to be specified that in organic systems the use of both manure/slurry spreading and the fertilization (with manure and slurry) in the agricultural phases of feeds cultivation implies a duplication of the emission by SimaPro database, but this duplication involves a lower error than that observed when emissions from manure spreading are not considered (V. Fantin, personal observation).

9. According to some literature (Cecchini et al., 2004; Falconi et al., 2005), mixed feed ingredients can be assimilated to the three major products, that is wheat, oilseeds, sugar, included in the mix. We took from the SimaPro database the wheat, oilseeds and sugar processes (from agricultural phases to feed transformation at mill/refinery), including all their impacts and emissions.

10. For more information: http://www.lcia-recipe.net/.

11. Weighing allows to evaluate the importance of each category of impact obtaining aggregate results (Fiore et al., 2008).

was mainly due to management of animals and diets. The use of commercial mixed feeds had the largest impact on conventional farms mainly as a consequence of the industrial process for soybean meal production (solvent extracted), not allowed in the organic system (Reg. EC 889/2008). In the studied organic farms, grass (ensiled in Org A_1 and A_2), maize (ensiled in Org A_2) and barley (in Org. A_2) cultivations had the highest impact. By comparing the weighing (fig. 2), it was evident that the Conv. B had the highest impact followed by Conv. A_2 and A_1; between organic farms, the Org. A_1 was the most impactful.

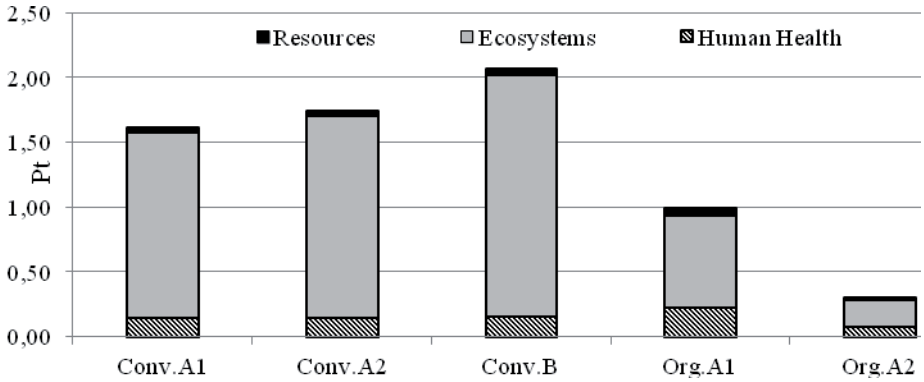

Figure 2. Weighing results (pt*), comparison among farms.
* The Eco_indicator point (pt) is an indicator that lets you find, within life cycle of a product, the most impactful steps (Fiore et al, 2008).

Moreover, in all the farms the main damaged category was the ecosystem (fig. 3).
These results depend mainly on different diet efficiencies, with special regard to the organic farms, where different breeds are also raised.

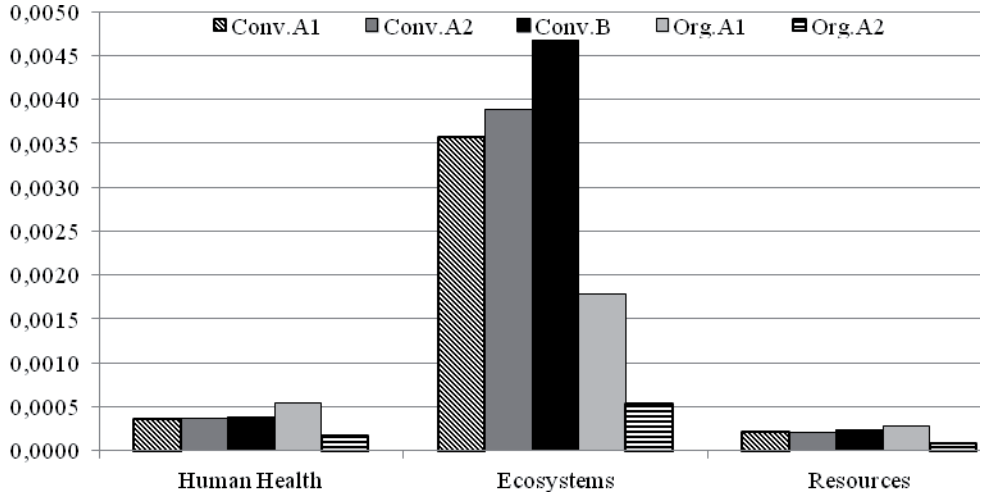

Figure 3. Results of normalization (pt), comparison among farms.

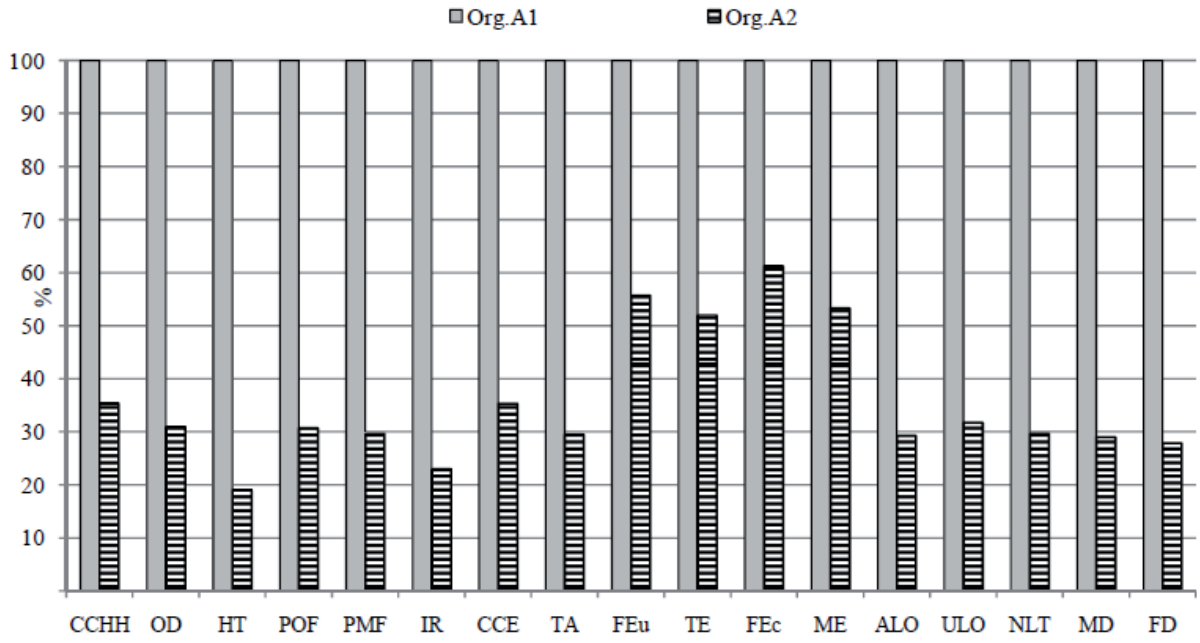

Figure 4a. Results of the characterization, comparison between org A1 and A2. Note: The percentage indicated for each category express the relative impact respect (100%) to the most impactful farm. Legend: see note 12.

The results of the characterization[12] allocate the environmental impacts to the "midpoint" categories.

The results show that Org A_1 farm has more impact than Org. A_2 on all impact categories in relative terms (especially on FEu TE FEc ME, see fig. 4a), while different specific categories are more relevant than others in absolute terms (PMF, ALO, FD, see figs 4a.1-.2).

The impacts of Org. A_2 farm account in average for about 35% of those attributable to Org. A_1 farm. In organic farms, manure management is related to phosphorus emission in FEU, TE, FEc, ME categories, so confirming some literature (Fantin et al., 2012; González-García et al., 2013).

Within the "midpoint level" categories belonging to human health (fig. 4a.1), both organic farms had the highest impact on PMF. The highest impact of Org. A_1 farm on PMF and CCHH categories were caused by ammonia from fertilizer and dinitrogen monoxide from tractor fuel combustion in grass cultivation and ensiling. The impacts of Org. A_2 farm on PMF and CCHH categories, rather similar in size, was caused by ammonia from fertilizer of grass cultivation and ensiling[13] and dini-

12. The "midpoint level" categories are grouped at "endpoint level" into the categories of damage for human health, ecosystems and resources, as follows. For human health: the impact of climatic change on human health (CCHH), the ozone layer depletion (OD), the human toxicity (HT), the formation of photochemical oxidants (POF), the formation of particulates (PMF), and the ionizing radiations (IR). For ecosystems: the impact of the climatic change on ecosystems (CCE), land acidification (TA), freshwater eutrophication (FEu), terrestrial freshwater and marine eco-toxicity (TE, FEc, ME), urban and agricultural land occupation (ULO, ALO), the transformation of natural soil (NLT). For resources: the exhaustion of metals (MD) and fossil resources (FD).

13. The different impact of grass silage cultivation on organic farms were due to quantity used on both diet's (30 Kg versus 7.5 Kg, see tab.1).

trogen monoxide emission from manure/slurry. Both organic farms impacted the human toxicity category for manganese, coming from hay cultivation[14] and "bioaccumulation" processes. The lowest impact of both farms was on the ozone layer depletion category and it was due to methane bromotrifluoro - Halon 1301 emissions coming from grass cultivation practices (Org. A_1) and maize cultivation for ensiling on the Org. A_2 farm (tab. 2).
Among the ecosystems categories (figure 4a.2), the highest impact was attributed to agricultural land occupation, followed by the climatic change on ecosystems category. ALO impact was caused to pasture/meadow occupation and its lowest impact (Org. A_2) was due to dietary differences with Org. A_1.
Finally, as far as the MD and FD "midpoint level" categories belonging to resources, almost equivalent between the two organic farms in relative terms (fig. 4a), the highest impact is on fossil resources depletion (FD) due to crude oil from fuel consumption for grass cultivation and ensiling.

14. The impact of Org. A1 farm depends on highest amount of hay in rations (see tab.1).

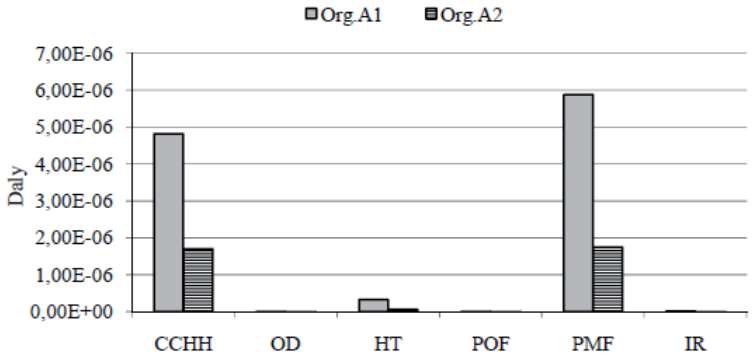

Figure 4a.1. Results of the characterization. Human Health impact categories. Comparison between Org. A_1 and A_2. The values expressed in DALY* unit indicate the impact in absolute terms identified for each impact category on organic farms. * Daly (Disability Adjusted Life Years) is an index of disease weight, i.e. years in ill or lost to premature death.

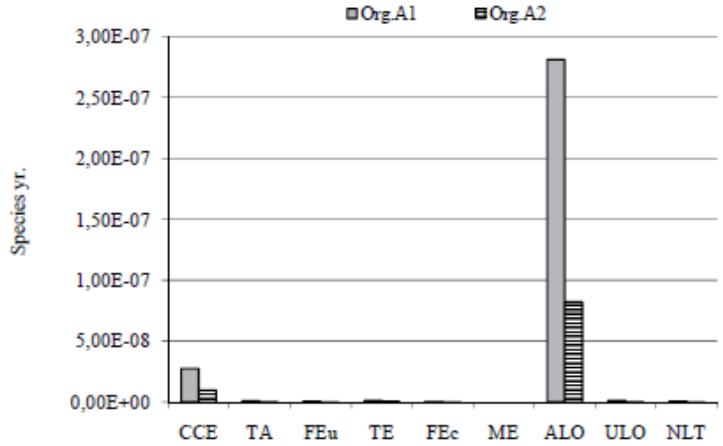

Figure 4a.2. Results of the characterization. Ecosystems impact categories. Comparison between org A_1 and A_2. The values expressed in species yr. unit indicate the impact in absolute terms identified for each impact category on organic farms. Species yr. Unit is the number of living species lost per years due to the impact on ecosystems (Fiore et al., 2008)

As depicted in fig.4b, the Conv. B farm had the highest levels for 10 out of 17 impact categories, followed by Conv. A_2 (4 out of 17) and by Conv. A_1 farm, while the organic farm A_1 shows a global best environmental performances.
Considering the impacts in absolute terms, among "midpoint level" categories belonging to human health (fig. 4b.1), the highest impact was on CCHH category and it was due to the dinitrogen monoxide caused by tractor fuel combustion in cereal cultivations (see note 9). The differences between CCHH impact of Conv. A_2 and A_1 farms were likely due to daily milk yield, confirming that the environmental impact decreases at increasing milk yields (Nemecek et al., 2011). The lowest impact on CCHH was observed in Org. A_2 farm where it was due to the dinitrogen monoxide from manure/slurry generated within the productive phase.
In PMF category, Conv. A_1 farm had the higher impact than that of other studied farms and it was caused by ammonia from grass fertilization. The least impact of Conv. A_2 and B farms on PMF category was due to ammonia coming from meadow fertilization; while the impact of Org. A_2 farm was caused by ammonia from organic fertilisation for forage cultivation.
Among "midpoint level" categories belonging to ecosystems (fig. 4b.2), the highest impact was on transformation of natural soil (NLT), followed by ALO categories. The pro-

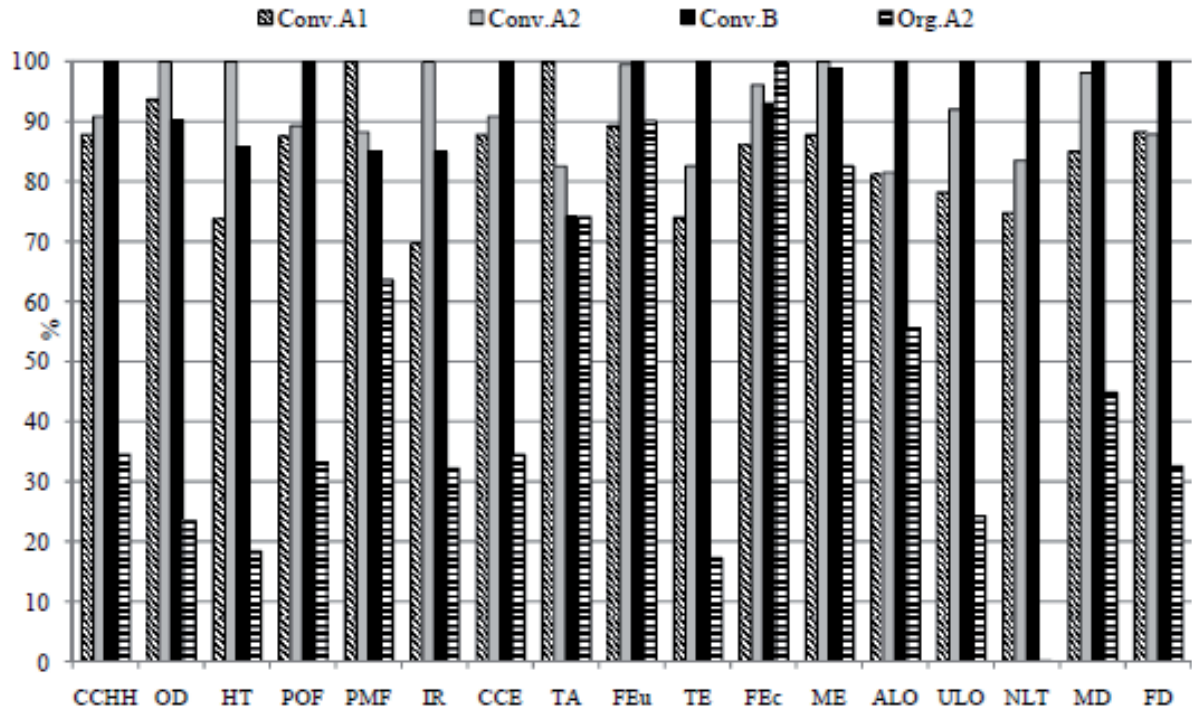

Figure 4b. Results of the characterization. All impact categories. Comparison among conventional and organic farms raising IF cows. Note: The percentage indicated for each category express the relative impact respect (100%) to the most impactful farm. Legend: see note 12.

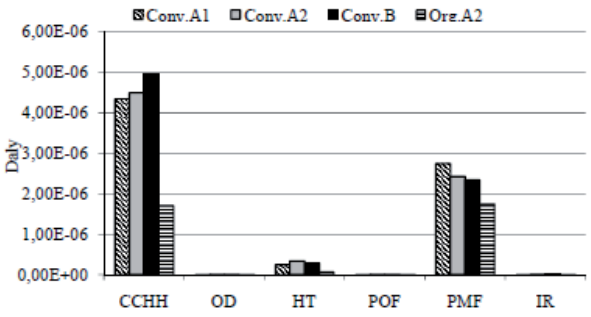

Figure 4b.1. Results of the characterization. Human Health impact categories. Comparison among conventional and organic farms. The values expressed in DALY unit indicate the impact in absolute terms identified for each impact category on organic farms.
Legend: see note 12.

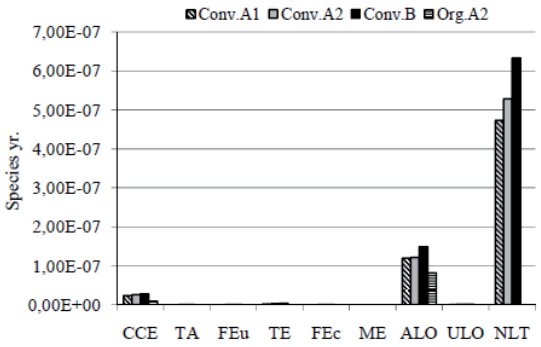

Figure 4b.2. Results of the characterization. Ecosystems impact categories. Comparison among conventional and organic farms. The values expressed in species yr. unit indicate the impact in absolute terms identified for each impact category on organic farms.
Legend: see note 12.

cess of soybean seeds to soybean oil and the cereal cultivation (see note 9) cause, for conventional farms, the above mentioned transformation on NLT and occupation of arable land. The gap of NLT impact among conventional farms depends on different daily milk yield and amount of mixed feeds used (tab.1). The impact on CCE category was referred to dinitrogen monoxide emissions from tractor fuel combustion in cereal cultivation (Conv. B) and soybean cultivation (Conv. A_1 and A_2), both components of mixed feeds.
The highest impact on resources was on fossil resources depletion (FD) category caused by crude oil from fuel consumption both cereals (conventional farms), and grass cultivations and ensiling (organic farm).
The Org. A_2 farm had the best performance in terms of environmental impact in comparison with both the Org. A_1 and all the other farms and it was due to feeding strategy, breeding methodology and milk yield per cow.
Among conventional farms, the Conv. A_1 showed the lowest environmental impact, confirming that the environmental impact decreases at increasing milk yields (Nemecek et al., 2011).

Conclusions

LCA results highlights an average higher environmental impact of conventional farms than organic farms, mainly due to the management of feeds and diets of lactating cows. The inclusion of commercial mixed feeds had the largest impact on the conventional farms mainly as a consequence of the industrial extraction (by solvents) of oil from soybean seeds. In organic farms, cultivation of grass forage (ensiled), maize (ensiled) and barley has the highest environmental impact. The best environmental performance of Org. A_2 compared with that of Org. A_1 could suggest that replacing the breed of cows would result in a lower environmental impact, but differences in quality of forages of the diets (hay and silages) should be also considered because of the crucial role on rumen (and ruminant) welfare.
Moreover, the cultivation of protein feeds

used within the organic farms is related to a lower environmental impact than the use of soybean byproducts (conventional farms). However, antinutritional factors naturally present in many proteinaceus feeds should be carefully evaluated in the diet since they can affect digestive efficiency. Besides feed processing, management of dairy animals should be considered for best economic, environmental and welfare performances.

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Wild Plants as Recource for Productive and Economic Purposes: Do Reasons Exist to Develop New Supply Chains?

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Abstract
Edible wild plants have been traditionally used by rural population and a growing interest in their cultivation has been detected in recent years. This paper investigates about wild plants verifying if potential economic chances may derive from the domestication of wild plants and if new supply chains can be proposed. By analyzing the opinions and attitudes of stakeholders potentially involved in wild plants market, this study detects the most important factors linked to the use and domestication of wild vegetable resources and highlights the favourable chances deriving from plant biodiversity exploitation in a socio-economic and environmental sustainability perspective. Results indicate that wild plants could be cultivated as crops and identify a set of strategic planning to introduce new supply chains in food markets.
JEL CODE: Q32, Q57
Keywords:
edible wild plants, vegetable biodiversity, environmental sustainability, stakeholder analysis, economic exploitation

Introduction

Since ancient times, edible wild plants have been used in the diet of human societies, and traditionally rural population and farmers have been consuming these products up to the present. In the last years, modern urban society has rediscovered more and more natural and biodynamic products and a growing appeal has been observed for wild plants, for their important nutritional aspects (Branca and La Malfa, 2008).
The interest for traditional products has also characterized the horticultural industry but despite wild species could be potentially important as agricultural crops, limited attention has be paid to the introduction of the these plant into agricultural production activities (Timpanaro et al., 2012; Zarbà et al., 2013). Given that several of local wild plants show a good adaptability to cultivation (Bianco and Boari, 1996), the growing of edible plants could represent a very interesting field of research, both for technical, economic and environmental aspects.
Concerning technical aspects many the studies have focused on domestication of wild plants (Branca, 2002; Allegra and Zarbà, 2012) and despite this plants are not giving higher yields with the increase of agrotechnical inputs (Bianco and Boari, 1996), their wildness allow them to adapt in less favorable agronomic and climatic conditions (Lee, 2004).
In an economic perspective, the start of wild vegetables cultivation could become very important to support and supplement the farmers' income (D'Amico et al., 2011; Pappalardo, 2012). This objective might also be achieved with the help of other economic actors, over the whole vegetable supply chain, involved in processing and marketing activities. The economic function of wild plants has also been highlighted in a recent study that suggests their importance in rural development terms (Chen et al., 2012).
Furthermore many of these aspects have to be

deeply analyzed and a set of challenges has to be faced both by private and public sectors. In the European Union agricultural policy safeguard of environment is one of most important objective and it becomes strategic in a long-term future of agriculture and rural areas (European Commission, 2010).
The vitality and socio-economic potential of many rural areas are closely linked to the presence of a strategic management of landscapes and farmland biodiversity. The enhancing of the knowledge on indigenous plants allows the diversification of traditional agriculture and a better awareness of biodiversity can play a key role in improving the social and economic structure as well human well-being of rural communities.
The purpose of paper is to investigate about main indigenous plants in order to verify if potential economic chances may derive from the domestication of wild plants. At the same time this study aims at verifying if new supply chains can be proposed. By analyzing the opinions and attitudes of stakeholders potentially involved in wild plants market, this study detects the most important factors linked to the use and domestication of wild vegetable resources and highlights the favourable chances deriving from plant biodiversity exploitation in a socio-economic and environmental sustainability perspective.

Survey context and edible species

Indigenous plants are very common both in uncultivated and cultivated areas in southern Italy (Bianco and Boari, 1996) and - given Sicily boasts a wide variety of landscapes and a great diversity of edible wild plants - several food plants are available across region's varied countryside or even in urban and peri-urban areas (parks, empty lots, backyards, green spaces, gardens, etc.). For this reason consumption of indigenous plants is a very common practice, above all in Sicilian countryside or in small towns located near rural areas. A growing interest has been also observed in urban areas, where in autumn and winter seasons wild plants are easily purchasable at local or peddle markets.
Harvesting wild food plants is very common and these plants, once collected are addressed to self-consumption as well offered for sale. In specific times of the year, Sicilian farmers and plants collectors go around for countryside looking for edible wild plants and after collection, wild plants are placed on sale by same collectors at the farmers markets. In any cases these plants are door to door delivered by same collectors. In Sicily several wild plants are easily recognizable and they amount around 1,100 different species and subspecies (Provitina, 1990). With the help of biologists and botanists we selected the most important and well-known edible plants in eastern Sicily. Table 1 shows the most common and consumed species and reports a list of edible wild plants. The list contains the scientific denomination of species, regional name, harvesting period and plant parts used for food.
Phytoclimatic seasonality and harvesting period of wild edible plants, as well the pedological characteristics of area, represent so peculiar factors of tipicity that cannot be reproduced elsewhere (wild biodiversity). Wild edible plants in this way express the bond with the culture and history of territory and their use in human food becomes a heritage of local and traditional knowledge, whose maintenance allows a sustainable development of an ecosystem (Cetinkaya, 2009). In light of this, as previously argued (Signorello and Pappalardo, 2003), the domestication of native wild species may represent a further opportunity in terms of environmental sustainability.

Species	Regional name (1)	Harvesting period (2)	Edible plant parts (3)
Asparagusacutifolius	Asparagi	winter-spring	shoot
Foeniculumsylvestre	Finocchietti	winter-spring	sprout, leaf, and flower
Brassica fruticulosa	Cavuliceddi	spring	leaf and turnip top
Sinapispubescens	Mazzareddi	spring	leaf and turnip top
Lactugaviminia	Lattughedda	winter-spring	leaf, wholeplant
Borragoofficinalis	Borragine, vurrania	spring- summer	leaf and turnip top
Sonchusoleraceus	Cardedda	winter-spring	leaf and stam
Portulaca oleracea	Purciddana	winter-spring	leaf and e turnip top
Sinapisarvensis	Senape selvatica, sinapi	winter-spring	leaf
Cichoriuminthybus	Cicoria	winter-spring	leaf, flower and sprout
Taraxacum officinale	Dente di leone	winter-spring	leaf
Hypochoeris radicata	Costolina, coscivecchia	winter-spring	leaf and wholeplant
Isatistinctoria	Cavulucarammu	winter-spring	sprout
Daucus carota	Carota selvatica	spring	root
Valerianella locusta	Songino	winter-summer	leaf and sprout
Beta Vulgaris	Bietola selvatica, giri	winter-spring	leaf

Table 1. List of main wild plants used as edible in Sicily.
(1) Regional name refers the most commonly used for each species, however local dialect's denominations vary considerably in relation to the territory.
(2) Harvesting period reports the season in which the presence of wild vegetables prevails.
(3) Edible part plants are the most commonly consumed.

Data collection and design of survey

In order to verify the initial hypothesis of study and create a background of information about social and economic phenomena of above mentioned products, the research was divided into four different steps. The first one was addressed to identify main edible wild plants and their degree of domestication as well the current distribution chains. The second part of survey was lead to the identification of local stakeholders involved in collecting and trading indigenous plants. With this aim researchers, wild flora experts and public functionaries provided an useful support to identify main stakeholders that operate all over the chain in rural and peri-urban areas of Eastern Sicily. Third step was focused on swot analysis about the potential development of wild plants supply chain, in order to define the economic chance for stakeholders deriving from cultivation and trade of indigenous plant and verify if new supply chains can be proposed.With the aim to involve a wide number of stakeholder, several focus group and meetings were carried out in all regional territory. The first part of focus group was carried out in rural areas of two different Sicilian provinces: Enna, (8 participants) and Messina (10 participants) while the other focus groups and meetings were held in two agri-business areas of Catania (12 participants) and Ragusa (10

participants). To this end, collector, farmers, researchers and agronomists, food industry managers, peddlers and retailers were invited to take part at meetings in order to express their opinions about the development of wild crop species supply chain.
Discussions were focused on participants' opinions about opportunities, weakness, strengths and threats deriving from the domestication and cultivation of wild or indigenous plants. Collective answers, personal observations and open-ended individual interviews of respondents were elaborated taking also into consideration main topics emerged during the meetings. At the end of each meeting and focus group, information were gathered and included in a general data base and subsequently categorized in a swot matrix. These factors were evaluated on the basis of observations frequency expressed during the focus group by each of categorized observer. Judgments reflect the opinion of majority of group with respect to the subjects categories suggested by moderator, subjected categories were selected from previous meetings held with wild flora specialists. According previous literature (Ansoff, 1965; Dealtry, 1992; Dyson, 2004) a swot analysis was carried out. Swot approach was selected as a tool to support strategic planning for the launch of wild plants domestication. "SWOT analysis is often presented as a method of rapidly moving towards an agreed strategy. It can certainly be an aid to generating new strategic initiatives, but a strategic development process also requires considerable analysis and testing of new initiatives before adoption" (Dyson, 2004). The last part of study was focused on gathering stakeholder's opinion about the sustainability of supply chain, measuring the sustainability levels for each category of plant previously identified. Given the geographical and botanical similarities of examined ecosystems, the results of analysis carried out in Eastern Sicily can be reasonably extended to the entire regional territory.

Analysis of Results

Degree of domestication, distribution chain and sales markets

The first part of results was focused on detecting main features of most used wild vegetables and their distribution chains.For this purpose, according stakeholders' opinion and statement, wild plants were split into three different categories, depending on their techniques of collecting and cultivation. On the basis of current practices of collection and/or cultivation a classification of these plants was ordered as follows: 1) *Wild vegetables*: plants derived from spontaneous growth of native species in a natural habitat; 2) *Sub-wild vegetables*: plants obtained from collection of spontaneous seeds but propagated in natural soil; 3) *Domesticated vegetables*: can be considered as plants that derives from spontaneous seeds or parts of plants that subsequently are cultivated and propagated in agricultural soils (Figure 1).
Concerning the current sales channels of wild plants in Sicily, consumers usually buy them at neighboring areas of production. In many cases these products reach local market after travelling for very short distances. The presence of wild plants at the local markets or farm markets is quite limited, on the contrary outdoor markets, carried out by peddlers, represent the most widespread places of selling. Our analysis detected three different form of distribution systems: direct sale, short distribution chain and long distribution chain.
Direct sale (collector-consumer) - that can't be considered as a real distribution chain because of the lack of intermediaries - cov-

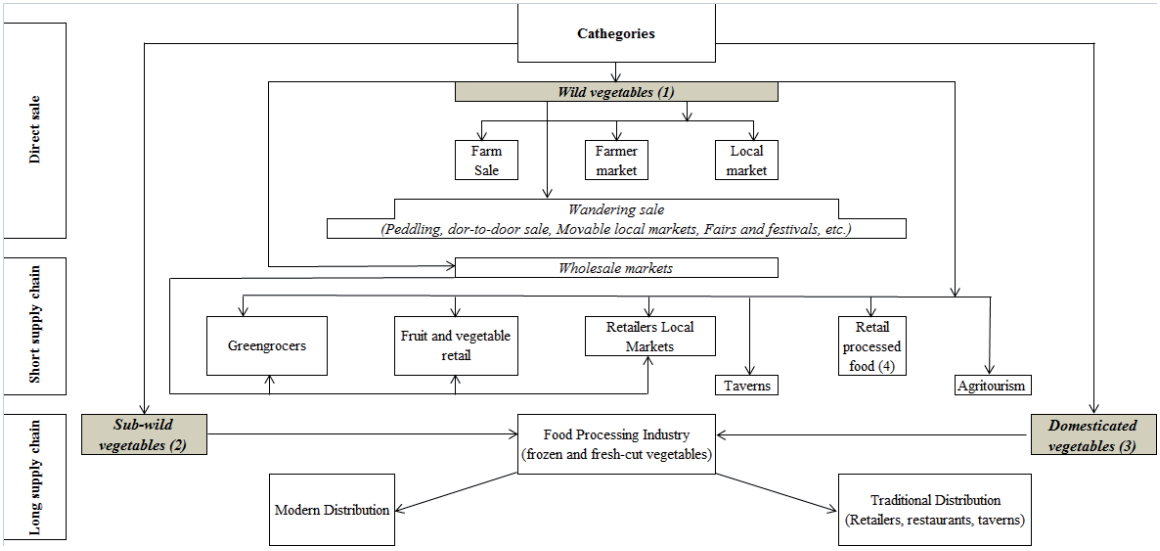

Figure 1. Sales markets and current supply chain for Sicilian vegetable wild plants.

ers the major part of current demand for wild plants.

Although it's not very common, wild plants can be occasionally founded at the traditional retail. In this case we can observe the existence of "elemental supply chain" that can be characterized as *short distribution chain* (collector-retailer-consumer) or *long distribution chain* (collector-wholesaler-retailer-consumer) where the presence of mediators, such as brokers or wholesalers, plays a very important role. Long distribution channel has gained importance in the last years, first of all for increasing interest of horticulture processing industry (fresh cut vegetables industry, canning industry and frozen foods industry) in wild vegetables. A growing demand for wild vegetables has been also registered in specialized stores such as grocery, butchers, bakeries and pizzerias which use wild vegetables as ingredients for their productions. This current trend reflects the demand of modern consumers for time saving products and typical products. On the basis of stakeholders' statement, different form of sales markets and distribution chain were reported in Figure 1.

According to the opinion of vegetable processing managers the demand for wild plants is increasing and market opportunities are developing. Fresh-cut vegetables industry has diversified own offer by introducing packaged wild species as *Foeniculum sylvestre* and more recently *Brassica fruticulosa* and *Sinapis arvensis*. With this scope these species have been introduced to the cultivation and other wild plant crops are currently tested in experimental cultivations in order to increase the range of offer for edible wild plants. For these reasons we argue that new long supply chains are taking place, enhancing and expanding current vegetable supply in food markets.

With respect to the identification of most representative local stakeholders involved all over the chain, the first outcome revealed the presence of six different categories of stakeholder, that were identified as follows: a) Collector, b) Farmers, c) Botanists and Agronomists, d) Process industry managers,

e) Peddler , f) Retailers (greengrocers).

Swot analysis (Stakeholder)

In order to better identify the economic chances linked to the development of cultivation and sale of these species, participants were asked to express their opinions. According to the stakeholders opinions, the most mentioned themes were synthesized and reported in a matrix; subsequently we carried out a SWOT analysis in order to better identify the main strengths and weakness as well the opportunities and threats for semi-domesticated (sub-wild plants) and domesticated vegetables (pseudo-wild plants) that could be adequately supported by a strategic planning of "responsible exploitation of wild flora".

Given the exclusive link between environment and wild plant, participants agreed that wild plants have a bigger exclusivity and tipicity than domesticated one's, however also for sub-wild vegetables these two features were identified as *strengths*. Semi-domestication was deemed a process innovation with a relatively low environmental impact because of low use of input in agricultural production. In fact, the hardiness of these species would limit the employment of energy inputs (water, fertilizers and pesticides) avoiding the pollution of natural habitats and ensuring the maintenance of an adequate level of biodiversity as natural resources (in situ).

According to the participant's statements, the short shelf-life of wild fresh vegetables was one of the most mentioned *weakness in* new supply chain development while unknown origin of products and irregular availability in the markets, due to the seasonality of species, have been perceived as very critical issues in vegetable trade. In the case of semi-domesticated vegetables seasonality can also represent a threat because the cultivation takes place in a natural soil and agronomical forcing techniques to extend the biological cycle of plants are not adopted. Moreover the lack of agronomical skills on wild plants cultivation was identified as further critical factor, given it could produce an increase in production costs due to the lacking of know-how. Favorable economic chances for an additional income for farmers seem to derive from high level of consumer's appreciation as well as the growing demand of vegetable processing industry, whose demand in any cases also increase the economic performance of smallholders (Di Vita et al., 2013). On the other side several *threats* are closely linked to management difficulties - arising from environmental factors due to the marginality of the cultivated areas and to the short seasonality of vegetables production, that are not grown as protected crops - and to a low degree of coordination among stakeholders, Table 2 reports the SWOT results for sub-wild vegetables.

STRENGHTS	WEAKNESS
Exclusive link environment/plants	Short shelf-life of fresh semi-wild vegetables
Tipicity	Irregular availability of products in the markets
Domestication as Process innovation	Unknown origin of vegetables
Low use of inputs	Lack of agronomic skills on wild plants cultivation
OPPORTUNITIES	**THREATS**
High interest for wild plant in urban areas	Management factors related to the marginality of cultivation
Additional income for farmers	Seasonality
Consumer's appreciation	Lacking coordination between producers and food industry

Table 2. SWOT analysis results for Sub-wild vegetables.

On the contrary total domestication of wild plants and their cultivation as crops can be considered as a "product innovation" which potentially represent one of the most important *strengths*. The introduction of new plants helps the producers to differentiate their production that gain a competitive advantage. Furthermore researchers and producers have experienced the good agronomical potential of wild plants that, in a modern vegetable growing system, induce an increase of economies of scale and scope (Table 3).

Interesting economic *opportunities* were detected also for domesticated plants and a high curiosity in wild edible plants in urban areas was also evidenced by growing widespread of consumer's demand at local markets but further researches are required to verify the willingness to consume of urban markets. With this respect, the participants highlighted the need to suggest new wishes linked to personal well-being in a perspective of environmental safeguard. Furthermore vegetable processing industry shows a very high interest in wild plants and, given the short shelf-life of fresh products, interesting opportunities may arise from the sale of packaged products, generating at the same time economies of scope. Canning industry and fresh-cut vegetable industry have experienced modern packaging forms that are able to extend the shelf-life of these products. Furthermore, according to opinions' producers, "*business agreements with process industry provides a greater security in the placing the product on the market at a reasonable price*" and very important chances can arise from a better coordination among stakeholders all along the whole supply chain.

Among *weakness,* in addition to the short shelf-life of fresh wild vegetables, we found the difficulties linked to the domestication process, in terms of times and methods, as well as the potential loss of wildness identity for cultivated vegetables, whose risks could even more increase for packaged one's. Finally, respondents identified as *threats* two different item in a marketing perspective. In fact the low identification of product by consumers and the limited information about product could negatively affect extra-local trade, limiting a market's expansion in extra-regional areas. External difficulties for farmers also increase because of the low institutional support; according to the participants statements, public institutions pay little attention to wild plants biodiversity, in terms of communication and financial resource availability. Furthermore while the risk of extinction of wild plants linked to their collection is not so relevant, and is practically inexistent, the loss of biodiversity of natural varieties, due to the pollination of cultivated and selected species and cultivars, could represent a real threats.

STRENGHTS	WEAKNESS
Cultivation of new species as "product innovation"	Short shelf-life of fresh wild vegetables
Good agronomical potentialities of wild plants	Domestication process (times and methods)
Economies of scale and scope	Loss of wildness identity for cultivated wild vegetable
OPPORTUNITIES	**THREATS**
Growing demand for wild plant in urban areas	Low institutional support
Creation of Integrated Supply chain	Low identification of product by consumer
Growing demand of vegetables processing industry	Loss of biodiversity

Table 3. SWOT analysis results for Domesticated vegetables.

According to Dyson (2004) the obtained results allowed to construct a basis *for identifying* a set of strategic planning in order to establish new supply chains. Concerning the strategies generated by the analysis, increase of research support in cultivation as well in marketing were identified as priority in almost all cases. In view of themes emerged during meeting, discussions were focused on the current lack of agronomical skills, and given the good agronomical potential of wild plants, we found that the improving technical efficiency of cultivation could better help the producers to domesticate and cultivate the wild plants as crops (Figure 2).
But in many opinions of respondents, the cultivation of new wild crops is a necessary but not sufficient condition for pursuing new market segments. For this reason many respondents agreed that the public institutions involvement is the first step to address the political choices in order to plan for the developing a supply chain strategy, for example by facilitating the access to credit and financial resources. The stakeholder coordination was another key issue emerged as a short run strategy, in this sense the enhancing of producers aggregation and the improving of vertical integrations should take place.
In view of a widest markets presence, the aspects related to the communication of the products should be stressed, for this reason the last strategy was linked to the development of marketing strategies focused on advertising campaign. With this respect, objective should be focused on promoting the tipicity content of vegetables and allowing their recognisability, further efforts could be put in communicating their environmental sustainability.

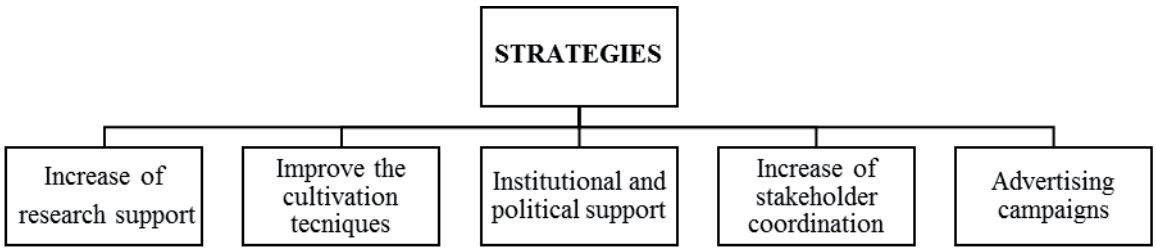

Figure 2. The strategic process.

The sustainability of wild plants supply chain
In order to comment the last objective of study, socio-economic and environmental sustainability of wild plants exploitation (collection or domestication) were measured according to previous gathered information.
According to Soster (2012), the introduction of wild edible plants in the agricultural production system makes possible to "adapt" the wild plant species to social (integrated food supply chain), ecological (productive management of environment) and economic objectives (increase of farmers' income). Furthermore the development of new supply chain, through the exploitation or domestication of wild plants, could help to maintain and preserve biodiversity and allow a socio-economic and environmental sustainability. For this reason, as a results of swot analysis, we tried to identify main aspects of new supply chain linked to: *a)environmental sustainability,* as ability to maintain or protect natural resources (Pergola et al., 2013) ensuring their quality and reproducibility; *b)econom-*

ic sustainability as ability to generate income and employment; *c)social sustainability* as a ability to enhance the life-condition within communities (McKenzie; 2004) and improve the wellness of community first of all in terms of health and safety.

On the basis of statements and opinions of stakeholders we provided to quantify the "sustainability of new supply chains" proposed, assigning different levels of importance (low, medium and high) to each category of plants, as reported in Table 4.

Category	Economic Sustainability	Environmental Sustainability	Social Sustainability
Wild	*	**	*
Semi-wild	**	***	**
Domesticated	***	**	***

*= low, ** = medium, *** = high

Table 4. Sustainability perspectives of wild plants exploitation.

With respect to the "economic aspects", the level of sustainability of wild plants exploitation can be considered *low* because it ensures a additional income just for collectors or for a very limited number of farmers, while the economic opportunities progressively increase for semi-wild and domesticated vegetables, whose levels of economic sustainability are respectively classified as *medium and high*. In this case we can observe how the exploitation of indigenous plant resources provides the basis for a successful strategic planning in their cultivation, favouring a more efficient management tools concerned with vegetable processing industry. Furthermore the chance to process the vegetables enables producers to get a product with a more added value, being also useful to the processing industry that are allowed to put into the market a product with a longer shelf-life.

Concerning *environmental sustainability* no protection directly related to wild flora can be recognised for wild plants, in this first case the level of sustainability is *medium*. In fact the cultivation of wild vegetable has no direct implication on the protection of wild flora, on the contrary a high level of wild vegetable exploitation could lead to a modification of environmental equilibrium with potential risks for the biodiversity safeguard. For sub-wild and domesticated wild plants we detected respectively a *high* and a *medium* environmental sustainability, in fact the domestication of wild vegetables does not imply a direct effect on flora biodiversity. At the same time, the seed collection for cultivation does not cause very significant modifications to the environmental equilibrium of indigenous flora, with a low risk of biodiversity loss of wild species collected. Conversely, given the genetic erosion and the progressive loss of biodiversity, the cultivation of these plants seems to be one of possible solutions to the risk of extinction. In

fact the use of these plants could contribute to maintain an equilibrium in natural and agricultural environment (Negri et al., 2008). Furthermore some authors observe how the introduction of the cultivation of wild plants and local ecotipes, which also addresses concerns about the depletion of the wild stock, may revitalize natural and ecological systems (Lee, 2004; Timpanaro et al., 2013). Referring to *social sustainability*, as a ability to improve the wellbeing and the quality of life of community, it appears *low* in the case of wild plants exploitation. The psychophysic wellness only concern the collectors or farmers, which are the main beneficiaries of environment fruition due to direct contact with nature and landscape; only in a limited way these benefits can be extended to consumers, whose requirements primarily concern healthier and more safety productions. On the other hand, the level of social sustainability for two remaining categories is *medium* for semi-wilds and *high* for domesticated plants, because of the increasing possibility to ensure the food safety and the geographic origin of products. Furthermore the chance to cultivate and process semi-wild and pseudo-wild plants can ensure employment opportunities in rural communities, thus reducing the effects of the rural depopulation and improving their quality of life.

Conclusion

Given the presence of multiform areas with very different ecological conditions Sicily holds a wealth of plant biodiversity whose exploitation can be addressed to human nutrition. Farmers, vegetable process industry and modern distribution are paying a special attention to current trends of consumer whose preference are directed more and more towards quality, regional and natural food (D'Amico et al., 2003). In this direction the domestication of edible wild plants seem to play a very important role. Our analysis argues that market of wild plants is experiencing a growing market's expansion and many are the economic perspectives for producers and vegetable processing industry. In this sense a particular attention should be paid tothe effects that the creation of a new supply chain could cause on environmental and socio-economic sustainability.

The first part of results was focused on detect main features of most used wild vegetables which were classified into three different categories: wild vegetables, sub-wild vegetables and domesticated wild vegetables, depending on their collection or cultivation modalities. Our findings showed also the main markets and distribution chains of wild plants.

In the second part of study a SWOT analysis allowed to point out also many critical factors and weakness but at the same time it allowed to observe that short food supply chain can be proposed for some products. Favourable chances seem to derive from plant biodiversity exploitation and new long supply chains are taking place, enhancing and expanding current vegetable supply in food markets. The exploitation of spontaneous and wild flora should engage producers and industry food processing to activate new business ideas and integrated supply chains, by involving different chain of marketing and distribution channels and actors.

Our study concludes that wild plants can be exploited as crops and identify a set of strategic planning to introduce new supply chains, but further market analysis are required to better identify which wild plants are specifically suitable to create new and competitive supply chains, in a sustainable perspective given that domestication process has been considered as necessary to this aim.

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MEASURING SUSTAINABILITY IN THE AGRI-FOOD SYSTEM

The Evolution of Life Cycle Assessment (LCA): Some Guidelines for Future Research in the Wine Sector

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Abstract
The international scientific community considers the Life Cycle Assessment (LCA) approach as a key topic in measuring sustainability of economic activities. The purpose of this paper is to focus on future eventual applications of the LCA approach in agricultural economics. In order to sketch some leading drivers for future research, first we will briefly summarize the evolution of the tool from LCA to LCSA, this latter considering more comprehensively the three pillar of sustainability (environmental, social and economic) under the Life Cycle Thinking approach. Then we report a review of the literature about the application of LCA worldwide within the wine industry. The aim is to highlight the used approaches and main economic results, making some critical considerations about the use of this tool and the fields of research that are still scarcely explored.
JEL: Q01; Q540;
Keywords: Life Cycle Assessment (LCA); Viticulture and winemaking; Bibliographical Review

Introduction: background and aims

Nowadays the wine industry is immersed in a worldwide market wherein any country faces external key decision drivers. Amongst these, we can include the movement of supply re-qualification coming by both New World countries, including Australia, California, New Zealand, South Africa and Chile, being among the leading exporters, and Old World ones where France and Italy are still at the forefront. All these countries have carried out projects for several years to upgrade the quality of production through the adoption of sustainable practices.

The orientation of consumer behaviour towards 'green' wines was enlightened by a survey conducted in 2011 on a sample of 11,312 regular consumers in seven European and non-European countries. According to this (Jones, 2012), the sustainability of production is the 8th ranked criterion for choosing a wine. Moreover, large-scale retailers in the United Kingdom and the United States show increasing orientation in vending wine labels that declare level of CO_2 emissions associated with the life cycle of the product.

In a wide sense, mitigation of global warming effects with reduction of CO_2 emissions is a hot topic in the current international political Agenda, and scholars show an increasing interest in environmental sustainability (Bettencourt & Kaur, 2011). In particular, the Life Cycle Assessment (LCA) approach has become a key reference tool for the international scientific community (Zamagni, 2012). Indeed, LCA is a standardized method to enable the characterization of potential environmental impacts (e.g. global warming potential) generated along the complete life

cycle of a good or service (ISO, 2006).
The possibilities of adopting the LCA methodology in the wine sector seem to be wide and capable of generating abundant results with a more diffused adoption by wine companies and in the whole sector, in order to meet the increasing sustainability patterns and needs of consumer behaviour.
This paper aims at providing a review outlook and tracing some guidelines for future research in the wine sector based on LCA. Accordingly, we have detected among the LCA approaches retrievable in the literature those that have been used in the wine sector, searching some useful starting point for the development of specific research. For this purpose, we first outline the historical development of LCA, reporting key methodological advancements and briefly analysing which of them have been used in the wine sector.

Methodology

This section reports the review design and method along three basic dimensions: 1. review aims and approach; 2. review structure and components; 3. breadth, depth, and 'work done', which can be useful to inform the process of synthesis and its interpretation (Gough *et al.*, 2012). In Figure 1 we enlighten the research question we tried to answer and the approach we followed. This latter is a mix between the explorative and generative methods and allowed us to achieve a twofold result: (i) to have a synthesis of the state of the art about international knowledge on LCA methodological approaches, generating new conceptual understandings; (ii) to check the international implementation level of LCA in the wine sector, both exploring the international state of the art and generating new patterns for future sectorial research.

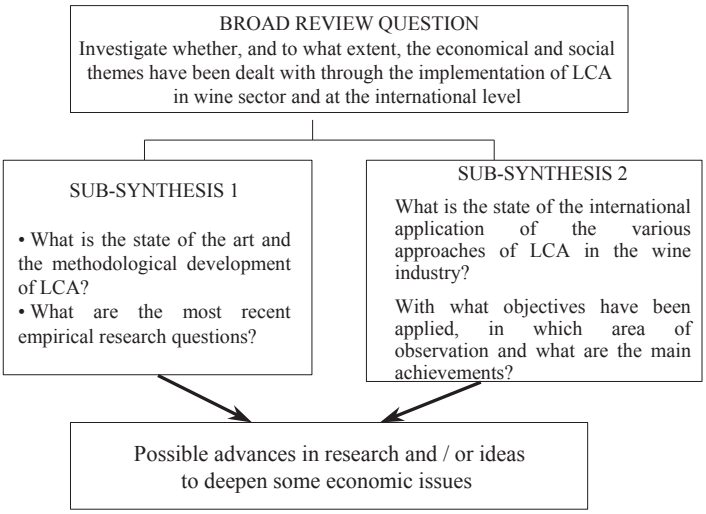

Figure 1. Systematic map of review searching for socio-economic LCA perspective in the wine sector.

Our synthesis has a configurative pattern, aiming at a theoretical research by means of fundamental literature contributions, yet representing main specific studies. Thus, even if the literature is more extensive than what is reported here, mainly for the second subsynthesis in Fig. 1, suitable information are given about the very complex and multifac-

ed topics retrievable in the general literature on wine LCA. A narrative synthesis of findings was undertaken.
The expected output is mainly focused on emerging ideas (shared at the international level) and the review is essentially aimed at highlighting possible future developments of the research, based on LCA in the wine sector.
We adopted our traditional 'lens' (i.e. that of the Italian Agro-economic School) not only stressing the technicality of the LCA approach but focusing the attention on the relevance of using LCA in order to better face and manage the complex socio-economic problems of farms, rural society and the productive life cycle surrounding the wine making sector.
In analysing the general and specific LCA literature we adopted a time criterion, following the evolution of the method and its operative implementation, and delving into the convergence between traditional LCA approaches and the economic method. To this goal, we have endorsed the analysis of studies that can better explain the surge of economics in LCA and the eventuality to use this approach also in the wine sector. Our topics of interest were the evolution of different LCA methods, their progressive "contamination" with economic tools, and the applicability in the agro-industrial sector.
We carried out the specific literature review on LCA and in the wine sector through the selection of specialized academic issues regarding two different topics: 1. related to the review of the LCA methodologies in the literature to answer the first sub-research question; 2. related to the review of methodological approaches of LCA applied in the wine sector in order to get to the second sub-research question. The comparison between the two sub-synthesis allows us to generate ideas for advances in research based on the implementation of LCA in the wine sector. In the first case, the searched keyword was "LCA methodological approach"; in the second the searched keywords were "LCA" and "wine", "CO_2 emission" and "wine".
We considered the following journals, proceedings and books.

- Journals: *Systematic review; The International Journal of Life Cycle Assessment, Journal of Cleaner Production, Journal of Environmental Management, Sustainability, Environmental Engineering Management Journal; International Journal of Agricultural Resources; Journal of Environmental Science and Engineering; Wine Economics and Policy; Journal of Industrial Ecology; Biomass & Bioenergy; Aspects of Applied Biology; Agriculture, Ecosystems and Environment; Journal of Sustainable Agriculture; Journal of International Law; Climate Change, Environmental Science Technology; Journal of Wine Research; Italian Journal of Agronomy*;
- Books: Green Delta; ILCD Handbooks; Some Guidelines of UNEP/SETAC;
- International Conference proceedings: International Conference on LCA; SETAC Conferences; Australian Conference on Life Cycle Assessment; Conference on Efficiency, Costs, Optimisation, Simulation and Environmental Impact of Energy Systems; International Conference on Life Cycle Assessment in the Agri-food Sector; American Association of Wine Economists; Australian Wine Industry Technical Conference; Annual American Association of Wine Economists Conference; ENEA; works of the Italian LCA Network.

Results

The LCA literature: from LCA to LCSA (Life Cycle Sustainability Assessment)

Along with the evolution of the concept of sustainability, which in recent years shows a major focus on the Triple Bottom Line (TBL), comprising economic, environmental and social pillars, a growing interest in the measurement of these three dimensions (both separately and within a single framework) took place (Finkbeiner *et al.*, 2010). Moreover, the LCA approach showed an evolutionary change over time, as depicted in the specific literature dealing with these advancements and changes (Zamagni, 2012; Guinée *et al.*, 2011; Klopffer & Ciroth, 2011; Finkbeiner *et al.*, 2010; Finnveden *et al.*, 2009; Thiesen *et al.*, 2008). These studies constitute an ideal framework to identify the main key research questions and methodological drivers. At the turn of the Sixties and Seventies, when environmental concerns burst into the public opinion, LCA developed as a tool to evaluate the potential environmental impacts of goods and services. In the subsequent thirty years from 1970 to 1990, research was oriented to test methods only through private and unpublished operational studies[1]. The decade 1990-2000 was the period of standardisation, with the issue of the SETAC Code of Practice in 1993, and the intervention of ISO in 1994, which produced the general LCA framework and many impact valuation methods that are still in use. In this second phase, LCA became part of policy and law documents, specifically referring to packaging both in the EU and in Japan (Guinée *et al.*, 2011). This second phase represents also the time for conceptual speculations such as, for example, the first attempt to include sustainability concepts in LCA (Andersson *et al.*, 1998) and the birth of the consequential LCA approaches (Weidema *et al.*, 1999; Earles & Halog, 2011).

The decade 2000-2010 has been defined the 'period of elaborations', since the concern on LCA and the necessity to transfer the Life Cycle Thinking principles to real practices, by upgrading data collection, tools and indicators, have increased. This tool became a pole for the EU (see for example the establishment of the European Platform on Life Cycle Assessment) and the USA policies (The Environmental Protection Agency that started promoting LCA).

From a methodological viewpoint, some emerging specific research necessities promoted different approaches, diverging from the traditional LCA in the definition of allocation methods and system boundaries. These are the Dynamic LCA, Spatially differentiated LCA, risk-biased LCA, environmental IO-LCA and hybrid LCA (Guinée *et al.*, 2011).

Nevertheless, all these approaches do face problems of coherence in comparison to the basic standards proposed by ISO[2]. Among these, we can consider the Life Cycle Costing (LCC) approach and the Social-LCA (Guinée *et al.*, 2011, p. 92). As specified by Ciroth & Franze (2009): «LCC is an assessment of all costs related to a product or service, over the entire life cycle, from production over use until disposal… In combination with LCA… LCC can serve to address the economic dimension of sustainability» (p. 2).

For the definition of S-LCA we can refer to Benoit & Mazijn (2009): «A social and socio-economic LCA is a social impact (and po-

1. One of the first, frequently mentioned, has been conducted by the Midwest Research Institute (MRI) for the Coca Cola Company in 1969.

2. ISO never aimed to standardize LCA method in detail, arguing that: "there is no single method for conducting LCA", and there is no common agreement on how to interpret some of the ISO requirement (Guinée et al., 2011).

tential impact) assessment tecnique that aims to assess the social and socio-economic aspects of products and their potential positive and negative impacts along their life cycle encompassing extraction and processing of raw materials; manufacturing; distribution, use; re-use; maintenance; recycling; and final disposal. S-LCA complements E-LCA with social and socio-economics aspects» (p. 37).
Today, scholars face the so called Life Cycle Sustainability Assessment (LCSA) decade (2010-2020). A formal LCSA framework was stated (Klopffer, 2008) as follows:
LCSA = LCA + LCC + S-LCA;
However, it has been stressed that rather than a 'model' it is a trans-disciplinary integration of models (Guinée *et al.*, 2011, p. 93). The three summed methods have a diverse degree of maturity, in terms of refinement and diffusion of applications. In fact, application guidelines of the environmental LCC (Hunkeler *et al.*, 2008; Swarr *et al.*, 2011; Valdivia *et al.*, 2011) have been published only in recent years. Similarly, the guidelines for the implementation of the S-LCA have been also recently introduced in the literature (Benoit & Mazijn 2009).
A complete application of LCSA that considers interrelations among the three pillars of sustainability is still lacking.

The wine sector: LCA literature
We built a literature database containing 32 studies which offer a sound description of the-state-of-the-art of the LCA implementation in the wine sector, notwithstanding some involuntary lacks. We still consider it a work-in-progress job, needing continuous updating about operational and theoretical issues in the wine sector. We argue that our work, trying to answer a different and original research question, could be also a useful update of previous recent studies (Petti *et al.*, 2010; Rugani *et al.*, 2013). Fig. 2 shows that the literature on CO_2 emissions rose after the end of the conception and international standardization of the LCA methodology.
The first study on LCA has been issued in 2001 (Nicoletti *et al.*, 2001) and developments raised (Notarnicola *et al.*, 2003) just in Italy (34% of papers analysed), with a constant distribution over time. Surely, the birth in 2006 of the Italian Network of LCA, after the first proposal by ENEA, gave a strong impulse to the diffusion of the LCA method in the agri-food and wine sectors.

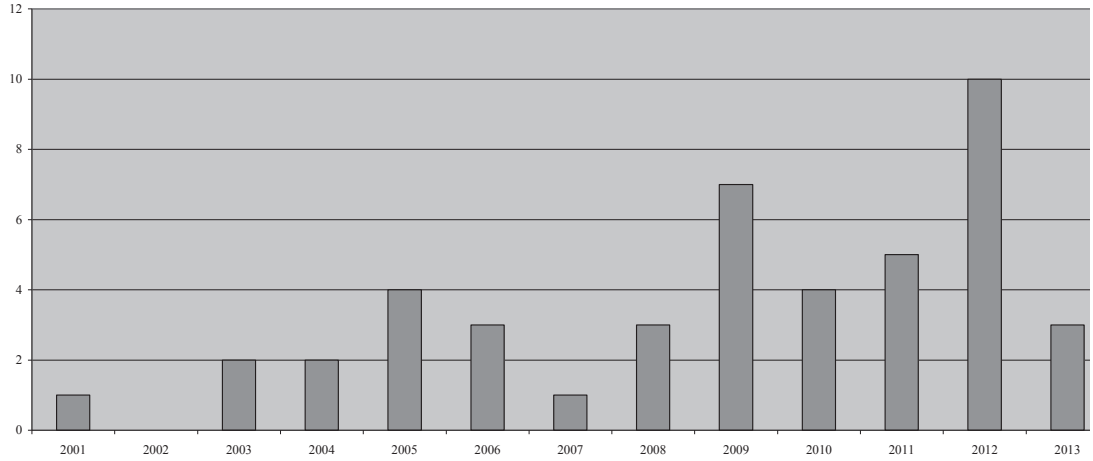

Figure 2. Evolution of studies reporting LCA and CF evaluations in the wine sector.

At the frontline at the beginning of the evolution (Zabalza *et al*., 2003), we find studies where wine case studies are from Spain, mainly concentrated between 2009 and 2013; followed by cases from USA (Colman & Paster, 2009; Cholette & Venkat, 2009; Venkat, 2012) and UK (Wrap, 2007), which also focused on the topic of transport emissions. Other countries which have provided relevant studies are Australia (SAWIA, 2004; Soosay *et al*., 2012), New Zealand (Greenhaig *et al*., 2011), Canada (Point *et al*., 2012), Romania (Comandaru *et al*., 2012), and Portugal (Neto *et al*., 2013).

Table 1 shows an overview of the studies including the assessment of environmental emissions in the wine industry, considering the diverse implemented methodologies and their evolution over time.

Tab. 1 - Temporal distribution of wine studies according to the methodology used

	Attributional			
	AP-LCA *cradle to gate*	AT-LCA *cradle to grave*	CF	LCA vs others
2001				
2002				
2003	Notarnicola *et al* (Ch. In Book)	Zabalza *et al* (Conference)		
2004			SAWIA (report)	
2005		Aranda *et al*		
2005				
2005				
2005				
2006		Gonzalez *et al* (report)		Petti *et al*
2006	Ardente *et al*			
2007			WRAP	
2008				Pizzigallo *et al*
2008				
2008			Niccolucci *et al* (EF)	
2009			Carballo Penela *et al*	Rugani *et al*
2009			Cholette & Venkat	
2009			Colman & Paster	
2009			Kavargiris *et al*	
2009		Ruggieri *et al*		
2010		Gazulla *et al*	Reich-Weiser *et al*	
2010	Schlich (Conference)			
2010				
2011				
2011		Bosco *et al*		
2011			Greenhaigh *et al* (report)	
2011				
2011				
2011				
2012	Vázquez-Rowe et al	Comandaru *et al*		
2012	Vázquez-Rowe et al	Point *et al*		
2012				
2012			Pattara *et al (b)*	Pattara *et al (a)*
2012				
2012			Venkat	
2012		Arcese *et al*		
2013	Benedetto			
2013	Neto *et al*			
2013	Vázquez-Rowe et al			

Along the analysed studies, the attributional LCA, focused on environmental aspect, is the typical approach used, while the system boundaries are most commonly 'cradle to grave' (Fig. 3).
The assessment of environmental emissions associated with the production of a bottle of wine (functional unit 0.75 l) is essentially devoted to:

- identify the critical hot spots of the process (Benedetto, 2013; Arcese *et al*., 2012; Point *et al*., 2012; Vázquez-Rowe *et al*., 2012a; Gazulla *et al*., 2010; Gonzalez, 2006; Ardente *et al*., 2006; Petti *et al*., 2006; Notarnicola *et al*., 2003; Zabalza *et al*., 2003);
- communicate the results through ecolabelling (Vázquez-Rowe *et al*., 2013; Point *et al*., 2012; Bosco *et al*., 2011; Carballo Penela *et al*., 2009; Gonzalez *et al*., 2006; Ardente *et al*., 2006).
- There are cases of comparison among different types of wine (white vs. red, premium and medium quality, e.g. Notarnicola *et al*., 2003) or considering different kinds of process (i.e. conventional vs. organic; e.g. Venkat, 2012; Colman & Paster, 2009; Kavargiris *et al*., 2009; Niccolucci *et al*., 2008; Pizzigallo *et al*., 2008; Gonzalez *et al*., 2006), LCA of organic wine (e.g. Petti *et al*., 2006; Rugani *et al*., 2009), but also among individual companies and cooperatives (e.g. Bosco *et al*., 2011).

With regard to our research question, most interesting is some works that used LCA for solving strictly economic problems. Schlich (2010), using a partial LCA (i.e. cradle to gate), demonstrates his scientific hypothesis about the existence of an "Ecology of Scale" in the wine industry, i.e. the inverse relation between the ecological impact and the economic dimension of the firm, where the lower the firm the higher the impact.
Other studies determine relationships between economic productivity and the territorial/operational conditions. For example, Vázquez-Rowe *et al*. (2012a) assessed the wine production in a temporal trend providing time environmental scaling and demonstrating the high dependency on annual crop productivity. Vázquez-Rowe *et al*. (2012b) applied LCA in combination with Data Envelopment Analysis (DEA) providing also insights on economic savings linked to the accomplishment of operational targets. Soosay *et al*. (2012) combined LCA and Value Chain Analysis (VCA) to find the best practice to equilibrate the resources allocation in value industrial chain and consumer's preferences in a selected market segment. Ardente *et al*. (2006) performed LCA and POEMS (Product Oriented Environmental Management System) to foster the dialogue among all the stakeholders and implementing efficient improvement strategies. Finally, Ruggieri *et al*. (2009) carried out an LCA with specific focus on composting systems from a technical, economic and environmental viewpoint.
In any case, those contributions are mainly oriented to the assessment of environmental sustainability.

Discussion and conclusions

Further to the general and simplified review of current literature on wine industry LCA, we propose here an outlook towards the implementation of additional LCA based research lines, which could be also used to improve the rest of the agri-food industry LCA research.
First of all, it is worth noticing that research should be primarily focused towards the development of LCSA, comparing the environmental impact dimension with the social and

economic ones, or use it jointly by applying the S-LCA and/or LCC together with environmental LCA or in an integrated framework (Guinée *et al*., 2011).

The S-LCA and LCC approaches are particularly interesting in agricultural economics and rural policy because they allow introducing principles and socio-economic mechanisms that the environmental LCA cannot simply afford. Indeed, considering the social constraints of farmers and wine making entrepreneurs is a fundamental concern for Italian agro-economists. In this line, we suggest to contribute to the interdisciplinary debate by exploring the possibilities to incorporate into these two approaches some specific economic and social issues traditionally debated among the agro-economic scholars and professionals (e.g. in the case of the LCC, the problem of calculating the implied costs and the discount rate choice, in the case of S-LCA the multifunctional role played by the viticulture).

At the same time, it is important to highlight the research challenges for the implementation of consequential-LCA. A key issue – linked to the application of LCA and CF – is how the results of the CLCA analyses can be communicated to the final consumer, both at national and international level. Three main topics seem to be relevant, as they can influence both the method implementation and the actual pursuing of predefined aims.

The first is the traceability of emissions within the wine industry, which is associated with the debate about the social responsibility of environmental emissions (Rugani *et al*., 2013). The second one, strictly linked to the first, is related to the Food Miles debate and the 'green competition' in the world wine market jointly to the ability/possibility to inform the final consumer. The third issue, instead, pertains to the indirect effects and Rebound Effect (RE) regarding the producer and consumer behaviour of a sustainable wine with low carbon emissions. In fact, the identification and the working mechanism of RE may have important policy implications because the intensity of the CF impacts is crucial when it allows to identify strategies and promote sustainable consumption. In this regard, it would be interesting, also for the wine consumption, deepen the theme of the transmission to the final consumer of the results obtained from the implementation of a low carbon protocol; further investigate the understanding of the environmental label; verify the willingness to pay for a wine with low environmental emissions. Finally, some possible research paths can be identified with regard to the environmental-LCA implementation, mainly oriented to encompass the full system boundaries (from a cradle to grave to a *cradle to cradle*), considering all the activities linked to wine production with a 'zero'-emission/resource consumption perspective. The life cycle of wine should be more comprehensively assessed, by looking at a more complete life cycle of the industry, from vine plantation (including also the production of rooted cuttings) to production of grapes, vineyard activities, winery processing, bottling, distribution, storage, use by final consumer, disposal and recycling. Moreover, the life cycle should include any detailed aspects related to the emissions coming from distribution of pesticides and fertilizers, and transport, as well as the measurement of carbon sequestration by the vineyard (to improve the biogenic carbon balance analysis).

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The Use of Environmental, Economic and Social Indicators as Decision Support for the Advancement of Farms towards Sustainability

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Abstract
Modern agricultural activities require a increasingly level of balance between the productive standards necessary for the food supply and the farms profitability and an equally sustainable social and environmental impact on today's rural systems. This work aims to create a multi-level support tool, able to support both the farmers and the relevant institutions towards the most appropriate technologies, choices and solutions. For these objectives, the evaluation of all these three scales of sustainability (economic, social and environmental) characterizing the farms, can be a valid support, through the construction of a single calculation tool, scientifically accurate and territorially validated, able to identify the links between them and to identify the strengths and weaknesses of the production system.
JEL: Q01; Q51; Q56.
Keywords: Sustainable Development; Sustainability indicators; Decision support tool.

Introduction

Constant innovation in the production techniques of the primary sector has contributed in recent decades to the exploitation - both good and bad - of agricultural systems and their resources. The intensification of production has led to important progress in the production systems needed to deal with the food demands of an increasing world population. On the other hand, it has also had a significant ecological and environmental impact on natural ecosystems. The sustainability of agricultural systems starts with this evaluation.
In 1987, the Brundtland Report was the first to describe "sustainable development" as "a development that meets the needs of the present without compromising the ability of future generations to satisfy their own needs".
In the literature, there are numerous definitions of "sustainable agriculture" (Hansen, 1995; Jacobs, 1995). It is thus necessary to distinguish between the different aspects of sustainability in relation to their aims: environmental, social and economic (Goodland, 1995). The important stages that have contributed to this awareness, such as the World Conference of Rio de Janeiro in 1992 and, more recently, the proclamation of the "Decade of Education for Sustainable Development" (DESD) 2005-2014 by UNESCO, have challenged the scientific community to establish techniques that combine adequate production with a more sustainable social and environmental impact. The application of indicators, defined as "synthetic variables of substitution of other variables that are otherwise difficult to determine" (Bockstaller et al., 1997), plays a prominent role in the

evaluation of sustainability standards both at decision-making and educational levels.
In agricultural areas characterized by intensive types of production, the need has emerged to establish what is still sustainable and what is not, in accordance with technological advances and new trends in agricultural markets: the differentiation of production, the use of low impact techniques, sustainable marketing techniques (shorter chains, certification tools) and new forms of income that can be integrated with traditional manufacturing processes.

Methodology

The method
The objective of this work was to construct a scientifically appropriate method for the assessment of the sustainability, technically applicable to different areas, through the evaluation of of farms in a local Italian context. This method will provide a support tool to farms (production, management and commercial decisions), local policy-makers (overview of the productions, creation of a database) and researchers towards innovative and more sustainable solutions.
The processed and aggregated data obtained are useful to assess sustainability levels in a given area, comparable with different production scenarios, both at a national and European level, and providing information on the real potential of policies to achieve the goals set by policy makers (Vos et al., 2000).
There are many different methodologies based on the scale of detail (field, farm or region), the objective of the work, the spatial and time scale, the resources available (human and economic), and the available data. It is possible to identify 3 main categories of approaches:

1) the use of individual indicators from different methods which can be used to focus on research aspects. On the other hand, these composite indicators lead to significant difficulties in finding the right combination of tools to achieve highly consistent final results (Gómez-Limón and Sanchez-Fernandez, 2010). They require a long time in terms of selection and collection of the necessary data;
2) the use of models (simulations) ensures a high accuracy of results through the use of a single methodology for different aspects of sustainability, but they are often complex (Castoldi et al., 2009), and the success of the work greatly depends on the availability and quality of the data;
3) from a strictly practical point of view, the choice of indicators often include synthetic applications, which lead to studies that are fast and applicable to different and unrelated situations. Thus, the use of a single method established through individual already aggregated and balanced indicators may be a viable alternative to assess sustainability in its various aspects, using qualitative and quantitative data, which are easy to find and adaptable for different contexts (Castoldi and Bechini, 2006). However, the validity of these methods depends on the accuracy of the data, and it is often necessary to deal with the problems of poor specificity in terms of the indicators, especially with the complex aspects of environmental and economic sustainability.

We therefore needed to find a system that requires easily detectable data (or at least that allows, in the absence of these data, equally simple and rapid evaluations) in order to minimize the loss of time and resources (Bockstaller et al., 1997), to avoid method-

ological and practical problems (Bockstaller and Girardin, 2003) and to reach a standardized evaluation. This process needs to describe the agricultural conditions wherever a farm is located and whatever its size. Often decision-making involves multiple, and sometimes contradictory, ideas about what is more or less sustainable (Blinder et al., 2010). The issues arising underline the need to find a practical approach, in fact sustainability requires an openness to new concepts and reflections rather than at an attempt at an overall understanding (Thompson, 2007).
Surveys were therefore carried out based on the IDEA method[1] (Vilain, 2008), which has been scientifically validated for a geographically defined context. Previous surveys carried out using IDEA (Zahm, 2003, Zahm et al., 2005, Cadilhon et al., 2006, Bockstaller et al., 2008, Zahm et al., 2009) provide important information on the degree of sustainability of farms with different productive systems, sizes, degrees of specialization and multi-functionality. In this way, we can compare and evaluate the most innovative technological solutions, thereby gaining knowledge on the most modern production systems. IDEA does not monitor or verify the real situation of farms, but is used as a diagnostic and support tool for entrepreneurial decisions (Briquel et al., 2001) and during the evaluation and monitoring of the agri-environmental Measures of the Rural Development Program, as a decision-making tool, providing practical knowledge for funding opportunities (Zahm et al., 2005).
The method compares farms on the basis of quantitative indicators, assessing the strengths and weaknesses of the production system, and identifying possible ways to improve the level of sustainability.
Operationally, the method is based on: (i) calculations (e.g. nitrogen balance, stocking rate, economic indexes), measurements (e.g. number of animal and vegetal species, pesticides distributed) and evaluations (e.g. quality of work, animal welfare); (ii) these data produce results that determine the sub-indicators (indexed scoring scales that characterize the single data or a small group of data that characterize a single aspect); (iii) an additive sum of the sub-indicators forms the single indicators, applying a maximum and a minimum (0) score, weighted considering their importance; (iv) in the same way, a sum of the indicators produces a range of possible scores of the components (v) and the three scales of sustainability (Table 1, 2 and 3).
The calculation of many indicators (formed by sub-indicators) is rather simple, as only attribution of tabular scores is needed (for example the assessment of biodiversity or the quality of the landscape). Others involve processes that require a large volume of data (such as the evaluation of the use of energy, fertilizers and pesticides) and other cases are more complex (as in some economic indicators, which are based on the calculation of the indices of profitability and efficiency, such as ROE and ROI).
When focusing on the area of interest, an evaluation of the results can be carried out by considering individual indicators, otherwise their aggregation occurs by summing the individual scores to obtain the result of the components.
Since its inception, IDEA has evolved with new farming practices and has also undergone important changes and adjustments which have contributed to the better strength and weight of many of its indicators.

1. IDEA, "Indicateurs de Durabilité des Exploitation Agricoles" or rather "Indicators of sustainable of the agricultural exploitation", was developed on the request of the General Directorate of teaching and research of the French Ministry of Agriculture and Fisheries.

COMPONENT	INDICATOR		SCORES
1_Biodiversity	A1	Diversity of temporary crops	0-14
	A2	Diversity of permanent crops	0-14
	A3	Animal Diversity	14
	A4	Development and conservation of the species	0-6
2_Spaces management	A5	Crop Rotation	0-8
	A6	Size of plots	0-6
	A7	Management of organic matter	0-5
	A8	Buffer zones	0-12
	A9	Environmental Safeguard	0-4
	A10	Stocking rate	0-5
	A11	Management of forage areas	0-3
3_Agricultural practices	A12	Fertilization	0-8
	A13	Management of livestock effluents	0-3
	A14	Pesticides	0-13
	A15	Veterinary treatments	0-3
	A16	Soil protection	0-5
	A17	Water management	0-4
	A18	Use of the energy	0-10

Table 1. Agro-ecological Sustainability: Components and Indicators.

However, since it was originally designed with reference to the different environmental, economic and political characteristics of the French agricultural system, adaptations were made to account for the local context. Changes were made to the sub-indicators, modifying some range of possible scores or even replacing some of them (such as those that focus on aspects of agriculture in mountains or hill areas) with others deemed more appropriate considering the local area where the analysis was carried out. In effect, while not focusing on a particular geographical area or production, these methods are of course designed with reference to the local contexts in which they originated (Galan et al., 2007). In addition, we were able to adapt several indicators to make them valid for a heterogeneous variety of contexts. A modelling of the method was required, in order to create a tool capable of evaluating any type of farm categorized by type of production and exclude aspects that do not involve the farm.

COMPONENT	INDICATOR		SCORES
4_Quality of products and the territory	B1	High quality brands	0-10
	B2	Development of rural landscape	0-8
	B3	Management of non-organic wastes	0-5
	B4	Access to spaces	0-5
	B5	Social implications	0-6
5_Work and services	B6	Development of short chain	0-7
	B7	Autonomy and exploitation of local resources	0-10
	B8	Multifunctionality	0-5
	B9	Contribution to employment	0-6
	B10	Cooperative work	0-5
	B11	Future prospects	0-3
6_Ethics and human development	B12	Contribution to the balance and sustainable management of resources	0-10
	B13	Animal Welfare	0-3
	B14	Education	0-6
	B15	Work	0-7
	B16	Quality of life	0-6
	B17	Isolation	0-3
	B18	Hygiene and safety	0-4

Table 2. Socio-territorial Sustainability: Components and Indicators.

COMPONENT	INDICATOR		SCORES
7_Profitability	C1	Viability	0-20
	C2	Economic specialization	0-10
8_Independence	C3	Financial autonomy	0-15
	C4	Dependency from PAC aid	0-10
9_Efficiency	C6	Efficiency of the production process	0-25

Table 3. Economic Sustainability: Components and Indicators.

The survey

For a farm analysis, it is advantageous to operate in a sufficiently large spatial context characterized by a good variety of production types, but also reasonably confined to homogeneous social and economic sectors.

Our case study was an agricultural park, named *Parco Agricolo Sud Milano* (PASM), which covers more than 40,000 hectares in the province of Milan (northern Italy), whose characteristics fit the considerations described above. The farms in the park have a very different production, economic and environmental systems and sizes, which is a necessary prerogative for the sustainability indicators in order to assess the level of specialization, multidisciplinarity, and production differentiation (Pirani et al., 1992).

Although the PASM, like agricultural areas in northern Italy, is completely flat and farming is extremely intensive using advanced technologies, it nevertheless has characteristics that are not common to the entire Padana plain. In fact, the geographical location is classified by the regional administration as an urban area (*Revision no. 5 of the RPD of Lombardy published on 29-03-2011*). It has a high population density and attributes typical of peri-urban areas, such as fragmentation, competition from other important industries and the high economic value of the land. On the other hand, this territory also play an important social and ecological function and meet the requirements of towns located near a rural environment (Gaviglio et al., 2006). These characteristics here bind even more farms, especially if multisectoral, with the urban context in which they are located. This helps to increase the environmental and social multifunctions of the agriculture.

The first step in the research was the study of the farms in the park, using the databases available through the local institutions that contain their characteristics. Due to the large number of farms in the park (about 1000), it was thus necessary to sample a limited number of farms. Considering the type of production, the economic dimension and the geographical location (by splitting the the park into 4 production areas[2]), we selected 50 representative farms on which the analysis was conducted. We created a database to collect the data necessary to calculate the indicators. The requested information involved: (i) the database of the Lombardy region SIARL (farm size, crops, livestock, agricultural machinery, farm personnel, PAC contributions); (ii) interviews with farm personnel using a questionnaire (economic data, use of fertilizers and pesticides, other social and local area data); since the reliability of the farmers' responses is a limiting factor (Briquel et al., 2001), (iii) we also used estimates, observations and tabulated data (RICA).

Results

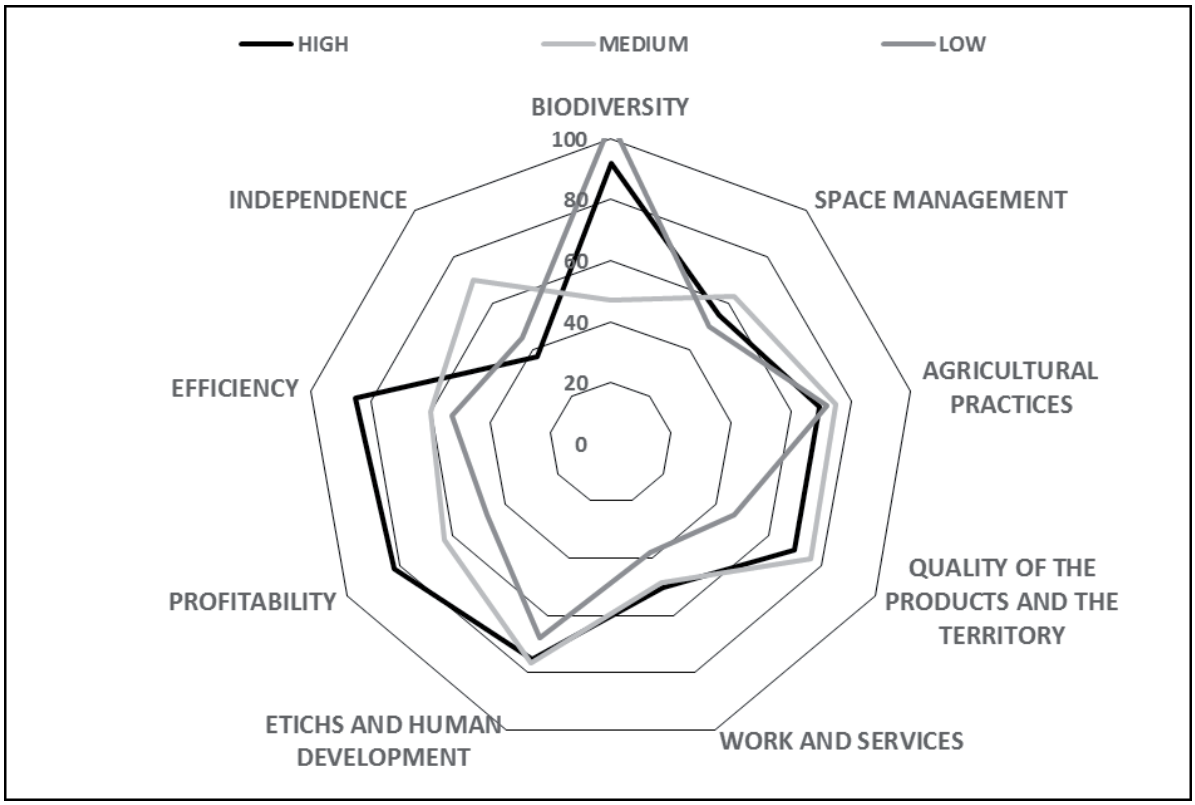
The method, with necessary changes, was particularly suited to the PASM. In fact, IDEA is characterized by a high degree of sensitivity to differences in the production and management of farms, and was used to highlight the strengths and weaknesses of many large-scale farms, but also of small farms in peri-urban areas in the Milan hinterland.

To facilitate the evaluation of the results, the categories of farms were stratified with the same criteria used for the sampling. The interpretations can be many: size, type of production, localization, etc.

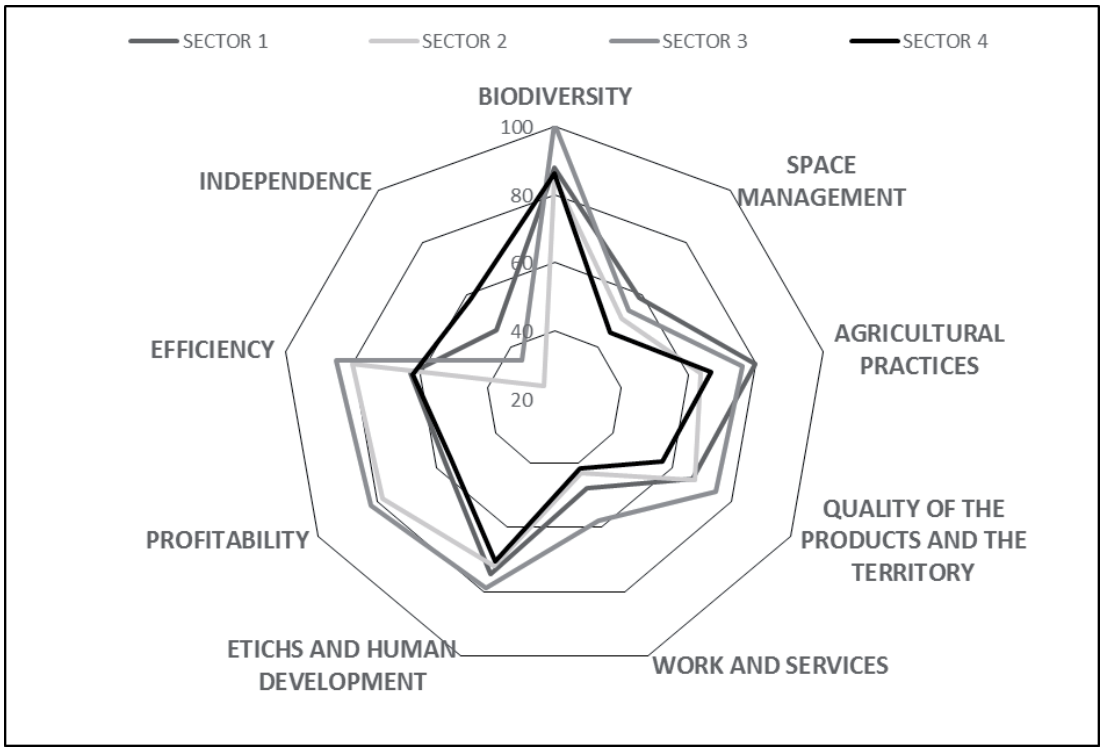
The agro-ecological indicators achieve higher results in contexts characterized by a high level of plant and animal biodiversity, by a virtuous space management, a high land-

2. Sector 1: North-West area, Sector 2: South-West area, Sector 3: South-East area, Sector 4: North-East area.

scape quality, as well as the rational use of energy resources, pesticides and fertilizers. Thus organic farms get particularly excellent ecological results, due to the non-use of chemical inputs. However, the approach used here raises some important questions regarding the compromises, which are considered necessary for an environmental evaluation, including obviously different inputs, in view of the diversity of the role and the objectives of conventional and organic production systems (Rigby et al., 2001).
Different ways comparing the results are possible which, when standardized and represented with a spider graph, provide a preliminary integrated characterization of sustainability (Girardin et al., 2000): (i) between 2 or more farms; (ii) between the results of the same farm over 2 or more years (iii) between farms aggregated for similar economic, productive or geographical characteristics.
In this case (Graphic 1) we aggregated the results of the sampled farms according to the related U.D.E. (Unità di Dimensione Economica: Unit of Economy Size) values (source SIARL).



Graphic 1. Results of the farms with a high (>100), medium (from 50 to 100) and low (<50) value of UDE.



Graphic 2. Results of the farms located in four different sectors of the Park.

The three classes highlighted important differences between the social and economic components. In general, medium-large farms have higher rates of the social components. In these cases, their results are in fact better in working conditions, animal welfare and the quality of products (often thanks to certifications and quality brands). The economic components have the same trends: large farms with a high number of animals (dairy and beef cattle, pigs and poultry), and the large rice farms located at the south edge of the park perform better in profitability and efficiency.

Even the agro-ecological components have a similar trend, however we noticed that their value is highly linked to the type of production. In this case, the organic productions (thanks to the more sustainable farming practices) and those with a wide variety of production and related activities (favoured by high biodiversity and a better organization of space) have clear higher values. The economic component named "Independence", linked to the weight of the subsidies on farm income, is notoriously dependent on the type of production (here particularly referring to the importance of the PAC aids in the rice production).

In a second approach, we classified the farms considering their location in the four sectors identified during the sampling phase (Graphic 2).

In this case we noticed a better performance

in the social component of farms located in sector 3 (which includes the city of Milan), characterized by the presence of a large number of multifunctional farms, with important agri-tourism activities.
The strong connection of the component of "Independence" with the type of production is even clearer here: the low value of sector 2, which is characterized by significant rice productions, confirms the high importance of the PAC aids. This sector and sector 3 have the highest values in economic indicators.

Conclusions

The method proved to be a valuable tool for assessing sustainability. The model was evaluated, selected and edited according to recent European policies, integrating agricultural production with environmental protection. The results highlight the need to now link these assessments with the income prospects of the farms provided by, European, regional and local institutions (the establishment PASM).
However, we identified a number of critical issues, principally due to:

- the low significance of some indicators linked to complex aspects of the environment and economic sustainability. Thus, considering the high malleability of the method, we attempted to improve it through the introduction of more specific parameters (even with more costly and time data);
- we often had to balance some indicators that we believed should have more or less importance in relation to our local context;
- the additive aggregation of the sub-indicators, indicators and components highlights the limitations of the results. The decision to remove the capping of scores ensured a better performance; however, we aim to adopt solutions that will achieve a more homogeneous aggregate score;
- the use of IDEA highlighted the need for standardized parameters and especially more objective evaluations of components such as labour, animal welfare, and environmental and landscape quality. Even the use of renewable energy sources and the use of energy saving systems, may be further evaluated in the calculation of agro-ecological sustainability and, consequently, if virtuous, the financial losses. In this case, "unsustainable" indicators can be applied to assess the sustainability itself, not as a goal, but as the process itself, or to provide information regarding the risks or the potential effects of actions or any negative impact (Smith, McDonald, 1998).

The PASM, founded more than 20 years ago, is one of the first cases of territorial institution for the protection of peri-urban agricultural areas. In these years, the territory and the economic situation have undergone changes and the institution needs to be able to take advantage of the opportunity of the interest of the citizens of Milan for the nearby rural areas. The results highlight the relevant role in the peri-urban areas of both large and small farms.
Small farms need of leaving the old patterns of production to cope the competition of larger farms, economically and technologically competitive, diversifying the production, the marketing, the buyers and the secondary activities (agritourism, school farm, restaurant, etc.), promoting the creation of new mechanisms of short chains, civic food networks, on-line sales and cooperation.
The large conventional farms need of protection because of their high economic importance and their role against the increasing

fragmentation and edification of the territory. Given the location of the PASM, a fourth scale was needed when calculating the overall sustainability of a farm, with the focus on institutions and decision-makers in general. Many of the choices that affect the three scales described so far also depend on the political, legal and bureaucratic context in which farms operate. This type of scale, called *Governance* (FAO, 2013) aims to assess the degree of evolution of the relationship between farms and decision-makers, i.e. information on technologies, streamlined bureaucracy and knowledge of regulations. We were therefore able to catalyze the path of a farm to sustainability through new technological choices and management (fewer chemical inputs, the use of renewable resources, new marketing systems, etc.).
We thus seek to grasp the aspects related to consumers, through marketing analyses, trends of production and consumption in order to create a match with those obtained from the supply side.

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New Methodological Frontiers for Sustainability Assessment: a Multidimensional Vulnerability Framework for the Agrofood System

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Abstract
Sustainable Food Security and Sustainable Diets are widely acknowledged and studied by the international community. The links between food regimes of populations and the environmental and socioeconomic issues concerning individuals, countries and geographical areas, are nowadays recognized and proved. Nevertheless, identifying metrics for a multidimensional analysis remains a challenging task. This methodological paper proposes a revisited vulnerability approach for an innovative application to food security and sustainability issues in the agrofood system. The aim is to identify qualitative and quantitative methods to consider the interrelating factors leading to vulnerability, in order to inform decision-making and adaptive strategies. An original methodological framework of the integrated vulnerability approach to analyze food insecurity and unsustainability is presented together with a metric methodology.
JEL Code: C18; Q01; Q18.
Keywords: Causal-factors, Decision-making, Food systems, Metrics, Resilience.

Introduction

Food Security, Sustainable Development and Sustainable Diets
In the last 25 years, the international political and scientific communities have been officially tackling the sustainability issues, as the Brundtland Report was agreed in 1987 (United Nations). The Sustainable Development definition "Sustainable Development meets the needs of the present without compromising the ability of future generations to meet their own needs" underlines the necessity to implement a human economic, social, environmental and institutional progress respecting the durability over the time. The worldwide debate about sustainable development passes naturally through the global food security concerns, as it was stated in the 1996's World Food Summit (WFS) declaration that "Food Security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life" (FAO, 1996). The 1996's Food Security definition shows the determinants assuring - or threatening if they are lacking - food security for people, identifying four main dimensions: food availability, access to food, food utilization, and the stability over the time of the three previous dimensions.
The result of the normative junction of the pillars that emerge from these two definitions (Figure 1), has led to the identification of several interconnected dimensions that specify the numerous fields comprising sustainable food and nutritional security and sustainable diets. The participants of the International Scientific Symposium on *Biodiversity and Sustainable Diets* agreed in defining sustain-

able diets as "those diets with low environmental impacts which contribute to food and nutrition security and to a healthy life for present and future generations. Sustainable diets are protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy while optimizing natural human resources" (FAO & Bioversity International, 2012).

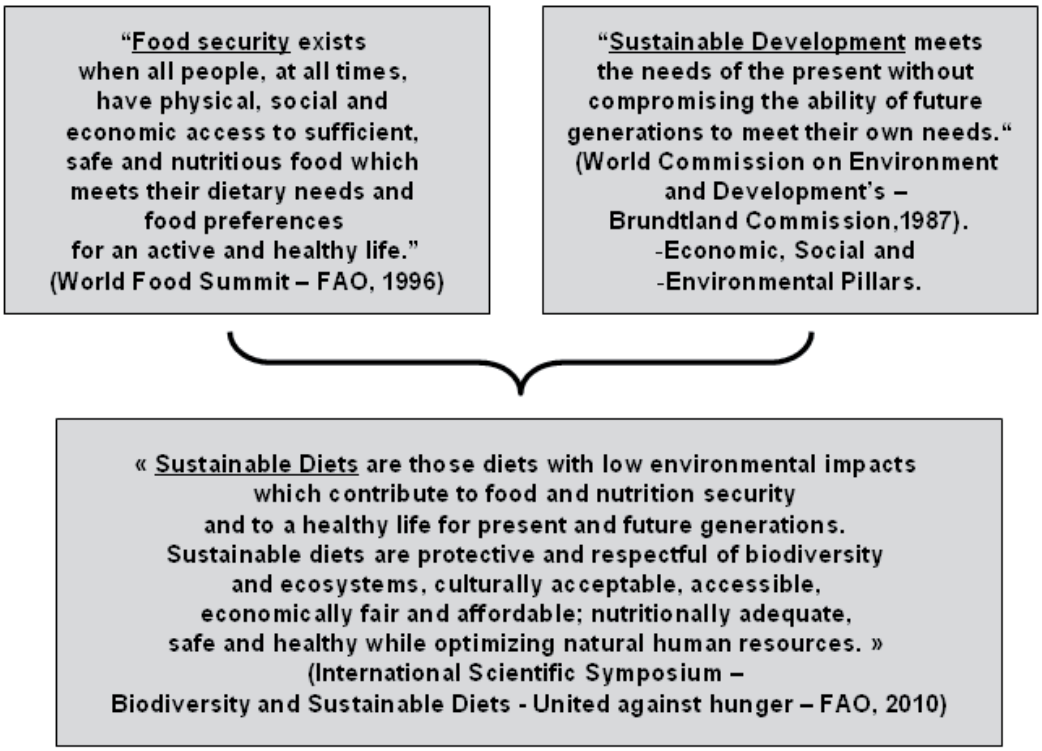

Figure 1. Conceptual evolution of Sustainable Food Security and Sustainable Development towards Sustainable Diets.

It is clear that in the latter definition, the whole food security issue is analyzed through a strong multidimensional approach. Particular crucial issues are mentioned, as the importance of biodiversity not just for the agriculture and the environment, but also for nutritional adequacy, cultural acceptability, functional services and market factors.

The analysis of food and nutritional security moves towards an approach aiming the sustainability of the whole agrofood system. This approach refers to the need of disaggregating the concept into different types of food and nutritional insecurity, varying on the nature and relevance of the problem and the kind of solution necessitated (Colonnelli & Simon, 2013; Pinstrup-Andersen, 2009). In the sustainable diets discussion process, four main

goals for the governance of a future sustainable food system are identified: nutritional health, cultural acceptability, economic affordability and environment protection (Fanzo, Cogill, & Mattei, 2012). Whatever the sequence of the definitions is, sustainable food is key for assuring food security (FAO, 2012), as it cannot be pursued in the absence of food security (Butriss & Riley, 2013). Food security and food sustainability are then indispensable prerequisites to each other and they need to be analyzed conjointly.

Watching back into the 1948 Declaration of Human Rights (United Nations, 1948), all these definitions represent some partial consequences of the 25th article that assures the human right to food security.

Decisions taken by policy makers should then assure the perpetual right of human beings - as individuals and in all their various forms of communities and societies - for a physical, ecological and socioeconomic access to sufficient, safe, bio-diversely nutritious and adequate food, issued by an agrofood system that is respectful of natural resources, peoples, incomes, local cultures, while protecting viable economic and political conditions and respecting the sustainability public criteria for healthy and ecological food and nutrition, in order to avoid geographical regions, countries, and people to be vulnerable but holistically resilient for all the critical socioeconomic and ecosystem hotspots of insecurity and unsustainability of the agrofood chain.

Policy and decision makers, stakeholders and the actors at a national and regional scale, play a key role in governance that is clearly identified in the stability dimension of sustainable food security and in the fourth "institutional" pillar of sustainable development.

Methodology

Causal factors for a vulnerability analysis

The several issues, related to food insecurity and unsustainability, are here multidimensionally considered as hotspots of vulnerability, of the countries' agrofood systems, integrated in a conceptual framework linking concepts, methods and metrics.

The UNDP in 1991 defined vulnerability as "the degree of loss to each element should a hazard of a given severity occur". Vulnerability is considered as the extent to which a community, structure, service, or geographic area is likely to be damaged, in relation to the probability of occurrence of a specified natural hazard at a specified severity level, in a specified future time (UNDP, 1991). The concept evolved as term of art and solid base to implement assessment methods in different research milieus such as climate impact analysis (Timmerman, 1981), disaster management (UNDRO, 1979), food security (Chambers, 1989; Dilley & Boudreau, 2001), and sustainability research (Turner et al., 2003).

In the food security context, the FAO specified that vulnerability is the relationship between three elements: risks, resulting shocks and resilience (FAO, 2004). The coupled risk-shock system affects the population wellbeing and the food security, while resilience concerns the strategies implemented to avoid the impact of shocks. Consequently, vulnerability is positively correlated to shocks' impacts and inversely correlated to resilience (FAO, 2004). If, on the one hand - in the natural disaster management approach to vulnerability - the degree of damage was found in the functioning of the socioeconomic assets, on the other hand food security specialists applied vulnerability for measuring the intensity of famines (Dilley

& Boudreau, 2001). Hence, it is possible to define the FAO approach to vulnerability in food security analysis as a direct *outcomes-approach*, whilst the natural disaster method is rather a *causal factors-approach*, describing the interconnectedness succeeding until the outcome. This different vision led to a lack of common understanding on the definitions of the central concepts, and to further disagreements about data needs and interpretations of vulnerability assessment (Dilley & Boudreau, 2001).

In order to explain this dichotomy of vulnerability approaches (between *outcomes-* and *causal factors-approaches*) we refer to the notions introduced by Sen in 1981. The access dimension, as determinant of famines, was added to analyze food security, reaching far beyond the availability factors. Then it was acknowledged the shifting from the natural causes to the societal causes of famines (Blaikie, Cannon, Davis, & Wisner, 1994) and vulnerability was indicated for assessing the multifaceted network of socioeconomic determinants of food insecurity (Borton & Shoham, 1991; Maxwell & Frankenberger, 1992; Middleton & O'Keefe, 1998; Ribot, 1995; Swift, 1989). Coherently, Chambers (1989) and Downing (1991) made considerable efforts in converting the Sen's analysis into assessment methods, but a lack of developed theory and of accepted indicators emerged. A main consequence was the wide acceptation of the expression "vulnerability to famine", which included the direct relation to the final outcome, becoming a protracted notion in food security literature, largely applied for assessments. Therefore, the adaptation of the concept of vulnerability to assessment methodologies became more complicated because of the a priori *outcome-approach*, making harder the identification of the causal factors (Dilley & Boudreau, 2001).

The definition of Downing (1991) strengthens the causal factors-approach, by stating that vulnerability is "a relative measure, for a given population or region, of the underlying factors that influence exposure to famine and predisposition to the consequences of famine" (p. 9). Causal factors are then identified in exposing and predisposing a "given population or region" to the causes-related final results of famine, taking into account the specific features of exposure and sensitivity. Therefore, an adequate solution is here identified in a deeper specification of the particular vulnerabilities and on the related causal factors of a wide and complex sequential phenomenon. This causal-factors specification will allow a dynamic analysis of the vulnerability hotspots instead of a static identification of the vulnerability to a broad and general final outcome. A broad vulnerability analysis leads to policy interventions that are not enough focused to determine the specific requirements for implementing actions. Diversely, the specific vulnerability assessment targets precisely the singular identified problems, in order to recommend the related interventions and scales of policies needed to reduce the vulnerabilities (Ionescu, Klein, Hinkel, Kumar, & Klein 2009; Luers, 2005). A vertical fragmentation of the broad vulnerability in an integrated general framework - where the particular vulnerabilities are adequately specified - represents a first response to the problem of lacking of a causal factor analysis.

One key conceptual element required is a clear separation between selected causal events and outcomes (Dilley and Boudreau, 2001). Further analyzing the concept of vulnerability, Downing (1991) specified that "vulnerability is the composite of two prospects: risk of exposure and risk (or magni-

tude) of consequence". For this, the exposure to the risk of experiencing a dangerous circumstance is distinguished from the likelihood of enduring specific magnitudes of possible consequences that result from the exposure. Since vulnerability is a relative measure, the exposure of individuals/households/countries/regions is related to their specific conditions face to a risk. Coherently, the magnitude of the consequence is linked to the particular predisposition and sensitivity expressed face to the exposure, and resilience integrates the responses that it is possible to implement, considering the exposure and the sensitivity degree. Accordingly, the causal sequence is identifiable in the exposure-risk component of vulnerability, and the outcome, is recognizable as part of the sensitivity-shocks component.

Nevertheless, the strengths and success of a vulnerability approach depend strictly on the quality of the application. So, in order to prevent erroneous applications of the vulnerability analysis, Dilley and Boudreau (2001) give some fundamental indications than consist in avoiding four main detrimental *modi operandi*:

- The use of vulnerability related to the final consequences rather then to the causal factors;
- The lack of specificity in the definition of sensitivity and hazards exposure;
- The inaccuracy in the characterization of the relationship of connectivity between sensitivities and the susceptible targeted elements;
- The imprecision in identifying measurable outcomes, by using thresholds.

Vulnerability analysis for multidimensional sustainability

The vulnerability approach evolves with Turner et al. (2003), who acknowledge that vulnerability analysis is necessary to implement the research on sustainability, referring in particular to the coupled human-environment systems. So, the analysis and assessment of vulnerability are supposed to provide a conceptual and methodological valid approach to the understanding of (un) sustainability.

According to the definition of sustainability of the agro-ecosystems coined by Conway (1985) "Sustainability is the ability of a system to maintain productivity in spite of a major disturbance, such as caused by intensive stress or a large perturbation" (inventoried by Hansen, 1996), and to the UNDP (1991) definition of vulnerability as the "degree of loss to each element should a hazard of a given severity occur", the vulnerability concept can be applied for its capacity to give a specular negative but constructive analysis of sustainability. Then, if sustainability is the dynamic condition of a given system to reproduce itself over the time and in the space, then the vulnerability - as sequence of phenomena due to a change that involves the system over the time and in the space[1] - provides the elements to understand the characteristics and the mechanisms affecting the system and those permitting to perpetuate its reproduction.

Moreover, the above-mentioned need of causal-factors analysis calls for a necessary multidimensionality of vulnerability, and the sustainability approach to the analysis of food insecurity already involves the segmentation in several specific dimensions that can be considered as vulnerability issues. Indeed, food insecurity and the unsustainability in food systems are both multidimensional

1. Time and space represent the "places" where the system "meets" the changes, as the "movement" occurs with vulnerability and for, or against, sustainability.

issues that need a wide-spectrum analysis in order to target theirs several main critical hotspots and causal factors. A multidimensional vulnerability approach to the analysis of (un)sustainability answers and adequately fits the multisectoral demand of assessment.
Furthermore, Turner et al. (2003) reaffirmed the need for robust vulnerability analysis and the role of sustainability and global change science in improving the bonds between the science problem and the decision-making needs. Previously, Dilley and Boudreau (2001) manifestly underlined the importance of adopting an experimented and efficient framework for informing and guiding policy makers: "Practitioners may wish to consider applying the general disaster formulation in actual situations to evaluate its relevance for program decision-making" (p. 245).
Therefore, the vulnerability approach is here considered as a double functional tool. It provides a logical conceptual basis and the method to build up a framework that leads the attention on: vulnerable people or entities to shocks; how and where the shocks changed the living conditions; which are the response strategies; the identification of the multiple metrics that assess the phenomena.

Results

Identification of a multidimensional vulnerability framework
According to the recent application by Hughes et al. (2012), the methodological approach to vulnerability assessment, by mean of a national-level vulnerability index, identifies three components of indicators interacting with vulnerability and confirms what it is widely acknowledged: the assessment of vulnerability is composed of exposure, sensitivity, and adaptive capacity indicators (Adger, 2006; Adger & Vincent, 2005; Allison et al., 2009; Cinner et al., 2011; Gallopin, 2006; Grafton, 2010; Kelly & Adger, 2000; Smit & Wandel, 2006).

Framework functioning
Vulnerability has been repeatedly calculated through multidimensional score systems, as in Cinner et al. (2011), Hughes et al. (2012), Manarolla (1989), and in Rastoin, Ayadi, and Montigaud. (2006).
In particular, in Cinner et al. (2011) and Hughes et al. (2012), vulnerability was calculated as Exposure + Sensitivity – Adaptive Capacity (as in Fig. 2). Lower levels of the final score indicate lower levels of vulnerability. Following the original structure designed by Hughes et al. (2012) for describing the practical calculation of vulnerability, we modified the outline keeping the same logical sequence of the signs. The order and the signs used for the calculation of vulnerability explicit the relationships between the three components. Several *n* vulnerabilities and components are listed, to underline the deep specification of the multidimensional vulnerability approach.

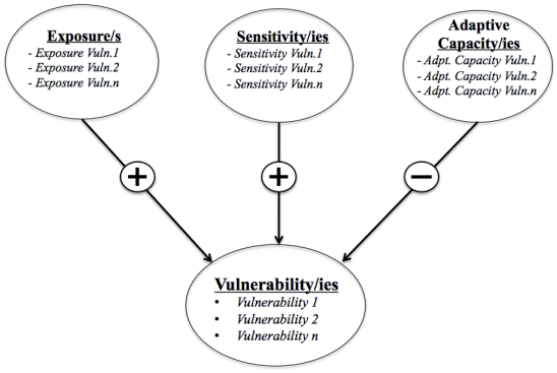

Figure 2. Calculation of Vulnerability (modified from Hughes et al., 2012).

In a metric-identifying approach for the vulnerability assessment, the indicators are expressed in different units of measurement. One analytical aim of studying vulnerability on a geographical scale is to obtain a ranking between several countries. Therefore, in several cases, the values of the vulnerability indexes are standardized. For instance, Hughes et al. (2012) normalized data of a specific geographical set of 27 countries, while Cinner et al. (2011) standardized the values of 29 local communities in 5 different countries and in the Global Food Security Index (GFSI) the data of 105 countries were harmonized (The Economist Intelligence Unit, 2011). In these three examples (two of them analyze vulnerability and the latter one tackles food insecurity) the standardization process operates on maximum values in the dataset, distributing them on a scale from zero to one (in the GFSI from 0 to 100), and using the classic normalization method "min-max" (Adger & Vincent, 2005; OECD, 2008):

$$X = (X - Xmin)/(Xmax - Xmin)^2$$

In this formula, Xmin and Xmax are, respectively, the lowest and highest values for any given indicator. The normalized value is then transformed from a 0 to 1 value (from 0 to 100 in GFSI) to make it directly comparable with other indicators expressed in the same scale. That means that the indicator with the highest raw data value will score 1 (or 100 in GFSI), while the lowest will score 0.

In these examples, the scores are normalized and then aggregated across categories to enable a comparison of broader concepts across countries. Normalization rebases the raw indicator data to a common unit so that it can be aggregated.

Finally, in our particular case the *n* specific vulnerabilities will be calculated following this formula:

$$V = (E – Emin / Emax – Emin)+(S – Smin / Smax – Smin) – (AC – ACmin / ACmax – ACmin)$$

Where:
V = Vulnerability
E = Exposure
S = Sensitivity
AC = Adaptive capacities

Another aspect that has to be considered is the weight, or quantitative relevance, that is associated to different domains and metrics. In Hughes et al. (2012) each component and the various metrics used to measure each component were equally treated. It was not used any weighting system. This choice was explained by the fact that weights reflect a value system specific to a given policy context, since the goal was not to guide country specific policies but rather to demonstrate the identification of a vulnerability index. In the GFSI the weighting assigned to each category and indicator can be changed to reflect different assumptions about their relative importance. In fact, two sets of weights are provided in the index. The first option, called "neutral weights", assumes equal importance for all the indicators and evenly distributes weights. The second option, called "peer panel weights", averages the weights that have been suggested from five members of the panel of experts, opening decisions to a participatory approach.

In a regional-geographic vulnerability assessment, several hypotheses can be developed for establishing common national domains of vulnerability and then the related weights. Therefore, it is possible to rank the countries in relation to their exposure, sensitivity and adaptive capacity vis-à-vis of a food unsus-

2. For the indicators where a higher value indicates a negative environment for food security, the normalization function takes the following form: X = - (X - Xmax)/(Xmax - Xmin).

tainability and insecurity in the agro-food system.

Relevance of a Vulnerability framework

It is possible to identify many opportunities of applying, through a suitable framework, the vulnerability approach to a large multidisciplinary, multidimensional and multisectoral approach for food insecurity and unsustainability.

The conceptual and methodological vulnerability approach allows improvements in developing metrics and information analysis through quantitative and qualitative data and novel methods, increasing the scientific knowledge through the vulnerability assessment (Adger, 2006; Dilley & Boudreau, 2001; Fussel, 2007; Locatelli et al., 2008; Sonwa, Somorin, Jum, Bele, & Nkem, 2012; Turner et al., 2003;).

Through a causal factors analysis – a further overture to the causal interpretation rather than analyzing the final outcomes - it is possible to identify the complexity and interconnectedness of the phenomena of change (Dilley & Boudreau, 2001; Watts & Bohle, 1993) and to provide dynamic tools, suitable for sustainability science (Turner et al., 2003).

The consequent gathering of information leads to a deeper interpretation of the phenomena for decision-making and for identifying response opportunities. This allows involving regional stakeholders in a place-based analysis and collaborative assessment (Adger, 2006; Dilley & Boudreau, 2001; Rastoin et al. 2006; Sonwa, 2012; Turner et al., 2003), understanding the vulnerability of a particular place (Turner et al., 2003) and opening to a geographical approach, in a given physical space where several environmental, social and economic food security vulnerability hotspots persist.

Furthermore this approach increases the multiple factor analysis for an interdisciplinary understanding of vulnerability, through a common general methodological framework suitable for different sectors, enlarging the range of expected outcomes compared to a one-dimensional vulnerability analysis (Adger, 2006; Sonwa et al., 2012; Turner et al. 2003).

Finally, one of the main goal-opportunity of a vulnerability approach consists in anticipating and predicting new hazards and changes to which a system may be exposed (Adger, 2006; Dilley & Boudreau, 2001; Rastoin et al., 2006; Turner et al., 2003).

Supporting decision-making

Policy responses and adaptive management strategies at the national-regional level need to be guided by vulnerability assessment. Vulnerability analysis is comprehensive, able to handle not only for a given system, but also for its many and varied linkages (Turner et al., 2003), as – for instance - for the whole sphere of activities linked to the agrofood system, comprising the agrofood chain (Ingram, 2011). In the case of food security and sustainability, the vulnerability approach allows finding, in a measurement framework, an opportune tool to practically evaluate, separately and conjointly, the main hotspots that lead to critical issues of the agrofood system. Hence, through a multi-level intersectorial and geographical analysis, a food chain approach allows a further ramification of a vulnerability framework to the unsustainable hotspots affecting, by means of specific stressors, the overall productive and supply agrofood activities, opening large opportunities in the research metrics starting by food security and sustainability. The results may suggest several different ways to develop context-specific policies and actions

to build adaptive capacities, or to decrease sensitivity and exposure.
The vulnerability assessment framework, in a given geographical region, proposes an innovative and transdisciplinary method for evaluating in multiple sectors and perspectives – as food security, sustainable diets and agrofood system - the stressors and the causal sequential factors where decision making and policy interventions are needed (Fig. 3).

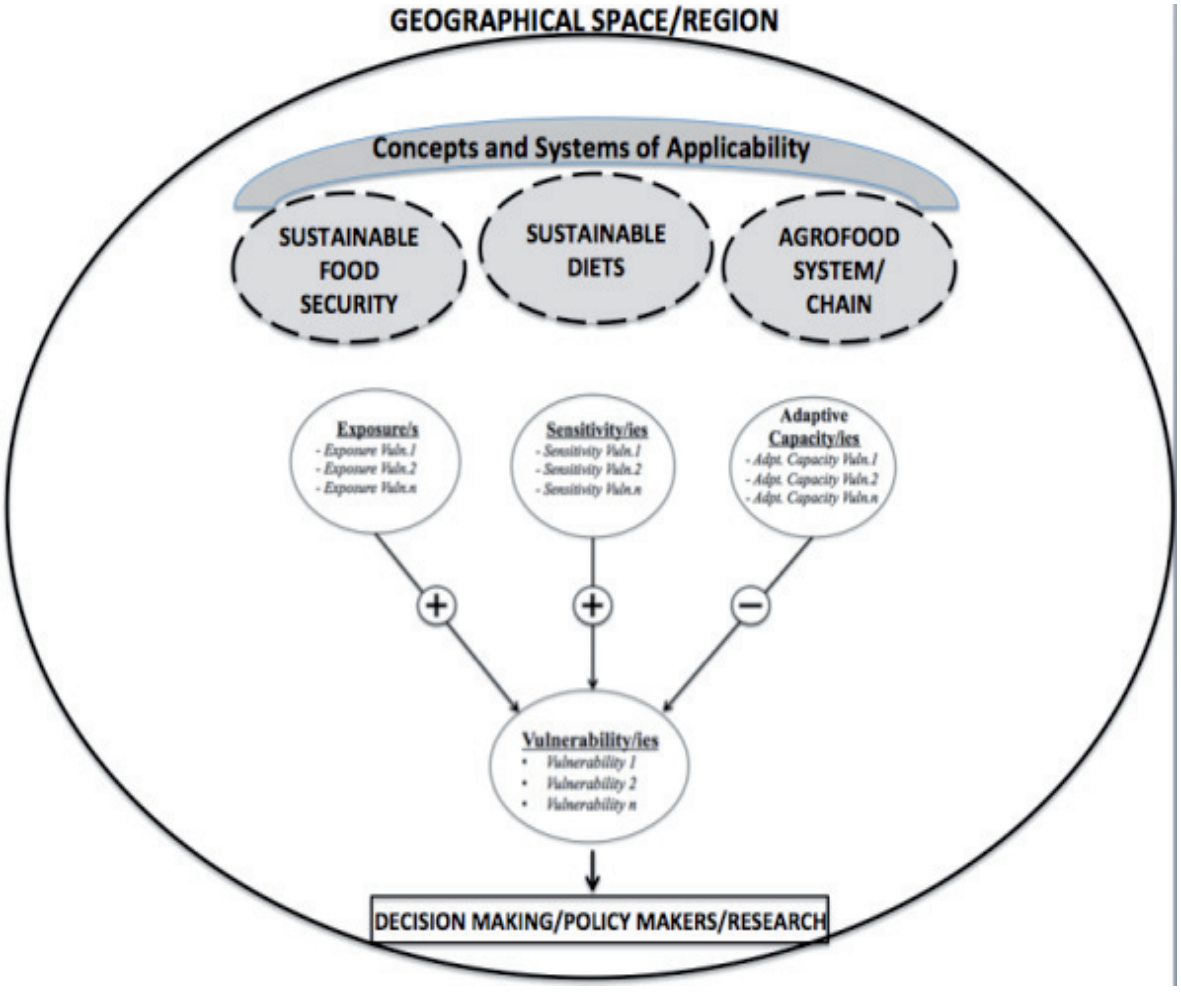

Figure 3. Potential fields of application of a vulnerability approach to critical domains in a given time and geographical space for informing decision-making strategies.

Conclusions

Food security and sustainability issues require precise definitions for multidimensional concepts, methodological approaches and metrics applications. Regarding the multidimensionality of the approach, it is acknowledged that the assessments based on one temporal-local scale, or just on one indicator, are no more considered as enough pertinent, since they act just on one component and can generate parallel or indirect undesired effects (Aubin, Donnars, Supkova, & Dorin, 2013; Vindigni, Peri, & Prosperi, 2011). Indeed, since the sustainability agenda grows further, there is a rising call for new types of system analysis and modeling tools that are able to simulate the future conditions of systems while capturing essential nonlinearities and complex behavior (Kates et al. 2001; Nicholson et al. 2009). However innovative analysis frameworks and system modeling that are able to largely understand and comprise the systems dynamics, are often challenged for accuracy.

A vulnerability conceptual and methodological approach for investigating on food insecurity and unsustainability domains is strictly linked to the identification of a methodological framework functioning as an architectural net for the assessment of exposure, sensitivity and adaptive capacities.

As several previous scientific experiences confirm, different specific advantages emerge from applying a vulnerability approach. The vulnerability-based development of novel methods, metrics and information analysis supports the scientific knowledge and the understanding of the phenomena of change occurring in local food systems, providing elements for implementing response opportunities and decision-making interventions, improving the predictive capacities to new hazards and changes, and increasing the regional involvement of stakeholders through participative context-based assessment. The analytical frameworks that take into account the causal and sequential factors of vulnerability, in an interdisciplinary perspective, provide dynamic tools for sustainability science and for understanding different sectors of activities through multidimensional lens.

Still, a deep and multidimensional understanding, of the causal factors engendering vulnerability related to food insecurity and unsustainability, represents the mean to get an evidence-based scientific knowledge of the agrofood dynamics and to get quantitative and qualitative information. So, the conceptual and methodological phases must lead to the identification of a suitable system of variables and appropriate metrics.

Sustainability assessments open three big challenges for scientific research: decision-making, participation and resilience. Since indicators inform action (Barrett, 2010), they are essential to establish the communicative link between science and policy-makers. However, it is important to define issues and challenges of food security and sustainability before choosing methods (Aubin et al., 2013). Targeting geographical areas, local actors and institutional stakeholders are key in order to define the hotspots of vulnerability of a specific region within a participative framework. Stakeholders can respond with coping strategies to rule the economic, financial, social and institutional changes, and managing the opportunities coming from risks effects, searching in their human, physical and social assets, and transforming changes and resources in capabilities to overcome the shocks impacts and be prepared for the next risks. Furthermore, since resilience represents - for institutional and actors' contexts and dynamics - the stakeholders' capacity of reactivity to institutional changes towards

sustainability (Conway, 1985; Strunz, 2012), the implementation of adaptive capacities still remains a major challenging opportunity for sustainable food security.

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Assessing Food Security: Economic Issues in Southern Mediterranean Countries

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Abstract

Food security is a subject of high relevance for many countries in the Mediterranean Basin, where agricultural production variability and structural dependency from imports are major issues that led to dramatic consequences for a large part of the population in occasion of the recent upsurge in international food prices and economic crisis. The aim of this paper is to highlight the main economic issues affecting food security in a selection of Southern Mediterranean Countries (Algeria, Egypt, Libya, Morocco and Tunisia), in order to improve policy guidance. Based on an extensive literature review conducted, a reduced set of core indicators was selected and calculated, so as to provide empirical evidence of their food security and vulnerability structural conditions, as well as of their development over a twenty-year time span.

JEL codes: Q18, Q01, O13

Keywords:

Food Security, Vulnerability, Indicators, South Mediterranean Countries.

Introduction: food security and vulnerability economic issues

The recent international economic crisis has hampered the debate on food security and brought to prominence the need to monitor its development, so as to improve policy guidance. However, due to the multi-dimensional nature and complexity of the matter, food security assessment is a challenging task. To do that a plethora of different approaches and methods are provided, so that 200 definitions and 450 indicators were listed up already 15 years ago (Hoddinott, 1999).

Many papers in the scientific literature focus on the nutritional aspects of food security, while its economic aspects have been addressed less frequently and only in recent times. Nevertheless, there are many economic issues related to food security, whose relevance and trends can vary across regions and countries (Saravia-Matus et al., 2012).

Scarce productivity levels are a major constraint especially in most low-income countries, where it is hindered by a number of factors. Inefficiencies (such as higher costs and output losses) are experienced both at the farm level and at the market level. At the farm level, the major constraints are due to low cropping intensity and poor yields, water scarcity and insufficient irrigation systems as well as inadequate harvest equipment and storage facilities. At the marketing stage, inefficiencies relate to long travel distances and/or poor roads and vehicles.

Even in high-income countries, where farmers attain high productivity in the use of agricultural inputs, the efficiency and effectiveness of transport and retailing practices need

to be improved in order to provide safer and healthier food and to reduce food waste.
Finally, it is important to underline that often farmers are not able to react to market trends due to resource constraints and the difficulties to obtain timely access to market information, credit and extension services (Evenson and Gollin, 2003; FAO, 2009).
This is why the emphasis in the economic literature dealing with food security has lately shifted from income earning and purchasing power to food and market access (Smith et al., 2000; Tomlinson, 2011; Saravia-Matus et al., 2012).
Along with the food security concept, many authors have been induced to make reference to the concept of *vulnerability*. This idea has its origin in the 1970s as a response to the perception of disaster risk (Birkmann, 2006), but lately it has emerged more and more on the international agenda, as referred to risk exposure of countries and populations (Guillaumont and Jeanneney, 2011; Loening, and Ianchovichina, 2011, Ianchovichina et al., 2012; IFPRI 2012). As far as vulnerability to food insecurity is concerned, Guillaumont (2009) provides a definition that include and further elaborate the concepts proposed by previous authors. According to him, economic vulnerability is considered as the result of three determinants: *i)* shocks, *ii)* exposure and *iii)* resilience. Shocks can be of different nature, such as: environmental (drought, floods etc.), but also external shocks (trade and exchange, world commodity price instability) and they can have origin from market and political instability. The exposure to these shocks depends on the location and structure of the economy. Resilience concerns the capacity of countries to manage shocks and to cope with them.

Main trends in the Southern Mediterranean Countries (SMCs)

The issues discussed above are matters of high relevance for many Countries in the Mediterranean Basin, particularly those of the southern shore. In fact, the whole region is facing complex economic and social changes: on the one hand there is the necessity to satisfy the increasing and changing food demand of the growing population; on the other hand it is important to promote economic growth and adjust the agricultural production to food demand (IFPRI, 2012b).
A major issue in various countries is their structural dependency from imports to satisfy domestic demand. This condition led to dramatic consequences for a large part of the population in occasion of the recent upsurge in food prices and their volatility. In fact, the share of food expenditure on total income in SMCs is relatively high (35% to 55%), entailing a major exposure to shocks, such as food crisis and high food prices (Albers and Peeters, 2011). Furthermore, trade flows are significantly concentrated in few geographical regions and consist of a limited number of commodities. Namely, the most important origin and destination of SMCs' imports and exports is the EU market and the main commodities imported are cereals, in particular by Egypt, Algeria and Morocco. The lack of geographical and commodity differentiation entails a relevant exposure of SMCs agri-food sector and population to price and volume variability on international markets (Mulazzani and Malorgio, 2009; La Rovere et al., 2010).
As far as domestic markets are concerned, SMCs present many common features but also significant disparities either in food demand (food consumption patterns, food safety and nutritional conditions), food sup-

ply (agricultural production conditions, climate, integration into international markets,) and governments' policies (Belghazi, 2013). Overall, total available food supply has grown considerably over the past 40 years, reaching sufficient food availability - over 3,000 calories per person per day. In fact, average productivity per agricultural worker rose significantly in many SMCs during the last decade (from 2.3 thousand US$ per year to 3 thousand US$, at constant 2000 prices). However agricultural productivity is still highly sensitive to climate fluctuations (except Egypt), in particular rainfall, which can vary greatly from year to year. Moreover, there are strong disparities in income distribution and the diet is mainly vegetarian (only about 10% of total calories are of animal origin), cereals being the basic ingredient (Belghazi, 2013).

Objectives and methodology

Given these premises, the present paper intends to contribute to the identification of the main economic issues affecting food security and vulnerability in SMCs, by selecting and calculating a reduced set of core indicators.

As a preliminary step, we conducted an extensive literature review on more than 100 documents retrieved from the main research information online bibliographic databases (mainly Web of Science by Thomson Reuters and SciVerse Scopus by Elsevier), as well as from the web sites of major international institutions (EU, FAO, UN, USDA, World Bank), to explore the indicators used to assess food security and vulnerability to food insecurity conditions. Based on the FAO definition[1], the main dimensions of *i) availability* (such as food production, stocks and trade), economic and physical *ii) access* (incomes, expenditure, markets and prices), and *iii) utilisation* (sufficient energy and nutrient intake) were used to classify both food security and vulnerability indicators. In the case of vulnerability, a fourth dimension – *iv) resilience* – was added to account for the capacity of a country to cope with shocks threatening food (Guillamont, 2009). Following the approach proposed by Lovendal and Knowles (2006), we chose to focus on long-run trends - i.e. chronic food security (FAO, 2006) - and to consider the stability of the variables observed as a *proxy* for the probability of becoming food insecure (i.e. vulnerability).

As a second step, a qualitative evaluation of the existing food security indicators was conducted, based on the application of relevant selection criteria and in accordance with the objectives of the study (Habicht and Pelletier 1990). To do that, the so called "S.M.A.R.T." criteria (which is frequently used in the context of sustainable development and evaluation of projects) is adopted, entailing that each indicator has to be: *i) specific, ii) measurable, iii) achievable, iv) relevant* and *v) time-bound* (Bossell, 1999).

Finally (third step), the indicators selected are calculated with specific reference to the five South Mediterranean Countries of the African shore (Algeria, Egypt, Libya, Morocco and Tunisia), so as to provide empirical evidence of the development of their food security conditions. In order to obtain a measure of food (in)security and vulnerability a "cut off point" should be defined. However Lovendal and Knowles (2006) acknowledge that "*no standard exists that defines this threshold*". In order to overtake this obstacle,

1. According to FAO, food security exist when "(...) all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active healthy life" (FAO, 1983, 1996).

in this study we will focus on the structural (or chronic) dimension of food security and vulnerability (FAO, 2006), assessing their improvement or deterioration over a twenty-year time span, divided in seven sub-periods of three years each.

Results

The indicators selected and their calculations are resumed in Table 1 and described in the following paragraphs.

	Food Security	Vulnerability
Availability	Per capita primary production Per capita food consumption	Per capita food production variability Arable land equipped for irrigation
Access	Rail lines and road density Income per capita Income distribution	Domestic food price volatility Value of food imports over total merchandise exports Food import dependency
Utilization	Dietary supply adequacy Percentage of stunted children	Per capita food consumption variability
Resilience	n.a.	Political stability and absence of violence

Table 1. Selected indicators.
n.a. – not applicable. Source: authors' elaboration.

a. Food security assessment

Availability dimension of food security

The first indicator used to assess the *availability* dimension of food security is *per capita primary production*, quantifying the availability of the main agricultural commodities. The indicator is calculated considering the quantity of primary equivalent crop and livestock domestic production available through FAO commodity balance sheets (FAOSTAT database), divided by population. The results obtained show that the most produced commodities are vegetables, fruit and cereals. Fruit and vegetables are mostly exported, thus contributing to the economic development of the country but not to their internal self-sufficiency. From the 90s to present production of fruit and vegetables has considerably increased for most countries, namely Egypt (respectively from 84 to 126 kg/capita/year and from 158 to 258 kg/capita/year), Tunisia (from 87 to 117 and from 195 to 268) and Morocco (from 87 to 107 and from 117 to 168). Cereals production is rather stable over the latest 20 years in all countries and it is particularly high in Egypt (about 267 kg/capita/year in 2008-2010). Animal productions, such as milk and meat are available in smaller amounts, even if milk production has almost doubled in Tunisia, Algeria, Egypt and Morocco over the time span considered.

The second indicator - *per capita food consumption* - refers to the total amount of foodstuff available for human consumption, and it is calculated adding the total quantity imported to the total quantity of foodstuffs produced, adjusted to changes in stocks during the reference period (FAOSTAT database). SMCs dispose of quite a large amount of cereals (from 200 kg/capita/year in Libya to 255 kg/capita/year in Morocco), which are only in part derived from domestic production, while relevant volumes are imported.

Other commodities which are available in large amounts for consumption are vegetables (204 kg/capita/year in Libya, 170 in Egypt and Tunisia) and milk (especially for Algeria, Tunisia and Libya, with about 80-90 kg/capita/year). Overall, the quantity of food available in SMCs remains stable over the last 20 years for all the main food categories considered - cereals, fruits and vegetables, meat, milk, oil crops and sugars.

Access dimension of food security

The *density of rail lines and roads* are used as indicators to assess the conditions of physical access to food markets. The results obtained show that infrastructure endowment in the SMCs is scarce and it has not improved significantly in the latest 20 years. Rail line density is higher in Tunisia (around 1.3 kilometres per 100 km^2) and much lower in Morocco and Algeria (respectively 0.5 and 0.2) and it improved slightly only in Egypt (from 0.45 to 0.51). Similarly road density remained stable in Egypt, Tunisia and Morocco (respectively about 10, 12 and 13) and improved slightly in Algeria from 3.8 to 4.7 kilometres per 100 km^2.

Two further indicators were used to assess economic access conditions. The first one is *income (GDP) per capita* that gives information on economic growth. In SMCs, GDP per capita shows an increasing trend - hence an amelioration in the economic conditions - for all countries, especially Tunisia, Egypt and Morocco (respectively +85% and +76% and 63%). However, Egypt remains the country with the lowest GDP per capita (1,556$) among SMCs, while Libya has the highest value (8,750$), followed by Tunisia, Algeria and Morocco (Table 2).

	1990-92	1993-95	1996-98	1999-01	2002-04	2005-07	2008-10	2011-13
Algeria	2,532	2,352	2,429	2,545	2,791	3,034	3,111	3,176*
Egypt	882	931	1,023	1,134	1,191	1,315	1,502	1,556*
Libya	n.a.	n.a.	n.a.	6,761	6,899	8,200	8,750	n.a.
Morocco	1,504	1,471	1,572	1,641	1,833	2,048	2,285	2,448*
Tunisia	2,065	2,183	2,417	2,716	2,977	3,371	3,735	3,735*

Table 2. GDP per capita (constant 2005 US$).
* average 2011-2012; n.a. – not available. Source: author's elaboration on World Bank data.

The second indicator measures inequality in *income distribution*. This is actually a major issue in SMCs, where the 10% richest part of the population earns 30% of the total income, while the poorest 10% earn only 3% of GDP. These figures show that there are serious constraints to access food for the poorest population (USDA, 2011). The Gini index (G) calculated by World Bank (World Development Indicators database) and Eurostat (SILC database) was used to quantify the extent to which *income distribution* among individuals deviates from a perfectly equal distribution (i.e. G=0). Results show a significant heterogeneity in SMCs, ranging from 30.8% in Egypt to 36.1% in Tunisia and 40.9% in

Morocco (as compared to values of 30% in Europe and 22% in Scandinavian countries). According to the information available, income distribution hasn't changed significantly in the last 20 years.

Utilization dimension of food security
The first indicator selected and calculated to assess the utilization dimension of food security is *average dietary supply adequacy* (FAOSTAT), measuring the percentage of the population at risk of not meeting standard food requirements, in terms of energy supply (calories). The calculations carried out show that SMCs food supply can be considered adequate. In fact the indicator has values well over 100% - the lowest values being those of Algeria and Libya at 136%. Furthermore, all countries show a constant trend since 1990, with the only exception of Libya (Table 3).

	1990-92	1993-95	1996-98	1999-01	2002-04	2005-07	2008-10
Algeria	133	132	128	129	132	133	136
Egypt	142	144	146	146	143	143	145
Libya	144	141	139	136	136	137	136
Morocco	135	130	136	134	137	138	138
Tunisia	140	139	143	143	139	139	140

Table 3. Average dietary supply adequacy (%).
Source : authors' elaboration on FAOSTAT data.

The second indicator considers the *percentage of children under 5 year of age who are stunted*. Children are actually the part of the population most responsive to changes in living conditions, due to the high physiological nutrient requirement for their growth (IFPRI, 2012b). The measure is provided by World Bank (World Development Indicators database) and it is based on household surveys, so that information is often fragmentary. According to the latest data available, lower values of the indicator are found in Tunisia (9% in 2005-07) and Algeria (about 16%), entailing better food security conditions, while Libya, Morocco and Egypt present higher percentages. However, Morocco and Algeria have progressively ameliorated their situation - Algeria passed from 22.9% in the '90s to 15.9% in 2005-07, Morocco from 29.9% in the '90s to 23.1% in 2002-04. Egypt presents the most critical situation, with a percentage of stunted children that has progressively increased since 2005.

b. Vulnerability assessment

Availability dimension of vulnerability
The indicators selected and calculated to assess the availability dimension of vulnerability are *i)* the *per capita food production variability* and *ii)* the *percentage of arable land equipped for irrigation*.
Per capita food production variability is defined by FAO as the standard deviation of the net food production value in constant prices, divided by population. Table 4 shows that higher variability is observed in Tunisia (with a standard deviation between 38 and 62, with the only exception of the 2008-10 period) and Morocco (from 12.8 to 28.6), while

Algeria, Libya and (especially) Egypt have a more constant trend in food production. The oscillation of the food production over the years in SMCs is mainly attributable to climatic reasons, such as droughts, that hinder the achievement of stable food security conditions. Moreover great production variability induce these countries to rely more and more on imports to satisfy their domestic food requirements, thus increasing their exposure to international markets and external shocks (Table 4).

	1990-92	1993-95	1996-98	1999-01	2002-04	2005-07	2008-10
Algeria	5.1	8.9	9.9	11.0	5.5	10.3	15.5
Egypt	8.8	7.3	5.3	5.1	7.9	5.4	8.8
Libya	5.4	4.8	10.0	8.1	13.5	3.4	3.9
Morocco	15.6	21.4	28.6	23.7	12.8	14.0	20.5
Tunisia	38.1	45.4	62.2	57.2	48.0	45.5	15.8

Table 4. Per capita food production variability. Source: Authors' elaboration on FAOSTAT data.

The *percentage of arable land equipped for irrigation* is useful to assess structural adequacy and innovation in the agriculture sector. Watering land is scarce in most SMCs, with the only exception of Egypt, where it covers 100% of arable land ever since 1990 (Table 5). Algeria shows the lowest value of the indicator (7.6% in 2005-07), followed by Tunisia and Morocco (15.5% and 18%). Higher values are observed in Libya, where around 27% of arable land is equipped with irrigation. Furthermore, while Morocco and Tunisia show a significant improvement of their watering land over the latest 20 years (respectively +25% and +20%), the share of arable land equipped with irrigation is steady in Algeria and Libya. This is a major factor exposing SMCs agricultural production to adverse climate conditions, thus reducing productivity and increasing their vulnerability to food insecurity.

	1990-92	1993-95	1996-98	1999-01	2002-04	2005-07
Algeria	6.8	7.4	7.4	7.4	7.6	7.6
Egypt	100.0	100.0	100.0	100.0	100.0	100.0
Libya	26.0	25.6	24.0	25.9	26.2	26.9
Morocco	14.3	13.9	14.0	16.1	17.0	18.0
Tunisia	13.0	12.4	13.4	13.8	14.7	15.5

Table 5. Arable land equipped for irrigation (%). Source: authors' elaboration on FAOSTAT data.

Access dimension of vulnerability

The economic *access* dimension of vulnerability was assessed by means of three indicators, namely *i)* the *domestic food price volatility*, *ii)* the *value of food imports over total merchandise exports* and *iii)* the *import dependency ratio*.

Domestic food price volatility is an index of observed variability in the annual food price level index (calculated as its standard deviation), aimed at capturing the consequences of all factors that determine local imbalances in the food market (FAOSTAT database). Data available (no data for Algeria and Libya are provided) show an increasing trend in food price volatility in Tunisia and particularly in Egypt, while domestic food prices in Morocco seem to be more stable, with a decreasing variability over the years - from a 23.7 to 14.2 (Table 6). This might depend on the presence of policies of control and subsidies, adopted to make the countries less vulnerable to price changes.

	1990-92	1993-95	1996-98	1999-01	2002-04	2005-07	2008-10	2011-12
Algeria	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Egypt	n.a.	n.a.	32.7	16.8	30.5	67.2	58.2	72.2*
Libya	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Morocco	n.a.	n.a.	23.7	25.2	14.9	12.1	12.8	14.2*
Tunisia	n.a.	n.a.	10.1	16.6	17.2	10.3	17.7	22.5*

Table 6 - Domestic Food Price Volatility (food price index standard deviation).
* average 2011-12; n.a. – not available. Source: authors' elaboration on FAOSTAT data.

Table 7 shows the *value of food imports over total merchandise exports*. This indicator captures the ability of a country to finance food imports through exports of goods and services (IFPRI, 2012). Higher values of the indicator show higher vulnerability, due to the reduced capability to finance food imports through total merchandise exports. Egypt and Morocco present the highest values of the indicator, respectively 33% and 20%. Libya presents the lowest value (4%), followed by Algeria and Tunisia (both around 10%). From 1990 to 2010 Morocco vulnerability increased, as the indicator value increased from 15% to 20%. Figures related to all other SMCs show a decreasing trend, entailing lowering vulnerability.

The *food import dependency* ratio provides information on the extent to which a country is dependent on imports to meet its domestic demand. The main commodity group imported by SMCs are cereals. Libya is the country most dependent on cereals imports, followed by Algeria, Tunisia, Morocco and Egypt. This phenomenon shows different trends over the years. On the one hand, Libya reduced its import dependency for cereals from 104% in the 90s to a 84% in 2008-10. On the other hand, Morocco has increased its cereals import share from 28% in the 90s to 53% in 2008-10. Import of sugar and sweeteners, milk and vegetables are also very important for most SMCs. As far as sugar and sweeteners are concerned,

	1990-92	1993-95	1996-98	1999-01	2002-04	2005-07	2008-10
Algeria	16	27	20	13	12	7	10
Egypt	69	59	59	46	29	25	33
Libya	9	12	11	9	6	3	4
Morocco	15	24	21	17	16	17	20
Tunisia	11	12	11	9	9	9	10

Table 7. Value of food imports over total merchandise exports (%).
Source: authors' elaboration on World Bank data.

	1996-98	1999-01	2002-04	2005-07	2008-10
Algeria	59	31	31	29	31
Egypt	35	17	24	62	51
Libya	17	22	12	23	23
Morocco	70	57	45	28	27
Tunisia	36	70	78	30	28

Table 8. Per capita food consumption variability.
Source: authors' elaboration on FAOSTAT data.

Algeria, Libya and Morocco show very high values of import dependency - respectively 102%, 96% and 68%, in 2008-10). Dependency ratios for these commodity groups remain quite constant over the years from 1990 onwards.

Utilization dimension of vulnerability
The indicator selected and calculated to assess the utilization dimension of vulnerability is *per capita food consumption variability*. This indicator corresponds to the variable food supply total in kcal/capita/day as estimated by the FAO Statistic Division. The variability is obtained as the standard deviation over 5 years of the deviation from the trend of per capita food supply observed during the period 1990 to 2010. Besides the adequacy of the dietary supply described above (see section 3.1.3), SMCs show a significant variability in per capita food consumption. Higher values of the index (i.e. higher vulnerability) are observed in Tunisia and Morocco, while the lowest in Libya (Table 8). Looking at the 20 year trend, per capita food consumption vulnerability is increasing in Egypt and Libya, while reducing in Tunisia and Morocco.

Resilience dimension of vulnerability
The resilience dimension of vulnerability has been assessed by means of the *political stability and absence of violence* indicator, quantifying the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including

politically-motivated violence and terrorism. World Bank calculates this indicator (World Wide Governance Indicators database) based on different types of data sources (surveys, NGOs, commercial business information providers, and public sector organizations), with values ranging from -2.5 (weak stability) to 2.5 (strong stability). According to the latest data available (Table 9), the most instable countries are Algeria (-1.20), Egypt (-0.68) and Morocco (-0.54). On the other hand, in Libya and Tunisia positive values of the indicator are observed (respectively 0.49 and 0.15). Overall, from 1996 onwards, resilience improved in Libya and, to a lesser extent, in Algeria, while it worsened significantly in Morocco. However it should be noticed that, the indicator is not sufficiently up-to-date and does not provide information on the latest riots occurred, which have exacerbated the situation.

	1996-98	1999-01	2002-04	2005-07	2008-10
Algeria	-1.91	-1.50	-1.61	-1.04	-1.20
Egypt	-0.32	-0.01	-0.64	-0.69	-0.68
Libya	-0.99	-0.40	0.07	0.50	0.49
Morocco	-0.05	-0.17	-0.35	-0.51	-0.54
Tunisia	0.18	0.28	0.17	0.17	0.15

Table 9. Index of political stability and absence of violence.
Source: authors' elaboration on World Bank data.

Conclusions

The study focused on the main economic issues affecting food security in Algeria, Egypt, Libya, Morocco and Tunisia. Based on an extensive literature review conducted, a reduced set of core indicators was selected and calculated, so as to provide empirical evidence of their structural (or chronic) food security and vulnerability conditions, as well as of their development over a twenty-year time span.

The results obtained show satisfactory conditions in all SMCs concerning total food availability, average dietary adequacy, income level and economic growth. Critical aspects emerge from a closer examination of food production variability, farm structures and equipment, food access, and food utilization, particularly in terms of vulnerability.

A first major concern relates to the large oscillations taking place in domestic production, that are mainly attributable to climatic reasons (scarcity of water resources and droughts) and inadequate farm structures and equipment (irrigation). At the same time, a large share of agricultural commodities that are produced abundantly (such as fruit and vegetables), is usually exported. SMCs are then induced to rely more and more on imports to satisfy their domestic demand, thus increasing their exposure to international markets and external shocks (particularly for major commodity groups - e.g. cereals).

A further important distress relates to food access conditions that are impaired by important factors, such as the lack of adequate

infrastructures (rail lines and roads), price volatility and income inequality. As a result, a significant and increasing variability in per capita food consumption is observed, exposing the poorest population groups and children to increasing risks of food insecurity.
In order to reduce their vulnerability, SMCs should then adopt strategies aimed at improving agricultural productivity and market efficiency, production differentiation, trade and market integration. Technology enhancement is one of the key issue to stabilize productivity and boost efficiency, so as to achieve general food security objectives, both in its access and availability dimensions. Other useful strategies relate to the creation and enforcement of public-private partnerships (e.g. producer associations, cooperatives, etc.) aimed at supporting professional training and improving access to inputs and services (e.g. credit and insurance, certifications, etc.) for small and medium producers. Furthermore, efficiency in the food chains should be pursued by supporting networks of economic agents at various stages, from production to export, and introducing regulations which enhance market information and transparency and international trade opportunities. These measures may help producers to correctly perceive and react to market signals and benefit from opportunities or avoid threats arising from domestic and international markets. Overall, it is important to consider that these countries have recently entered into a process of economic and political transition so that policy design and implementation play a crucial role to control external shocks, reduce their disparities and improve their economic growth.

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How to Include Sustainability Criteria in Decision Making for the Food Sector? A Methodological Proposal

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Abstract
Political support to different food chain patterns often disregards a full assessment of their implications in terms of sustainability. This paper proposes an operative tool that, once these implications are measured, makes it possible to identify policy strategies able to pursue sustainability objectives for food systems, in the belief that they should be considered as decision-making key criteria. To do so, a conceptualization of food systems sustainability in three dimensions - environmental, social and economic - suitable to be measured through sets of indicators is suggested.
Then a multicriteria model can be applied in order to identify the combinations of different supply chain patterns allowing to maximize the contribution - or reduce the impact - on the total sustainability of the food system, within given constraints.
Results are summarized in the so-called "policies chart", a tool able to guide decisions of the local policy-makers in supporting the development of the alternative food chains.
JEL codes: Q18; Q01; C61
Keywords
Sustainability indicators; agro-food supply chain; multicriteria optimization; compromise programming; decision-making.

Introduction

This research fits in the current studies on sustainability of the agro-food sector. The search for innovative ways of organizing the food chain, which might contribute to the achievement of shared goals of sustainability, is a very topical issue in recent years.
A wide scientific and political debate has risen around how food production is distributed and sold in the market. This debate is driven, on the one hand, by the discussion about the environmental and social critical points of the big retail chains and, on the other hand, by the diffusion of short chains, often regarded as a more sustainable solution.
However, to what extent is it right to support, at the policy level, the development of such experiences? Addressing this issue from a scientific perspective essentially it means to measure the benefits associated with short food chains, in comparison with other marketing channels, with the aim to propose organization patterns of the agro-food systems able to maximize the achievement of sustainability goals.
Although many attempts to identify and to classify the benefits related to short food chains are reported in literature (the recent work of Kneafsey et al., 2013, being a very interesting synthesis of them), there is still a lack of an interpretative framework which could compound the different meanings of

the concept of sustainability to apply them at food chains and, at the same time, to translate the notion into variables and measurable indicators. An extensive review of the political and scientific literature on the topic, starting from the definition given by the Brundtland report in 1987 (WCED, 1987), allows the identification of its key features. Particularly important are the dynamic nature, the long-term perspective and the underpinning dimensions of sustainability, which, following the Triple Bottom Line approach (TBL; Elkington, 1998)[1] are identified in the environmental, social and economic spheres.
Therefore, a sustainability assessment of the food chain implies the need to measure:

- the impact of the food chain activities on the environment, e.g. resources consumption, GHG emission, soil degradations etc.;
- the contribution of food chains to social sustainability objectives, e.g. improving the network of relations within the community, enhancing trust among the people involved, assuring that quality food is available and affordable for everybody;
- the contribution that food chains can give to the local economy, in terms of value added produced, job creation, retention of money spent within the local system.

1. The TBL approach is the most common framework to develop the idea of sustainability into dimensions to be measured, namely the environmental, social and economic sustainability. Born in the business sector to understand what behavior of a firm may be considered "sustainable", it has been caught by many political documents about sustainable development. In the Report of the World Summit on Sustainable Development (EU, 2002) the slogan "planet, people, prosperity" has been coined, which builds on the TBL approach and proposes it as the key to interpret sustainability.

Indeed, in order to measure such concept, i.e. the sustainability level of a food chain, the contribution – or impact – on each of these dimensions should be assessed. Despite many theoretical issues that are to be clarified, different authors made this effort, thus demonstrating that it is possible to express the "sustainability performance" of a system through a set of indicators (Mineur, 2007; Mascarenhas et al., 2010; Moldan et al., 2011). Anyhow, once these indicators, whatever defined, are measured, the problem is how to use them to go beyond the simple descriptive analysis, with the aim to identify possible organization patterns for the food system able to achieve the highest level of sustainability.
In the paper a methodology is proposed which could help to identify the possible structure of a food system composed by such a combination of different chains – large retail, small retail and short chains – that makes it possible to maximise the sustainability performance of the system as a whole. The focus of the paper is therefore not on how to assess the sustainability indicators of different food chain patterns, but instead on how to combine this information in such a way that sustainable solutions for the food system are identified. Indeed, while it is the sake of researchers in the different fields to find suitable indicators to describe the environmental, social and economic sustainability performance of a food system, the search for convenient strategies to improve sustainability is a task for policy makers. It is clear that policy strategies should be aligned with the findings of the research, nevertheless the question is: how may policy makers use quantitative information provided by researchers to build up a "sustainable" strategy for the food system? Here, we make an attempt to answer this steering question,

which is not concerned with research on indicators, while it is strictly connected with policy making in the food sector.

Proposed methodology

The methodological proposal assumes that it is possible to express the level of sustainability of a given food chain through the assessment of indicators for its environmental, social and economic performances, in such a way that these measures are consistent with the definition of the three pillars of sustainability. This is the task, as we have clarified in the introduction, of the researchers expert in the related fields. The result of their effort would be a set of coefficients, expressing the environmental, social and economic sustainability of each food chain under analysis. If the aim, at the policy level, is to define development strategies for the food system of a given area, all the different food chain patterns active within it should be considered. The coefficients would therefore express the relative sustainability performance of each chain with respect to the others.

Then, the point is how to combine such information to identify the total level of sustainability of different food chain patterns. The existence of trade-offs among the environmental, social and economic issues of sustainability prevents the unambiguous identification of a "best chain"; thus the focus goes on which combination of the different food chain patterns allows for a higher sustainability performance of the whole system. A mathematical model would be useful to this purpose, identifying the solution able to maximise the total level of sustainability, given the context constraints. Such solution may be viewed as a goal to be reached, through the strategies implemented by policy makers.

A suitable model is, in this case, a multi-objective mathematical optimization (MOP – MultiObjective Programming; Cochrane & Zeleny, 1973) where each objective refers to one of the sustainability pillars. Usually, the environmental performances of a food chain are expressed in terms of impact, this is why the first objective of the model may be conceived as a minimization, whereas the social and economic objectives as maximizations, since the related coefficients are usually expressed as contributions that food chains could give to these two pillars of sustainability. The model could thus be written as:

$$\text{MIN} \quad f(A) = a_1 x_1 + a_2 x_2 + a_3 x_3 + \dots a_n x_n$$

$$\text{MAX} \quad f(S) = s_1 x_1 + s_2 x_2 + s_3 x_3 + \dots s_n x_n$$

$$\text{MAX} \quad f(E) = e_1 x_1 + e_2 x_2 + e_3 x_3 + \dots e_n x_n$$

where x_1, x_2, x_3, x_n are the unknown proportions of the n food chain patterns under consideration, while (a_1, a_2, a_3, … a_n), (s_1, s_2, s_3, … s_n) and (e_1, e_2, e_3, … e_n) respectively stand for the environmental, social and economic performances of the n chains.

Therefore, given the a_i, s_i and e_i coefficients, the model looks for the x_i values that are able to maximise the total sustainability of the system. In order to facilitate the interpretation of the results, the proportions of the food chain patterns (i.e. the x_i values) might be expressed in terms of market share of each chain instead of using absolute values, e.g. tons of marketed products or euros.

The optimal solutions is calculated within a given set of constraints, which might be categorised into:

- physical restrictions, e.g. related to the maximum local production achievable;
- consumer behaviour restrictions, given the well-known resistance to change shopping habitudes consumers show;
- logistics related restrictions, such as geographical distribution of the demand, perishability of products etc.

The solutions identified by the model may therefore suggest to market a certain quota of the basket of products analysed through each of the chains – large retail, small retail, short chain and others – in order to get the higher level of sustainability for the food system. The suggested quota for each chain clearly depends on the chains' sustainability coefficients that have been entered in the model, as well as on the constraints imposed. An example of the latter could be that the amount of locally grown product may act as a limitation factor to the development of the short food chain.

The efficient solutions may then be treated with a further methodological implementation, through the application of compromise programming (CP; Zeleny, 1973; Yu, 1973). CP evaluates the closeness of the solutions to the ideal point, thus measuring the degree of dissatisfaction with the failure to achieve the objectives, typical of each of the solutions analysed. Such assessment brings to the identification of the closest solution to the ideal, which displays the best compromise among the objectives, as well as the goal to which policy strategies in the food sector should be directed.

It is clear that the compromise solution emerging from the CP strictly depends on the weights that policy makers give to the different sustainability objectives: different compromise solutions apply when the importance given to environmental, social and economic sustainability of the food chains changes. Assuming, as an example, that the short food chain has a high economic sustainability performance, it is likely that solutions recommending an increase in the market share of short food chain would come out in a model where the economic issues of sustainability are weighted as important.

Solutions from the CP can be found for any possible combination of the weights among the three pillars of sustainability. This process generates a sort of "policies chart", where each optimal market share of food chains corresponding to an explicit system of preferences among the three pillars of sustainability is displayed. This tool would be a very easy-to-use guide for policy makers challenging with decisions in the domain of food system strategies.

Building a "policies chart": a first attempt

Although this paper essentially proposes a methodological contribution to an operational consideration of sustainability criteria in food policy decision making, a first basic application of the proposed model, in order to test its functioning and to face the interpretation of the possible results, is proposed. Such empirical validation of the model refers to the assessment of the sustainability level of three typical food chain patterns – large retail, small grocery store, short chain (referring to the most widespread experience, i.e. farmers' markets) – within the province of Viterbo, central Italy. These three cases have been modelled as "chain-types" and apples have been considered as the case-study product. Large retail is characterised by apples coming from outside the province, sold in a big supermarket; by small retail we consider family businesses managing a small store, with fruit coming mainly from outside the province; instead, at the farmers' market a direct connection between producers and consumers occurs, with all the apples sold coming from within the province. All the other possible food chains are considered as having a constant market share in the model.

As mentioned in the introduction, the aim is not to discuss how to get sustainability indicators to compare different food chains. Instead, the idea is to take the role of policy

makers, who get from researchers a set of environmental, social and economic indicators, and are willing to promote a sustainable policy strategy for the food sector.
Therefore, with the aim to simulate the results of sustainability assessment for the three food chains, a very simple qualitative evaluation of the environmental, social and economic sustainability was carried out. The scores derive by experience and knowledge about the local food sector, without any purpose of validation or reliability: the "marks" we gave to each chain only stand as an estimate which is functional to the application of the model.
Table 1 resumes the qualitative evaluation of the sustainability performance of large retail, small retail and farmers' market. They are expressed with a score ranging 1 to 10, which have been assigned following a relative criteria, as we had to answer this question: how sustainable is this food chain pattern in the apples market, with respect to the others, in the province of Viterbo?

Sustainability pillar	Large retail	Small retail	Short food chain	Objective
Environment (impact)	8	3	4	MIN
Society (contribution)	7	4	4	MAX
Economy (contribution)	5	4	6	MAX

Table 1. Sustainability qualitative coefficients used as input for the model

For environmental sustainability, a score of 1 stands for a minimum impact of the chain on the environment, whereas a score of 10 identifies the maximum impact. Literature supports our perception that large retail, with all the long-range transports connected to logistics, has the highest impact on the environment among the three cases. Short food chain is scored a little higher than small retail, given the claim by some authors (e.g. Edward-Jones et al., 2008) about the high rate of GHG emission per food ton typical of this case.
For social sustainability, a score of 1 stands for a minimum contribution of the chain to the local social network of relations and trust, whereas a score of 10 identifies the maximum contribution. Although some researches (e.g. Sommer et al., 1981) discuss short food chains' and small food stores' ability to put people in contact thus enhancing the network of relations of the community, there is evidence that they are not likely to involve a high number of consumers, while it is the case for large retail, which consequently gets a higher score.
Finally, in the evaluation of economic sustainability, a score of 1 (10) stands for a minimum (maximum) contribution of the chain to the local economy. Here, the short food chain has been scored the highest, because it enhances the retention of the money spent in the local economic system, activating the so-called multiplier effect (Bullock, 2000), and it improves equity among the food chain actors, giving to farmers' a higher share of the final price. Small retail is scored the lowest because of the limited value added achiev-

able, due to the many intermediaries needed between producers and consumers in this chain-type.
These coefficients are the basic input of the mathematical model used to determine the combination of food chains' market share allowing for a higher sustainability of the whole system.
However, there are some constraints to the market share of the three chain-types in the province of Viterbo, which should be included in the model:
Physical restrictions: the market share of short food supply chain cannot exceed the amount of apples locally produced.
Consumer behaviour restrictions: consumers might not accept sudden changes in distribution (see Kahneman, 2003 for more insights in the prospect theory and consumers' resistance to change), so a limited range of possible values of market share for the three chains around the current situation should be established;
Logistics related restrictions: in the province of Viterbo there are several villages where no supermarket is available; it is therefore likely, particularly for elderly people, that apples are bought in other food stores.
Running the MOP with the scores and the constraints as inputs, a set of efficient solutions is computed (Table 2).

Table 2 – The solutions of the efficient set

Efficient solutions	Market share*			
	Large retail	Small retail	Short food chain	Other chains
A	36,0	22,8	4,2	37,0
B	36,0	25,0	2,0	37,0
C	40,3	17,0	5,7	37,0
D	44,0	17,0	2,0	37,0

*Expressed in % of total apples sold in the area; other chains than the three considered are supposed to be constant

If the compromise programming is applied, with the three pillars of sustainability being equally weighted, the better solution is C, in which large retail and short food chain are improved at the expense of small retail. This solution is able to improve both the environmental and economic objectives, keeping at the same time a good level of social sustainability.
However, if the weights of the environmental, social and economic objectives are no longer equal, the compromise solution is likely to change. The results of the compromise programming, performed with all the possible weights, can be displayed on a graph that describes which solution is the best compromise for any degree of importance given to the three pillars of sustainability. If, for example, the weight sum is set equal to 3, the graphic representation appears as shown in Figure 1. Namely, the B solution only applies when all the importance is given to the environmental pillar (values close to 3 in the "environment" axis, which means values close

to 0 in the other two axis), whereas the D solution emerges when a very high weight is given to the social domain (values close to 0 for the "environment" and "economy" axis, values close to 3 for the "society" axis). The A solution applies when a high importance is given to the environmental sustainability and a medium importance is given to social and economic issues. Of course, the C solution stands for a wide range of combination of the weights, especially those in which economic sustainability is weighted important at the expense of environmental and social issues.

This chart might represent a very interesting tool for a decision maker who wants to identify the solution to be pursued in the political action, according to his own system of preferences. Indeed, policy makers need information in the right form to determine which choices would create sustainable trajectories. To be usable and effective, these tools should be developed in a way that the decision-maker can easily understand their meaning and choose readily among possible alternatives.

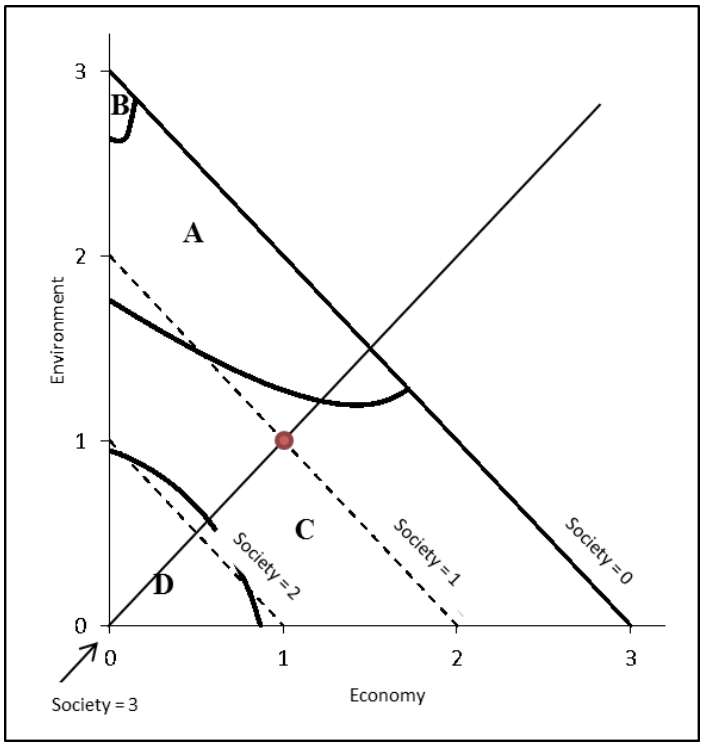

Figure 1. The "policies chart".
Note: the red dot identifies the equal-weight hypothesis.

We have named such figure "policies chart", because it acts as a guide to choose among different solutions. Indeed, the chart, while retaining the ability to attach greater importance to one aspect of sustainability rather than another, identifies the best combination of chains which corresponds to an explicit system of preferences, thus helping policy makers in identifying sustainability-improving strategies for the food sector.

Conclusions

The main aim of this research was to model the sustainability performance of different food chain in such a way that it is possible to identify an optimal combination in which the total sustainability of the food system is maximised. To do so, a multi-objective programing, followed by an analysis of the compromise solutions, has been proposed. The "policies chart" that emerges from such an analysis is a very interesting output, with significant potential applications. Indeed, it might be able to guide the definition of the policies basing on empirical evidences anchored to a theoretical model, rather than on subjective judgments or beliefs.

Of course, the problem is how to calculate the indicators to input to the model, but several authors have argued that indicators might change according to the type of chains and the territory under investigation. The results of the application of the proposed methodology would be much more reliable and replicable if a convenient set of indicators, coming from a much deeper study in the field, could be found for food chains of the same area.

However, the contribution this paper aims to give to this debate refers to what could be achieved in terms of support to decision making after the indicators have been calculated, rather than how to measure them. This allows to explicitly include in the processes of political decision the issue of sustainability, no longer considered as a vague and indeterminate concept but quantitatively defined and empirically measured.

More research has to be done to find convenient sustainability indicators for different food chain patterns. If a more reliable set of indicators could be achieved, the methodology could provide a "real" policies chart, which might be used for the identification of food strategies with the aim to drive food system to a higher level of sustainability.

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SOCIAL SUSTAINABILITY IN AGRI-FOOD SYSTEM

Farmers Decision Making in Civic Agriculture

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Abstract

Reciprocal interactions among farmers and consumers can be seen as the central point of market exchanges in Civic Agriculture (CAs). This work exploits the concept of *social embeddedness* as a conceptual tool for describing some phenomena related to CA. *Social embeddedness* concept might help to understand how consumers and producers behave in the market beyond the paradigm of neoclassical economics theory. The objective of this study is to empirically evaluate which attitudes may influence farmers decision to participate to several types of CAs. Our results confirm the strong role of *social embeddedness* phenomenon in those forms of CAs characterized by personal relations between farmers and consumers: A greater presence of community relations implies a greater role of *social embeddedness* on farmers decision.

Keywords: local food, farmers' attitudes, psychometric scales, ESDMF, EFAS.

JEL Classification: Q13, P32, Q56.

Introduction

In the two last decades the common opinions about the damages caused by intensive resources conventional agriculture practises have become apparent (Lyson, 2002). Disastrous consequences of "industrial agriculture" (IA) have been experienced such as degree of soil erosion, pollution, fossil fuel consumption, and rural and local community devastation (Conner, 2004; Caracciolo and Lombardi, 2013). Due to the concern about safeguarding of environment, human health and protection of varieties and resources, an increasing number of consumers start to ask for a more sustainable agriculture system and search for an alternative model of production and distribution of food (Nygard and Storstad, 1998; Marsden et al, 1999; Hendrickson and Heffernan, 2002; Caracciolo et al., 2011). Civic agriculture, developed worldwide, captures and represents the problem-solving principles of sustainable agriculture (Lyson, 2000). Civic Agriculture is rooted in peculiar socio-cultural environment where promotion of economic sustainability made by farmers and consumers, together with sustainable production of food, aim to increase social equity and democracy among members of a community (Murdoch et al., 2000; Feenstra, 2002). Put differently, CA responds not only to an active political behaviour in a growing group of consumers (Graziano and Forno, 2012; Cembalo et al, 2012), but also it contributes in building new economic relationships between farmers and consumers (Goodman and De Puis, 2002). One of the main features of civic agriculture model is the involvement of consumers in the local farm with the consequent creation of a real community in which consumers and producers strongly interact while sharing decisions and resources. To illustrate, community generated by CA are spaces

where rules are different compared with those inherent the dominant market system (so called mainstream market), where new social paradigms and new models of system innovation are experimented (Brunori, 2000, 2012; Seyfang e Smith, 2006). As example of sustainable agriculture, the aim of CA is to become a suitable alternative to mainstream models and it aims at representing an opportunity to recreate a place where community participants can share and develop values and attitudes (DeLind, 2002) and support to local products (Baker, 2004). Moreover, civic agriculture model materializes as the way to create job and recirculate financial capital in the community (Feenstra, 2002). Compared to the total sales of food, CA is still a niche, but at the same time it can represent a valid solution to the current difficult state of conventional food system (Murdoch et al,2000; Ilbery e Kneafsey, 2000; Marsden et al, 1999; Miele, 1999). If territorially based production systems may thus offer new opportunities for capturing and retaining economic value in rural areas, there is also a growing appreciation of the socially embedded character of alternative economic systems that it generates (Sage, 2003). Interaction between economic activity and social behavior is called *social embeddedness* by Granovetter (1985). Widely used in economic sociology, the notion of social embeddedness has recently been used as a conceptual tool to describe the phenomenon of CAs (Hinrichs, 2000; Sage, 2003; Kirwan, 2004; Sonnino, 2007). Originally introduced as a euphemism for market relations based on social interaction and relations of loyalty and trust, *social embeddedness* works to mediate self-interest in place of a concern for the wider common good. The relationships that arise between the various agents involved in the CA facilitate the spread of critical resources for the mobilization (information, know how, material resources) and for the elaboration of shared interpretations of reality, providing the preconditions for the development of collective actions and other forms of cooperation (Ostrom, 2000; Brunori et al., 2012). *Social embeddedness* may, therefore, help to understand how producers and consumers behave in the market beyond the paradigms of neoclassical economics theory. In this regard, Offer (1997) shows that market exchange process is not purely economic in its nature: In other words, the exchange of goods is influenced from the reciprocal interaction between producers and consumers, assuming several stages: recognition, attention, trust, respect, reputation, friendship, sociability. Briefly, the interaction is driven by *"the pursuit of regard"*. (Offer, 1997). This reveals that moral considerations exist in any economic decisions (Sage, 2003). The exchange, therefore, is not only an economic transaction in itself, but it involves continuous personal interactions between the agents. The prices of goods, in fact, facilitate the exchange when information is scarce and when the traded goods are mainly standardized. Conversely, *reciprocal* exchange has been preferred when trade involves a personal interaction, and when goods or services are unique, or have several dimensions of quality (Offer, 1997; Caniglia et al., 2008). Thus, in addition to the desired product, the consumer acquires knowledge on the production system, as well as the unique experience associated with the consumption and preparation of food (Cembalo et al, 2013; Migliore et al, 2012; Schifani and Migliore, 2011). Farmers, on the other hand, not only provide the value of the marketed goods, but continuously learn from the consumers preferences also (Lee, 2000). The *social embeddedness* phenomenon is used

to distinguish the CAs from the traditional food chains. However, despite the apparent homogeneity, several types of CAs exist (Follett, 2009). One possible distinction among CAs can be made based on the intensity of social embeddedness that occurs within the economic agents.

The objective of this study is to analyse, on the basis of a psychometric framework, the role of social embeddedness factors in the farmers' decision to participate to CAs. This is one the first studies to introduce psychological constructs into the study of farmers who participate in CAs. We attempted, therefore, to investigate the relations between farmers attitudes and the intensity of participation in some peculiar forms of CAs, namely farmer's markets (conventional or organic), solidarity purchase groups (GAS), direct selling, and box scheme as a special case of community supported agriculture.

To this end, a survey was carried out among farmers who participate in CAs in Sicily. In particular, the present work aims to evaluate which farmers' attitudes influence their decision to participate in a specific type of CA, and if *social embeddedness* related attitudes occur with different intensities within the different types of CAs.

Farmers' decision making: a little literature review

In the agricultural economics literature, several studies have analysed and interpreted farmers decision processes and the consequences of their choices. Farmers' behavior patterns have been formalized in a variety of situations: credit requests, adoption of environmental schemes and crop variety selection (Herath et al, 1982; Hong and Hollaway, 1991).

Many of these models are largely based on neo-classical economics paradigms which assumes that all farmers are profit maximisers. However, several studies have demonstrated that farmers behaviour is not driven only by the profit maximization' objective. It is well known in the literature, in fact, the role of socio-demographic and psychographic characteristics of farmers in influencing their choices (Wilson and Hart, 2001; Winter et al, 2007).

A framework for understanding these aspects, for capturing the decision making process of farmers, should include a broad set of variables suggested by psychological theory. In this regard, Edwards-Jones (2006) points out that the psychological characteristics of farmers are the main "non-economic" predictors of farmers' decision making. Main proposition to this type of research is that *attitudes* are the basis of individual behaviour. In particular, attitudes are defined as positive (or negative) response towards a particular *attitude-object* (a person, an object, an idea or a concept), and they can be represented by information, knowledge and / or emotional reaction towards the object (Willoch *et al.*, 1999). In the social sciences the relationship between attitudes and behaviour have been modelled by the *Theory of Reasoned Action* (Fishbein and Ajzen, 1975), which assumes that the behaviour is directly influenced by intentions to act, and in turn, intentions to act are influenced by attitudes. Once adopted to analyze farmers behaviour towards the environment protection and conservation, the TRC has progressively shown some limitations, with respect to the attitudes that could influence directly the behaviour (Bender and Speckart, 1981). Theory of Planned Behaviuor (TPB) (Ajzen, 1991) is another psychological model used to explain individual behaviour : in this model the behaviour is the result of three psychological constructs: individual attitudes, perceived control on behaviour and the influence of '"important oth-

ers[1]". Examples of applications in agriculture of the TPB have focused on specific situations: business diversification (Hansson *et al*., 2012), farmers responses to environmental programs (Sutherland, 2010) and more generally to agricultural policy (Gorton *et al*. , 2008).Among the conceptual models widely validated at the international level, the Edinburgh Study of Decision Making on Farm (ESDMF) of Willoch et al. (1999) provides a clear explanatory framework for analyzing farmers decision making process through reliable psychometric measures. The ESDMF examines the nature of the interactions between farmers psychological characteristics (attitudes and objetives) and their farming decisions. In particular the ESDMF is based on three types of construct corresponding to as many groups of variables such as: antecedent, mediating and outcome variables. *Antecedent variables* refer to the individual's personality, his social network and attitudes: the latter plays a great role in the decision making process. The *antecedent variables* can directly affect the behavior or they can be conveyed by *mediating variables*, which refer to cognitive constructs such as farmers objectives. However, as regards as the participation to CA, any study exists investigating the psychological constructs of farmers. This study uses a slightly modified section of ESDMF, the one related to the antecedent variable, in order to be optimally adapted to farmers participating in the CA in Sicily. A specific questionnaire was developed, containing general sections for measuring the structural characteristics of the farms and socio-demographic characteristics of farmers, and including also a specific sections designed to measure farmers' attitudes.

1. *Important other* is the term used by Ajzen (1991) to describe the influence of social approval or disapproval of a specific behaviour.

Method

In Sicily region, 286 farms[2] participate to the main Civic Agriculture's regional initiatives. 136 farms join solidarity purchase groups (SPG) and the *A 'Fera bio* fair, while 150 farms constitute the *Campagna Amica* farmers markets, organized by *Coldiretti*, the largest farmers' union in Italy. For the present study, we collected data from 71 Sicilian farmers who participate in different forms of CAs. In several cases farmers participate in more than one form of CA. However, taking into account the prevailing participation rate, 51% of our sample include farmers participating to *Coldiretti*, while the 31% of the sample represent farmers participating to solidarity purchase groups agriculture groups and the *A 'Fera bio* fair. The remaining 18% of the surveyed farms provides farm selling and a simplified form of community supported agriculture known as Box Scheme. The 27% of the total farmers interviewed are female, the median age is 44 years (in the range 24-66 years), with on average 19 years of experience in agriculture. The 48% of the interviewed farmers have a diploma of secondary education while about 20% of the interviewed have a higher level of education. With regard to the structural characteristics, about approximately the 41% of the investigated farms are between 1 and 10 hectares in size, while the average annual net sale from the participation in the CA has been evaluated to € 42,488, equal to 60.4% of total sales; of this, about the 50% comes from the sale in *Campagna Amica*, 20% from SPG, 20% from *'A Fera bio* and 10% from *Box Scheme*. Finally, about the 66% of the surveyed farms benefit of an organic certification.

2. Source: www.retegas.org and primary data collected at regional level. 150 farms participate actively in Campagna Amica fair, although a total of 380 farms are indeed accredited.

Variables and Models

The empirical strategy of this study thus focuses on providing evidence that farmers attitudes influence their decision making processes, farmers decisions to participate to CA schemes in particular. Farmers attitudes were collected using 59 questions (Table 1) adapted from the *Edinburgh Regional Farming Attitudes Scale* (EFAS) (Willoch et al, 1999), inferring on the influence that *antecedent variable* may have on the farmers' behaviour. The items were structured in a 7-point Likert with anchor points 1 = strongly disagree to 7 = Strongly agree. In order to reduce, the information contained by the large set of collected variables, a principal component analysis (PCA) with orthogonal (Varimax) rotation was performed. 7 factors were indeed extracted, and successfully named following the EFAS framework. The results of the PCA summarize the main concepts related to the prevailing attitudes of farmers: Embedded Values, Financial Risk, Policy Communication, Openness, Achievement, Pessimism, and Success. Briefly, overall the 7 factors extracted are conceptually in line with those resulted from the ESDMF, with the exception of the first factor, Embedded Values, which is enriched with variables related to social relations and social connection, in line with the overall phenomenon of social embeddedness (Table 1). Briefly, the first factor is characterized by 17 items (from 1 to 17 in table 1) expressing the farmers attitudes towards environment and social relations. The second extracted factor expresses the information of 10 items (from 18 to 27) reporting the farmers attitudes towards *financial risks*. 7 items are included in the third factor, *Policy communication* (from variable 28 to 34). The fourth factor is named *Openess* and it is characterized by 7 items (from 35 to 41). The fifth factor, *Achievement*, mainly includes information of 6 items (from 42 to 47), while the sixth extracted factor is named *Pessimism* (five items, from 48 to 52). Lastly, the seventh extracted factor *Success*, reports the farmers attitudes towards success and reputation, and it synthesizes seven items (from 53 to 59). Internal consistency of scales was measured by means of Cronbach's □. Finally the factor scores obtained from PCA were used as regressors for subsequent econometric analysis. The modelling approach implemented in this paper uses the Tobit estimator (Cameron and Trivedi, 2005). Tobit estimator is suitable when the dependent variable of a linear regression is observed only over some interval of its support. In our case dependent variables range from zero to 100. They were expressed in percentage terms. To illustrate, three equations were set up. The dependent variables express the degree (or intensity) of participation to one of the three alternative food chain considered[3], namely: farmer markets organized by Coldiretti (Campagna Amica); farmer markets for organic producers (*'A fera bio*) combined with GASs farmers participants; and all the other forms of CAs collected that are on farm selling and a simplified form of community supported agriculture known as Box Scheme (Cicia et al., 2011). The rationale behind this classification comes from the presumption that farmers participating in *'A féra bio* and SPGs are much more involved in a community network, if compared with those participating in Campagna Amica only, so that they are expected to act more likely as nodal points for a social embeddedness (Cembalo et al., 2012; 2013). Combination of *'A fera bio* and SPGs forms of CA in one variable was due to the fact that most of the farmers (over 60%) participating in one form participates also in the other.

3. It was multiplied the percentage of net farm income coming from any short chain channel by the percentage sold through the specific short chain.

Variables	Components						
	PC_1	PC_2	PC_3	PC_4	PC_5	PC_6	PC_7
The direct relationship with consumer creates a mutual loyalty	.806	.130	.132	.077	.010	.008	-.088
I am satisfied by CA; consumer understand food quality and my work	.771	.262	.085	.074	-.151	-.010	-.181
It is important to reduce nitrogen application by using nonchemical methods	.760	-.174	-.079	.113	-.143	.086	.007
It is important to reduce pest control chemicals by using effective rotations	.746	-.242	-.007	.160	.019	-.020	.018
Talking directly with consumers helps me to improve my offer	.712	.293	.177	.063	-.149	.060	.124
It would be nice to give up farming	-.613	.014	.015	-.013	-.345	.287	-.083
Organic farming is a fad	-.612	.276	.237	-.051	-.008	.116	-.169
Talking with consumers allows me to establish a personal relationship	.600	-.053	.397	.137	-.029	-.130	-.045
In CA is not only important the economic aspect	.552	-.291	.059	.106	.319	.064	.081
It is important to share with other farmers solutions to resolve problems	.550	.190	.190	.023	.081	-.014	.302
Young people should not be encouraged to farm	-.517	-.089	-.273	.049	-.103	.469	.041
The meeting with consumers has improved my sensitivity towards environment	.512	.301	.366	-.092	-.015	.375	.291
The meeting with consumers has improved my sensitivity to food safety	.464	.180	.405	-.091	-.021	.398	.208
Farmers are important in a community	.393	.140	.075	-.034	.264	-.068	-.125
The meeting with consumers has improved my sensitivity towards other people	.375	-.010	.271	-.044	.349	.303	.107
Farmers should help other farmers / artisans / workers if it is required	.330	.006	-.018	-.012	.074	-.150	.206
Short term loans are a good thing for farming	-.328	.079	-.123	.286	-.149	-.241	-.021
It is appropriate to take financial risks in farming	.027	.773	-.005	.295	.011	.037	-.049
In starting a new farming venture one should be willing to take out a loan	-.179	.694	-.135	.200	.192	.159	.054
To farm successfully one must be in debit	-.126	.580	-.093	.155	.298	-.280	-.002
It is important to have the occasional visit from consumers	.299	.542	-.100	-.104	-.145	-.088	.290
Farmers are generally in control of their farm business	.150	.536	.127	.078	.315	.306	.226
Farming is satisfying	.403	.510	.135	-.038	-.001	-.135	.161
Farmers should make sure they have insurance to cover most loss	-.028	.494	-.123	.026	.116	.100	.243
Farm land should be fully productive	-.339	.476	.060	.361	.113	.239	.212
Pest control should be dictated by farmer, not by environmental groups	-.008	.423	.001	-.047	.188	.348	.068
Other employment would be better than farming	-.263	-.318	.268	-.078	.013	.318	-.006
There is no clear overall strategy in agricultural policy	.143	-.076	.783	.072	-.009	-.077	.163
Even advisors can't tell you what the current legislation is	.058	-.131	.769	.048	.067	.009	.141
Farmers are sometimes informed about legislation too late to put it into practice	.003	-.262	.700	.175	-.019	.013	.103

There is insufficient information on policy changes	.210	-.055	.613	.003	-.144	-.230	.012
Farmers in Sicily are demoralized	.025	.125	.565	-.043	-.080	-.058	-.212
Borrowing money is bad for farming	.045	.104	.489	.228	.049	.039	-.260
"Green" groups are useful	-.010	-.218	-.348	.097	-.299	-.056	-.043
It is important to read about farming practices	-.059	.115	.104	.720	.088	-.044	.083
Farming problems are best tackled head on	.212	.116	.119	.681	.259	-.297	.152
Successful farmers take financial risks	.142	.255	-.097	.580	.139	.271	-.202
It is important to read about new farming practices	.424	-.006	.044	.568	-.090	.146	.153
Sometimes it is important to consult with professional farming advisors before decisions	.091	.107	.100	.561	-.259	-.094	.206
It is important to keep up with new farming policies	-.057	.026	.024	.541	.462	-.109	.222
It is important to visit other farms to look at their methods	.350	-.117	.245	.490	-.124	.264	.263
Farmers generally enjoy their job	.178	.103	-.166	.195	.688	.119	.091
Important information on new farming ideas can be obtained at agriculturl shows	.215	-.058	-.017	-.064	.588	-.190	.364
Farm production is the thing to take most pride in	-.210	.217	-.057	-.011	.564	.069	-.203
It is not important to monitor the farm production levels	.029	.226	.105	.090	.517	.118	.314
Cheap government loans to farmers would be preferable to grant	.019	-.003	-.052	.200	.512	.404	-.094
Farming is a job with a lot of scope to do things your own way	-.046	.304	.052	-.099	.399	-.037	.093
Farming is depressing	-.340	-.083	-.155	-.270	-.016	.622	.141
Modern record keeping systems are unimportant in farming	-.081	-.069	-.091	.286	.071	.616	-.136
New technology in farming have not improved upon traditional techniques	-.140	.167	-.257	-.251	.436	.516	-.201
Price of crops and stock are bound to fall in the future	.076	.250	-.272	-.098	.061	.434	.003
Production decisions should be made by farmers only	.252	.290	.281	.007	.031	.420	.057
It is important to have the best livestock/crops/pastures	.008	.248	.025	.290	.200	-.006	.716
It is important to have a tidy farm	.173	.053	.158	.154	.276	-.097	.705
It is important to respect the current legislation	-.132	.157	-.178	.037	-.095	.031	.601
A farm is a business to be run efficiently	.239	.174	.219	.307	.041	.254	.461
It is important farmers be respected in local community	.364	.048	.029	-.015	-.007	.083	.413
Successful farming is the result of cautious planning	.098	.346	.030	.148	.101	-.149	.363
It is important to pay attention to market prices	-.198	.217	.116	.160	-.225	.260	.282
Cronbach α	*.66*	*.73*	*.66*	*.79*	*.69*	*.63*	*.74*

Table 1. Variables and factors.

Results and Discussion

Estimating a linear regression in the presence of censoring involves additional computational complications. OLS regression does not yield consistent parameter estimates due to censored sample that is not representative of the population. In the Tobit model the regression is specified as an unobserved latent variable, y^*:

Eq. 1 $$y_i^* = x'\beta + \varepsilon_i, \quad i = 1 \ldots . N$$

where $\varepsilon_i \sim N(0, \sigma^2)$, and x_i denotes the (K x 1) vector of exogenous and fully observed regressors. If y_i^* were observed (i Î O), we would estimate the parameters by OLS. For left-censored observations (i Î L) and right-censored observations (i Î R) we know only that the unobserved y_i is less than/greater than y_{Li}/y_{Ri}. The corresponding log-likelihood function is:

Eq. 2 $$\ln L = -\frac{1}{2}\sum_{i\in O}\left\{\left(\frac{y_i - x'\beta}{\sigma}\right)^2 + \log 2\pi\sigma^2\right\} + \sum_{i\in L}\log\Phi\left(\frac{y_{Li} - x'\beta}{\sigma}\right) + \sum_{i\in R}\log\left\{1 - \Phi\left(\frac{y_{Ri} - x'\beta}{\sigma}\right)\right\}$$

where $\Phi(\cdot)$ is the standard normal cumulative distribution function (Amemiya, 1973).

Stats			
Log pseudolikelihood	-198.87	-198.68	-118.72
McFadden R-square	0.3025	0.5790	0.2568
Dependent variables / Model	Campagna Amica	AféraBio + SPG	Others
Values Embedded	-10.63**	9.11**	7.80*
Financial Risk	10.87**	-10.66***	-8.59**
Policy communication	9.91*	-6.97**	-5.54**
Openness	-11.15**	-5.60**	-1.7
Achievement	27.30***	-5.54*	-4.08
Pessimism	15.67***	-6.19*	-2.5
Success	6.02	-3.04	-8.20*
Cons	7.34	1.26	-12.96**
Sigma			
Cons	35.54***	27.24***	20.61***
Left-censored obs. (at 0)	29	32	48
Uncensored obs.	36	38	22
Right-censored obs. (at 100)	6	1	1
ToT number of obs.	71	71	71
*legend: * p<.1; ** p<.05; *** p<.01*			
Robust Tobit estimation left and right truncated			

Table 2. Results of Tobit model

The empirical data examined in this study show that different behaviours exist within the several forms of CAs. In particular, the intensity of participation to the various forms of CAs, is mainly influenced by 6 of the 7 extracted factors. The factor scores attributable to *Values embedded* present opposite signs among farmers participating in *Campagna Amica*, compared to those participating in GAS and/or *'A Fera bio*, and other forms of CA (box schemes and direct selling). This result indicates that the latter show strongest attitudes towards the environment and towards social relations. Value embedded variable highlights the phenomenon of social embeddedness where social relationships and the sharing of common values with consumers are the base for a development of collective actions. Social embeddedness, in other words, underline how, in these different forms of CA, farmers show peculiar attitudes through a sort of laboratories in which new social paradigms and system innovations are experimented (Brunori et al., 2012). In addition, an overall interpretation of the results suggests that farmers participating in Campagna Amica show the highest attitudes towards the business, given the positive influence on the dependent variable of the factor scores related to attitudes towards *Financial risk* and *Achievement*. The negative sign of the *Achievement* factor among farmers participating in GAS and/or *'A Fera bio* seems to be linked to variables related to the degree of satisfaction gained by being a farmer. In particular, the negative sign of this factor reinforce the *Value Embedded* construct within which the *Achievement* is, for farmers, functional to an agricultural system not strictly aiming technical and output efficiency. On the contrary, farmers seem to embrace a set of factors such as the care for rural environment and its community. However, the nature of a high correlation among variables makes this factor hardly interpretable. This may be partly due to the small number of observations, imposing additional reflections and further analysis. The negative sign of the *Openness* factor in all the considered forms of CAs expresses a lack of willingness to learn about technical innovation in farming practices for participating farmers. *Policy communication* and *Pessimism* factors show opposite signs between the different types of CA. In detail, a greater attitude towards the communication of agricultural policies exists for the farmers participating in GAS/*'A Fera bio* and other forms of CAs, comparing to those participating in *Campagna Amica*. That result may suggest a better predisposition towards rural policies probably aimed at sustainability issues from the first group. *Pessimism* factor assumes negative signs to for farmers participating in *Campagna Amica* suggesting, therefore, an optimistic view, almost creative, for farmers participating in other types of CAs.

An overall outlook of the results seems to show that farmers participation to CA is defined by two distinct behaviour typologies. In *Campagna Amica* farmers' behaviour seems to be mainly affected by "business oriented" attitudes. Put differently, efficiency is a major concern. On the contrary, the influence of attitudes of farmers participating in other forms of CA seems to show a preponderant predisposition towards the construction of new economic relations based on environmental care and on the willingness to increase social equity and democracy for community members. This seems to line up with the conceptualization of social embeddedness. It also allows to suppose that some farmers behave as *profit sufficier* rather than profit maximizers.

From a policy perspective, the above considerations highlight the existence of an institutional form of the sustainability with strong connections among environment, economy,

and society that increase the likelihood of success of policies oriented to sustainable development.

Our empirical results, however, should be taken with certain limitations since the model is still based on a small number of observations. This analysis has to be seen as a first step for a broader study that will include also farmers not participating in the CAs as counterfactual. In that way it could be possible to analyze the role of the social embeddedness phenomenon on farmers decision making process, in the continuous dimensions of marketness and instrumentalism, following the suggestion of Block, 1990.

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Assessing Social Relationships within Local Action Groups: a Worthwhile Tool for Measuring Lags' Effectiveness. Experiences from two Sicilian Leader Lags

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Abstract
The LEADER programme supports the endogenous development of rural regions through a bottom-up- and an integrated approach implemented by the Local Action Groups (LAGs). The evaluation of LAGs' effectiveness in achieving the programme's objectives has already been discussed by the scientific community. One reason for discussion is that the effectiveness of LAGs also depends on intangible capacities such as social relations whose evaluation still appears to be difficult. This paper helps to define a framework for assessing LAGs' internal social relationships and drawing possible implications for the LAGs' effectiveness. Assuming that social relationships could play a strategic role in LAGs' effectiveness, the degree and nature of relationship between the members of two LAGs from Sicily are assessed. Social Network Analysis is used as methodological approach for investigating relationships within the LAGs. Results show that LAGs can be characterized by features of the social networks they are embedded into. As an important relational indicator turned out the density of actor relations potentially determining LAGs' effectiveness in terms of optimal level of cross-sectoral collaboration between the LAG members.
JEL: D79; R59
Keywords: Rural development, LEADER, Local Action Group, Social Network Analysis

Introduction

The European Agricultural Fund for Rural Development (EAFRD) co-finances diverse rural development actions through a package of measures grouped around 4 axes. Measures under the fourth axis, the LEADER Axis support the endogenous development of rural regions through a bottom-up- and an integrated approach. The latter entails cross-sectoral actions and the consideration of socio-economic and ecological concerns. Local Action Groups (LAGs), i.e. public-private partnerships, implement LEADER. They have the task of promoting not only economic, but also social development in their respective regions. LAGs are expected to induce added values not achieved by the other EAFRD Axes such as better targeting of funds by addressing local needs by decision-making at the ground and evoking synergies through cross-sectoral collaboration and sharing of resources between partners as well as improving the quality of life and furthering local identity and governance skills. Furthermore, LAGs have potential for the creation and use of "social capital". Social capital might be created through trust and repeated social interaction; it facilitates cooperative action. Social capital might a prerequisite for the foundation of a LAG partnership, but also an outcome of LAGs' action (cp. Marquardt et al. 2012), when, for instance, they improve

social relations in the region, cohesion and the integration of the weaker social classes.
The issue of rural development policies evaluation has been widely discussed in the scientific literature in order to evaluate the effectiveness of Common Agricultural Policy and the achievement of the objectives established by EU political institutions (Midmore, 1998; Blandford et al., 2010; Kinsella et al., 2010; Schmid et al., 2010). Also the evaluation of the impact of the LEADER program has been subject to discussion. Especially the assessment of possible intangible outputs and added values that might be created through LEADER called evaluators' and scientists' attention (Grieve, Weinspach, 2010). The reason for this is that the effectiveness of LAGs also depends on intangible capacities (Pisani, Franceschetti, 2011; David et al., 2013) which makes the assessment with quantifiable indicators challenging. While the tangible components can be more easily evaluated by quantitative indicators such as "result" indicators (e.g. number of funded projects) or "impact" indicators (e.g. improvement of long-term economic performance), the identification and evaluation of intangible added values, such as the growth of social capital in rural regions appears to be difficult (Lopolito et al., 2011).
The evaluation system of LAGs adopted within the EU, the Common Monitoring Evaluation Framework (CMEF), fails to capture some aspects of the network and governance skills promoted under LEADER, particularly with regard some specific intangible added values (e.g. capacities to create social capital, relations and cohesion within the rural population) (Dwyer et al., 2008; Nardone et al., 2010; Rizzo, Lo Giudice, 2013). Despite this program has found academic attention over the past two decades, the systematic evaluation of intangible components is not adequately developed. In this context Marquardt et al. (2012) have applied the Social Network Analysis (SNA) to assess the relationships underlying the formation of LAGs, correlating social capital creation or governance processes - assumed as added values - to theories of social networks.
Assuming that one determinant for the effectiveness of LAGs are certain characteristics of the social networks by which they are formed and surrounded, and therefore play a strategic role to create added value in rural regions, the research question of this paper is: in how far the assessment of social relationships a worthwhile tool for examining LAGs' effectiveness? It is asked, whether the measurement of network properties within the LAGs' partnership can provide information on how a LAG should work to better achieve effectiveness in creating intangible added values in LEADER programme.
By means of SNA it is strived for a quantitative assessment of degree and nature of relationships within the LAGs' partnerships and pointing out the presence of intangible added values created by LAGs' activities e.g. capacities to create relations and cohesion within the rural population. Network properties within two LAGs from Sicily (Italy) are measured. SNA data are supplemented by further qualitative empirical data. Possible factors that affect relationships within the LAGs have been analyzed.
Result can be an initial point for drawing a wider theoretical framework for assessing the degree and nature of relationship between the LAG's members.

Data and Method

The measurement of the network properties within the LAGs was approached with Social Network Analysis (SNA), using the UCINET software. SNA was applied to two case-study

LAGs from Sicily (Italy) currently implementing the LEADER program for 2007-2013 funding period. The two LAGs are from two of the most important rural areas of Sicily. The first one (indicated by synonymous LAG-CT) is from the province of Catania, which is one of the most economic developed rural area in Sicily and the second one (indicated by the synonym LAG-EN) is from the province of Enna, which conversely represents a more marginal socio-economic context. The two LAGs were researched from October 2012 to January 2013. Members of these LAGs were surveyed with a questionnaire, which included besides a set of questions related to LEADER in the current funding period a contact matrix. The first set of questions have concerned qualitative information such as the knowledge of the contents of the Rural Development Concept (RDC), the representativeness of the partnership, participation in the negotiation process, coherence between needs and measures adopted by LAG and so on. By means of contact matrix in the second set of questions, we assessed how all the members interact with each other. By measuring the properties of networks within the LAGs' partnerships we assessed the implications that social relations have in the activities of the two examined LAGs. The analyzed kinds of relationships between the members of the LAGs are reported in Table 1.

Kind of relationships	Description
Communication	Contacts (occasionally, monthly, weekly, etc.) that each LAG's member has with others
Formal and informal relationships	Relations (formal and informal) between a member of the LAG and all the others
Flows of information on the LEADER program	Degree of sharing and exchange of information regarding the LEADER program between the members of the LAG
Flows of information not related to LEADER program	Other kinds of information shared between LAG's members such as informal news or business information

Table 1. Kind of relationships between the members of the LAG.

The following network-analytical measurements are applied for assessing relationships within LAGs' members: "degree" (Freeman, 1978), "betweenness" (Freeman, 1978), "network centralisation" (Scott, 1991) and "density" (Scott, 1991).

Results

The main attributes of examined LAG's members are reported in Table 2. The structure of the partnership between the two examined LAGs doesn't show significant differences. Typologies of subjects in both LAGs are: municipalities, provinces, unions of industrial, union farmers, cultural and environmental associations and social cooperatives. Moreover in LAG-CT there are a lot of "social cooperatives" that play dynamic role in the partnership by helping to increase the cohesion and density within the network. The Administrative Council of the two LAGs is generally composed of municipalities and

labour unions. Instead, the world of cultural, environmental and other kind of associations is missing even though they represent an important proportion of the partnership.

LAG-CT				LAG-EN			
N°	Type of member *	LAG's members (years)	Fierld of activity	N°	Type of member *	LAG's members (years)	Fierld of activity
1	1	3	Municipality	1	1	10	Municipality
2	1	3	Municipality	2	1	14	Municipality
3	0	3	Private farm	3	1	10	Municipality
4	0	9	Union farmers	4	1	3	Municipality
5	0	3	Social coop.	5	1	14	Municipality
6	0	2	Social coop.	6	1	14	Municipality
7	0	3	Social cooperative	7	1	10	Municipality
8	0	3	Social coop.	8	1	10	Municipality
9	0	3	Research center	9	1	3	Municipality
10	0	3	Development agency	10	1	3	Chamber of Commerce
11	0	3	Development agency	11	0	3	Union traders
12	0	3	Foundation	12	0	2	Farmhouses
13	0	3	Sociology Inst.	13	0	3	Cultural association
14	0	2	Social coop.	14	0	14	Private firm
15	0	2	Social coop.	15	0	3	Cultural association
16	1	2	Province	16	0	3	Cultural association
17	0	2	Union traders	17	0	2	Environmental association
18	1	3	Municipality	18	0	3	Cultural association
19	1	1	Municipality	19	0	14	Union farmers
20	1	3	Municipality	20	0	3	Social coop.
				21	0	6	Environmental association
				22	0	3	Farmers' association
				23	0	2	Farmers' association
				24	1	13	Province
				25	0	8	Association of agronomists
				26	0	14	Union craftsmen
				27	0	na	Union of industrial
				28	0	na	Women association

* Public: 1 - Private: 0

Table 2. Attributes of LAG's members.

With reference to the network of the two LAGs as a whole, values of network's centralization and network density for relational indicators are reported in Tables 3-6.
With regard to "communication" the network density expressed as proportion of the maximum possible number of ties, was higher for LAG-CT (0,56) than for LAG-EN (0,38). These values are higher than other kind of relationships examined in the paper. This result is consistent with other studies (Morone et al., 2006) and suggests the strategic role that LAGs can play for promoting a wider cohesion between its members also for other kinds of relationships. The values of "network centralization" are generally higher within LAG-EN than LAG-CT. This means that network of communication in LAG-EN is more focused around a few actors (Table 3). As shown by the out-degree and in-degree measurement not all of the LAGs' members contribute to the communication with the intensity they are contacted by others. The highest value of out-degree of LAG-EN (66,81) compared to LAG-CT (48,54) means that within LAG-EN the contacts depend on a few "influential" subjects that communicate with the majority of members. On the other hand, in both LAGs values of in-degree (LAG-EN: 34,90; LAG-CT: 36,84) are lower than out-degree. This indicates the lack of members, definable as "prestigious", to which the majority of the others members are addressed.

Table 3 – Comparison of centrality measures for communication network within examined LAGs

Indicator	LAG-CT (20 Members)	LAG-EN (28 Members)
Freeman's Degree Centrality measures		
- Network centralization	**22,22**	**52,42**
- Network centralization (out-degree)	**48,54**	**66,81**
- Network centralization (in-degree)	**36,84**	**34,90**
Freeman Betweenness Centrality		
- Network centralization Index	**10,39**	**16,62**
Network density	**0,56**	**0,38**

Measuring formal and informal relations could be useful for examining the degree and the potential for partnership-formation within a LAG. First we are referring to "formal relations" (Table 4) for which the highest network density was found in the LAG-CT (0,18) while in the LAG-EN it was much lower (0,046). In the latter the total network centralization is higher (54,13) than for LAG-CT (43,86). The measure of out-degree centralization in the LAG-EN is 54,84 compared to 33,04 of the LAG-CT. In the latter in-degree centralization measure is higher (44.73) than LAG-EN (6,98). The low values of network density associated with high values of centrality measures show the potential weakness of LAGs due to lack of current partnerships within the same. However, this result highlights the potential role of LAGs, which should strive for filling the lack of synergies and joint projects. Actually, the presence of isolated members could raise the question

about their role within the LAG. In fact the latter might weaken the LAG work for their marginal contribution to the LEADER implementation.

Indicator	Formal relations		Informal relations	
	LAG-CT (20 Members)	LAG-EN (28 Members)	LAG-CT (20 Members)	LAG-EN (28 Members)
Freeman's Degree Centrality measures				
- Network centralization	**43,86**	**54,13**	**33,92**	**56,41**
- Network centralization (out-degree)	**33,04**	**54,84**	**52,92**	**68,95**
- Network centralization (in-degree)	**44,73**	**6,98**	**11,99**	**21,08**
Freeman Betweenness Centrality				
- Network centralization Index	**12,63**	**2,40**	**11,66**	**15,01**
Network density	**0,18**	**0,046**	**0,26**	**0,14**

Table 4. Comparison of centrality measures for formal and informal network within examined LAGs.

As regards "informal relations" (Table 4), which might also compensate for missing LEADER-related relations and form a starting point for joint LEADER activities, the measures of network density are higher than the formal relations. However they were lower compared to other kinds of relationships examined in this paper. Furthermore, the centralization measures are high for both LAGs except for in-degree centralization, which might be explained due to the fact, that more actors have formal relations to several central public actors (even if less intense), so that the network of formal relations is more balanced in terms of centralization and centrality of the actors themselves.

With regard to "flows of information on LEADER" (Table 5), the network density of LAG-CT (0,36) is higher than LAG-EN (0,20). In comparison to previous relational indicators, out-degree and in-degree measurement are lower than previous kind of relationships. This means that in both examined LAGs does not exist very influential members from which depart information to the rest of the network or to which the majority of LAG's members are addressed.

Table 5 – Comparison of centrality measures for flows of information on LEADER within examined LAGs

Indicator	LAG-CT (20 Members)	LAG-EN (28 Members)
Freeman's Degree Centrality measures		
- Network centralization	**23,10**	**25, 55**
- Network centralization (out-degree)	**35,82**	**28,82**
- Network centralization (in-degree)	**15,35**	**10,21**
Freeman Betweenness Centrality		
- Network centralization Index	**14,73**	**6,91**
Network density	**0,36**	**0,20**

Finally, relations on "flows of information not related to LEADER" were examined. This kind of relationship allows us to assess whether exist ties not related to LEADER and if the flow of information on the LEADER program are more or less important than other kinds of information exchanged between the LAG's members. The first interesting result is provided by values of network density which are similar in the two LAGs (Table 6).

Indicator	LAG-CT (20 Members)	LAG-EN (28 Members)
Freeman's Degree Centrality measures		
- Network centralization	**57,31**	**49,00**
- Network centralization (out-degree)	**57,02**	**62,68**
- Network centralization (in-degree)	**33,63**	**18,80**
Freeman Betweenness Centrality		
- Network centralization Index	**24,78**	**10,10**
Network density	**0,28**	**0,27**

Table 6. Comparison of centrality measures for flows of information no LEADER within examined LAGs.

Furthermore, if we compare this network density with those concerning the "information flows on LEADER", within LAG-CT the level of information flow relating to the LEADER (0,36) is higher compared to information not related to LEADER (0,28). Conversely, within LAG-EN the flow of information on the LEADER program (0,20) is lower compared to other kinds of information not related to LEADER (0,27). This result might suggest the involvement of LAG's members in other integrated rural development initiatives. The presence of ties on no-LEADER activities is positive to facilitate processes of cooperation within the LEADER programme. Furthermore, it should be noticed that the understanding of the effectiveness of LAGs' activities in the production of tangible and intangible added values go beyond the simple measurement of network properties. As highlighted by Nardone et al. (2010), quantitative network measures could be adequately completed with other qualitative information that can provide a more comprehensive and nuanced evaluation of the degree and nature of relationships between the LAG's members. For this aim some specific qualitative information from the members of examined LAGs have been collected and the percentages of the answers are reported in Table 7.
This analysis showed that the members of both LAGs give great importance to the role that these institutions play in the development of the rural areas (Question 2). In addition, the contents of the LAG's strategy are known by members as it is widely believed that the LAG's strategy reflects the needs of the territory (Questions 6 and 7). However,

	Question	LAG-CT		LAG-EN	
		yes	no	yes	no
1	Is it important for your business to be a member of the LAG?	95%	5%	73%	27%
2	In your opinion, is the LAG important for the socio-economic development of your territory?	70%	30%	54%	46%
3	Do you think that an effective negotiation process took place associating planning of the LAG's development strategy?	70%	30%	62%	38%
4	Have you been involved in developing the strategy?	70%	30%	54%	46%
5	Do you think the chosen Measures in Local Development Plan are a good mean for tackling the problems in the region?	95%	5%	69%	31%
6	Are you aware of the content of the LAG's strategy in the Local Development Plan?	85%	15%	62%	38%
7	Do you think the real needs and strengths have been assessed in the LAG development strategy properly?	5%	95%	31%	69%
8	Resources foreseen for implementing the strategy are appropriate?	45%	55%	69%	31%
9	Do you think co-financing will be a problem?	10%	90%	12%	88%
10	Have you submitted an application for a LEADER project?	45%	55%	58%	42%
11	Do you think about applying for a LEADER project in the future?	80%	20%	46%	54%
12	Do you think the composition of the LAG represents the region in a good way?	75%	25%	54%	46%

Table 7. Other qualitative information collected by LAGs' members.

especially in the LAG-EN we found that the about half of the members do not give great importance to the activities of the LAG and they do not consider important the LAG for their economic activity (Question 1). Similarly, about half of the members in LAG-EN think that an effective negotiation process during the planning of the strategy of the LAG is not carried out or they did not feel fully involved (Questions 3 and 4). However, the factor that seems to take on greater importance is the opinion expressed by the members on some financial aspects. In both the LAGs, the majority of the members believes that the financial resources foreseen for the LAGs are insufficient (Question 8). In addition, co-financing the projects is considered a serious problem (Question 9). Likely because of this the majority of members from both the LAGs has not participated in LEADER projects in the past and does not plan to do so in the future (Questions 10 and 11).

In addition to these results, we compared the SNA findings with the qualitative information reported in Table 7 in order to observe the possible impact on the kinds of relationships investigated and, therefore, on the activities of LAGs. Obviously, some quantitative properties of LAGs' networks e.g. the network density and network centralization may be correlated with qualitative factors. For our case, when taking measurements related to the network as a whole and not to individual network members, such as the density of a

network, it has to be considered that we have only two LAGs as reference points and therefore the following results have to be carefully interpreted:

- Generally the network density indices in LAG-CT were always higher than the LAG-EN for all kinds of investigated relationships. The values of network density can be directly linked to the higher percentage of members in LAG-CT (95%) that consider important for their business the role of the LAG (Question 1) than LAG-EN (73%). The higher values of network density in LAG-CT than LAG-EN might also be related to the higher percentage of members in LAG-CT that positively evaluate the appropriateness of the negotiation process (Question 3); and might result in greater involvement of members in the elaboration of the strategy (Question 4). Furthermore, higher values of network density in LAG-CT than LAG-EN especially for "Communication network" and "Flows of information on the LEADER programme" might be related to a better perception of the positive implications that LEADER measures may have for developing cooperation processes between LAG members. In fact, the percentage of the members of LAG-CT that believe the measures taken in Local Development Programme are a good mean for tackling the problems in the region is 95% while in LAG-EN the same percentage is lower (69%) (Question 5).
- In the LAG-EN network centralization indices for the kinds of network relations investigated were generally higher than in LAG-CT. This result may be directly correlated to the presence of the particular high number of isolated or not very active members within the LAG-EN, which is higher than in LAG-CT. Especially for some kinds of relationships such as "Communication network", "Formal and informal relationships" and "Flows of information on the LEADER program" the higher values of network centralization in LAG-EN than LAG-CT might also be related to different causes such as the significant percentage of members (27%) who don't believe that the LAG's activities can be important for their economic activities (Question 1). Also, other factors might be related to the higher values of network centralization in LAG-EN. For instance 38% of members don't believe that an effective negotiation process took place associating planning of the LAG's development strategy (Question 3), which might reflect the centrally organized interaction patterns e.g. "Flows of information on the LEADER program", primarily involving a few actors and vice versa. In addition a significant percentage of members in LAG-EN (46%) think that members were not involved in the negotiation process (Question 4), LEADER Measures are not important for the development of their LEADER region (30%) (Question 5) and the LAG's partnership is not representative of the real needs of the rural area (Question 12)[1].

1. The lower percentage of members in LAG-EN than LAG-CT who are really satisfied to participate in the LAG's activities might negatively impact the relationships between members within the LAG-EN. This result highlights the need for an efficient and explicit system of ex-ante evaluation of the negotiation process in order to evaluate the coherence between planning strategy, representativeness of the partnership and needs of rural area.

Conclusion

This empirical research allowed assessing some aspects on the nature of relationship between the members within two LAGs from Sicily that are benefiting from the LEADER program in the current funding period. Through Social Network Analysis some aspects of social relations within the LAGs could be assessed. The main findings on social relations, and the possible indicative value of certain network-analytical measurements for assessing LAGs' effectiveness are summarized in Table 8. LAGs' characteristics could be reflected by means of calculating certain network properties, such network density and centralization and actors' centrality for specific kinds of relations (e.g. communication, presence of formal and informal relations and information related or not-related to the LEADER program).

Table 8 - The indicative value of social network properties for reflecting on LAGs' activities

Indicator	**LAC-CT**					**LAG-EN**				
	Network density *	**Network centralization actors' total degree ****	**Actors' in-degree *****	**Actors' out-degree ******	**Actors' betweenness *******	**Network density ***	**Network centralization actors' total degree ****	**Actors' in-degree *****	**Actors' out-degree ******	**Actors' betweenness *******
Communication network	medium	Low	medium	medium	low	medium	medium	medium	High	low
Implication for LAGs	*Positive . Good level of communication*	*Positive. Many members communicate each other*	*Positive. Active members with many relations help the LAG work*	*Positive. Active members with many relations help the LAG work*	*Potentially negative. "Brokers" members could be active to involve isolated members*	*Positive. Good level of communication*	*Negative. Communication concentrated around a few members. Low participation of all members*	*Positive. Presence of active members could help the LAG work*	*Positive. Presence of very active members. Negative. A lot of members do not communicate each other*	*Potentially negative. "Brokers" members could be active to involve isolated members*
Formal relationships	low	medium	medium	medium	low	low	medium	low	medium	low
Implication for LAGs	*Negative . Low level of relations. Presence of isolated members*	*Negative. Few central active actor. The majority of the members does not have relationships with others*	*Negative. A lot of members do not contribute to LAG work. Relations concentrated around a few members*	*Negative. A lot of members do not contribute to LAG work. Relations concentrated around a few members.*	*Negative. "Brokers" may contribute to involve isolated members.*	*Negative. Low level of relations. Presence of isolated members*	*Negative. Few central active actor. The majority of the members does not have relationships with others*	*Negative. Few relations concentrated around few active members. Presence of isolated members*	*Negative. A lot of members do not contribute to LAG work. Relations concentrated around a few members*	*Negative. "Brokers" may contribute to involve isolated members*
Informal relationships	*low*	*medium*	*low*	*medium*	*Low*	*low*	*medium*	*low*	*high*	*low*
Implication for LAGs	*Possible negative effect for future co-operation, agreements or partnership*	*Negative. Few active members. Majority does not have relations. Network weak*	*Negative. Absence of active nodes that could contribute to improve future relations*	*Negative. Few active members. Possible negative effects for future co-operation, or partners hip*	*Negative. Absence of active nodes that could contribute to improve future relations*	*Possible negative effects for future co-operation, agreements or partnership*	*Negative. Few active members. Majority does not have relations. Network weak*	*Negative. Absence of active nodes that could contribute to improve future relations*	*Negative. Network is weak and prone to collapse. Possible negative effects for future partners hips*	*Negative. Absence of active nodes that could contribute to improve future relations*

Flow of information on the LEADER	medium	low	low	medium	low	low	low	low	low	low
Implication for LAGs	*Positive . Good interest on LEADER activities*	*Positive. A lot of members exchange information on LEADER*	*Potentially negative. Presence of active members may involve other members*	*Positive. Presence of active member may improve LAG work and involve other members*	*Negative. "Brokers" could improve LAG work involving isolated members*	*Negative. Risk of low interest on LEADER activities.*	*Potentially negative. Combined with low density a lot of members do not communicate on LEADER topic*	*Potentially negative. Combined with low density central members may involve other member*	*Potentially negative. Combined with low density central members may involve other member*	*Negative. "Brokers" could improve LAG work involving isolated members*
Flow of information not related to LEADER	low	medium	medium	medium	low	low	medium	low	high	low
Implication for LAGs	*Negative. Low level of general relation between members*	*Negative. Few members are jointly involved in common business activities*	*Negative. Few members are active in joint activities. The majority does not have relations with others*	*Negative. Few members are active in joint activities. The majority does not have relations with others*	*Negative. "Brokers" could improve the involvement of members*	*Negative. Low level of general relation between members*	*Negative. Few members are jointly involved in common business activities*	*Negative. Few active members that may improve relationships within LAG*	*Negative. A lot of members do not have relations each other*	*Negative. "Brokers" could improve the involvement of members*

* From Network density measurement reported in tables 5-8: low: < 0,30; medium: from 0,30 to 0,60; high: > 0,60

** From network centralization measurement reported in tables 5-8: low: < 30; medium: from 30 to 60; high: > 60

*** From in-degree measurement reported in tables 5-8: low: < 30; medium: from 30 to 60; high: > 60

**** From out-degree measurement reported in tables 5-8: low: < 30; medium: from 30 to 60; high: > 60

***** From betweenness measurement reported in tables 5-8: low: < 30; medium: from 30 to 60; high: > 60

These results may have important implications on the LAG's effectiveness. For example, low levels of network density, i.e. a low level of social interaction, is likely to have negative impacts on one's LAG's effectiveness especially with regard to potential for cooperation processes or achieving synergies between actors' resources.

In the same way, high values of network centralization generally indicate that the majority of ties within the LAG rotate around a few members, while many others are located in an isolated position or they depend on other members.

Network-analytical results for each kind of examined relationships can have various implications for LAG's effectiveness. For example, within the networks of "formal" and "informal" relations a low level of network density and high network centralization degree implies presence of isolated members that hardly have relationships with other members of the LAG. The latter contribute marginally to the work of the LAG. As a result the relationship is concentrated around a few members and the network becomes weak. Furthermore, in communication and information networks it is positive to have

medium or high level of relations. A low level of network centralization in communication networks is likely be positive feature of LAGs because it implies that a greater number of members are equally in communication with each other. In information networks, a high level of centralization might be indicative for well-organized management (provided that all LAG members receive information). For networks on "flow of information on LEADER" a low level of network density potentially forms a risk factor. Moreover, the question can be raised whether all members of the LAG are really interested in the LEADER program. In such a case, influential members can concentrate the information around them making the network more weak and prone to collapse.

Similarly the absence of members actively contributing to the information network combined with low network density can (also) accentuate the weakness of the LAG because members appear to fail as potential promoters of initiatives. Finally the network on "flows of information not related to LEADER" may reveal the presence or absence of current or potential relationships independent from LEADER. Even in this case, the implications may be different: high levels of relationships can have positive effects on the LAG and the implementation of the LEADER program. In contrast, the strong presence of relations not related to LEADER associated with certain other phenomena such as low levels of LEADER knowledge are suggestive for a lack of interest towards the same.

Comparison between SNA findings and other qualitative data shows that network properties of LAGs can be affected by specific features such as importance to be a member of the LAG, involvement in development strategy, appropriateness of the negotiation process and so on.

Going back to what proposed in the original objective, this paper shows an approach to assess the degree and nature of relationships between the LAG's members and their possible implications in implementing LAGs' activities. In this context SNA method may be recommended as worthwhile tool for LAGs' self-evaluation. This recommendation is reasoned for several reasons. First of all self-valuation of relationships and flows of information are vital in the development processes promoted by these organizations. Furthermore SNA is a useful approach to investigate structural properties of LAGs' networks and point out the presence of intangible added values in rural communities. In this way SNA method can help the official evaluation systems adopted at European level to assess LAG's effectiveness in achieving intangible goals. In addition SNA can be useful because it points out weaknesses within the network. In fact by means of SNA critical points can be identified within the LAG's network, for instance the low level of relationships within the LAG's network.

However, the measurement of the network properties through the SNA method may be insufficient for understanding the process that leads to a real effectiveness of the LAGs in achieving intangible added values. For this reason, in this paper we tried to complement SNA results with the analysis of other qualitative data in order to observe their impact on social relations within the LAGs' networks. However, this approach represents a first analytical effort and a new empirical contribution to existing literature but it needs to be adequately deepened especially with regard the individual features of the LAGs' members that can affect network properties of different kinds of social relations within the LAGs.

For future research, it is important to link

the knowledge on relationships between the LAGs' members to indicators directly measuring the LAGs' achievements and to assess how these relationships can affect one LAG's effectiveness in the production of tangible and intangible added values in rural areas.

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Social sustainability and development of wine production: the case of Umbrian wines

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Abstract
This paper explores the notion of the social sustainability of wine production in the Umbria Region starting from the considerations that the ethical issues have long been involved in consumers' product evaluations. Ethics are examined in the framework of the increasing in social value of the wine produced by the Companies. It is shown how this value could be used to provide a based social sustainability of the wine sector. The implementation of social sustainability strategies of wine production may allow the creation of an innovative perspective for the development of the territories concerned.
JEL Classification: O13, Q01, Q12.
Keywords: social, ethical, wine, sustainability, firm.

Introduction

This paper summarizes the results obtained with the project "*Social value of Umbrian Wines*" funded under PSR Umbria 2007 – 2013 - measure 124 "Cooperation for development of new products, processes and technologies in the agriculture and agri-food sector", carried out by Cantina Sociale Sasso dei Lupi of Marsciano (Pg.).
The aim of the project was to identify, define and select tools of social valorisation of wine production enabling firms to achieve competitive advantages among consumers inclined towards ethical topics, so to reach significant segments of demand thanks to an increased perceived differential quality (Michelini, 2005).
The nucleus of the project is represented by the consciousness of consumers and stakeholders needs and expectations for information concerning aspects most closely connected not only to economic and environmental components but also those relating to social component of production process (Malagoli, 2006).
The rationale behind the project was the need, on one hand, to give rise to corporate activities capable of enhancing and give evidence to responsible behaviors (Banterle A., 2010) and, on the other hand, to exploit the growing interest for sustainability issues revealed by significant segments of consumer, whose willingness to pay higher prices for consumption of products incorporating social values has already been recorded in certain segments of the Umbrian food market (Marchini, 2007).
Preliminary consideration has been the awareness that social component is already naturally present in wine product not much for itself value but for its ability to better represent intangible values such as identity, territoriality, tradition, culture, well-being and the ability to create bonds in the reference community (Di Iacovo, 2003).
Element of further consideration has been the consciousness of Cantina Sociale that the action taken could have effects not only of economic nature but also on the social com-

ponents, because social capital represent the heritage of attitudes and beliefs shared by a particular community and, at the same time, one of the prerequisites of business cooperation in the community (Idda, Pulina, Benedetti, Madau, 2007).
The social value of the production has been verified on the basis of firm responsibility to ensure adequate level of sustainability (Briamonte, 2010).

Methodological aspects
The project activity has been developed starting from the need expressed by companies to make social aspects of their wine production rise, aiming at primarily sensitizing its members and secondarily other companies on the importance of sustainability aspects.
The described firms requirement finds its fundament and original reason in the pressure exerted by stakeholders (internal and external). These categories ask for increased information and entrepreneur that seek to stand in the market, need to accomplish a growing query of transparency.
The nature of the influence represent a positive stimulus for the company, forced to perform not only in economic efficiency terms but also in terms of social and environmental efficiency (Zecca F., 2003).
In order to give precise answers to the instance expressed, has been developed a multidisciplinary approach, able to collect all the required expertise, trying to involve the entire Umbrian wine system.
The work of investigation has been carried out on this basis, giving rise to the following actions:
- analysis of the competitive strategies of wine-making companies of the local system, carried out through the implementation of a questionnaire prepared *ad hoc*;
- collection of information about the consumer profile seeking for quality and perceiving social and ethics values, based on surveys supplied by literature and carried out at regional level.
- analysis of the characteristics of the region, led on the basis of what is expressed in the literature about the evolution of the ethical aspects of the product declined in geographical terms, in order to define the importance of territorial factors that affect ethical and social perceived dimension of wine production (Crane, 2001);
- development of operational guidelines for the enhancement of the communication of the social production.
The strategic reference model assumed is societal marketing implemented by nonprofit entities with the aim of creating an environment conducive to the promotion of social values by integrating this goal in a broader business plan.
The essential aim of this strategy is an increased perceived value (Zeithalm, 1988) also achieved through the adoption of social information of all operations carried out by the enterprise and based on the awareness and involvement of certain stakeholders among those able to define the profile of the brand.
Strategies aiming at valuing enterprise reputation represent a long term strategy to give competitive advantages to production (Antonelli, 2004). In this framework, communication becomes a fundamental activity to answer to expressed or implied demand both of customer and local institutions, showing growing interest for policies able to put together new actors of rural areas interests and agriculture (Marsden Murdoch, 1998).
According to the stakeholders theory (Freeman, 1984), in fact, in long terms, most competitive companies will be those able to combine and integrate their economic capabilities and skills with those of social nature.
The societal marketing relies on corporate

social responsibility and the task of the firm is to determine the needs of the target markets in ways that preserve or enhance consumer welfare. Corporate Social responsibility has set up, acting as a cultural basis, the activation of new competitive strategies and new paradigms of value production (Marotta, Nazzaro, 2012). Through socially responsible practices according to this interpretation, the firm is able to simultaneously ensuring adequate levels of social sustainability in the territorial context.
In this way, sustainability shows positive reflections not only inside company's boundary but also provide collective well-being in the territory of reference (Marotta, Nazzaro, 2012).

Results
The analysis of the competitive strategies pursued by wine-making companies of the area was carried out on two levels: the internal one, comprising the wineries belonging to the Cooperative Sasso dei Lupi and the external one covering wine firms located in Umbria reaching leadership at a national level.
The analysis showed that firms characterized by the prevalence of competitive brand produce constant effort of repositioning in order to reach competitive advantages. Sasso dei Lupi cooperative, otherwise, cannot disclose a competitive brand in terms of visibility but consortium companies reveal many virtuous behaviors that give their productions, even if unwittingly, a strong ethical content(see fig.1).
The value of business activity has been shown in this case to be outside from the strictly economic competitiveness and to also involve other aspects.
Overall, the business strategies adopted by Sasso dei Lupi leverage resources that belong to the environmental capital, social capital and human capital and link to environmentally-friendly production, the workers and the community levels, the need for oversight of the territories.

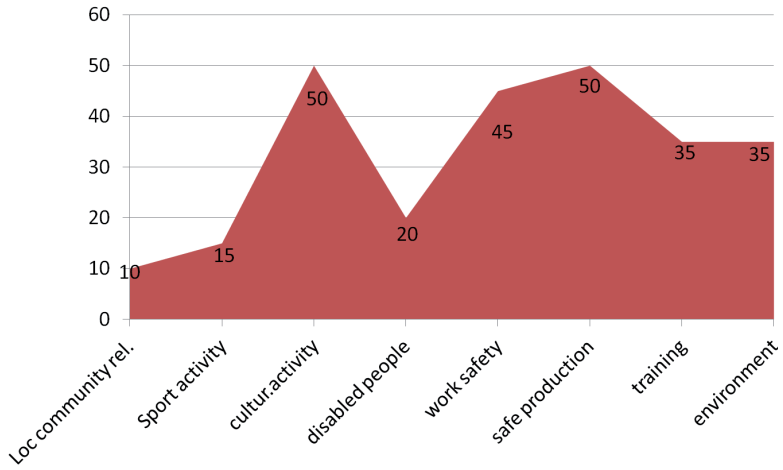

Figure 1. Activities fostered by interviewed Companies.

In the opinion of all surveyed companies, Institutional support mechanisms put in place to ensure the differential of quality production are deficient so as the ones to code the brand in promotional terms and make it an effective source of value.

The entire sample of companies surveyed have demonstrated as evidenced the need of social awareness by the results of one of the questions in the questionnaire that was clearly dominated by the ethical factor next to that of reputation and customer satisfaction(see fig.2).

The overall result of the project was the creation of a structured approach in the form of guidelines for the development of social production in order to facilitate the marketing and distribution of products in terms of benefits extended to the entire wine region system.

The interest areas of the guidelines, that has guided conceptual definitions, have been set in cooperation with the operators concerned and can be summed in environmental protection, need for territorial defense, development of rural areas, promotion of local traditions, maintenance of employment levels.

The benefits expected from the guidelines were classified according to the following diagram (Fig. 3):

Through the implementation of the guidelines were correctly identified the pathways and strategies used to raise the level of brand awareness for Sasso dei Lupi and "fill" the image of the firm social sustainability related topic.

More precisely, the intention is to place guidelines on three pillars consisting of:

- human capital, in relation to requests made externally and internally to the enterprise
- social capital, with reference to the benefits that the company brings to the social context in which it operates through land development and enhancement of human resources;
- environmental capital, in order to integrate environmental objectives in company strategy so to reduce the environmental impact of the production process.

The instruments defined for the implementation of the strategy have been translated into actions to be carried out with reference to the size internal and external to the company (see Figure 4).

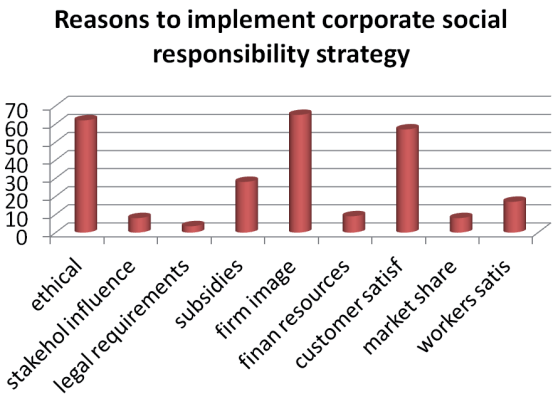

Figure 2. Need of social awareness (%).

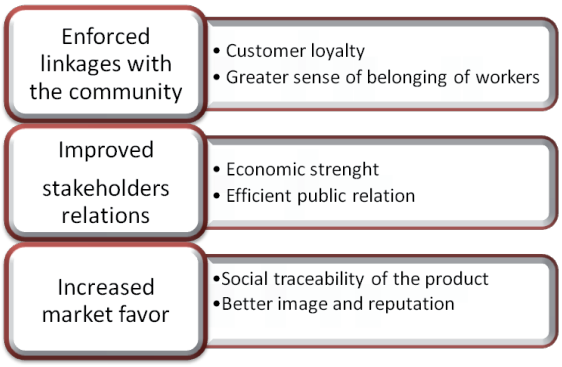

Figure 3. Guidelines of benefits and advantages.

Internal Dimension	External Dimension
Human resources Protection of health and safety at work Caution in the organization / optimization of corporate actions Natural resources and effects on environment	Suppliers and consumers Defending Human rights Environment Local Community

Figure 4. Social dimension of the Company.

Conclusions

The project revealed that both for the Cantina Sociale and almost all companies involved, the image and reputation represent a factor of decisive competitive advantage, like those related to product characteristics.

The analysis allowed to define as the social value element is able to influence in economic terms the results of the wine industry and the relationships within the system and the supply chain.

In particular, the competitive development path set by Sasso dei Lupi and associated farms seems to succeed if based on the possessed social sensibility.

Therefore, market demand shows room for wine product policies seeking for increased competitiveness through the affirmation of a social brand.

This confirms the theories that currently underpin the new competitive strategies based on the differentiation of production processes and oriented to the pursuit of ethical values within the agri-food system.

The used methodological approach allowed to collect in a single instrument the heterogeneity of the initiatives carried out to enhance food production in social terms, with particular reference to wine.

The next step will be the creation of network between all economic, social and institutional stakeholders of the Region able to promote a based social sustainability development of wine sector.

Coherence criteria between guidelines and companies behaviour is in fact a prerequisite to enable the consumer recognition of social traceability of productions and consequently promote cooperation through business belonging not only to the same territory but also to the same values.

The implementation of social sustainability strategies of wine production at a regional level may allow the creation of an innovative perspective for the development of the territories concerned.

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Agri-food supply chain and sustainability: towards a measurement tool for socially responsible products

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Abstract
Sustainability and social responsibility can be measured trough several dimensions. This study aims to understand which ones are important for the consumers and how much information they are expecting on them. Too little information may be irritating for some consumer, too much may overload them. In this paper, we have developed and evaluated four different types of sustainable and socially responsible labels inspired from a multi-criteria decision aid approach. Each one has an additional piece of information. The research has evaluated the corporate social responsibility performance of three food companies operating in the Sannio area (South of Italy) that produce respectively oil, pasta and wine. The sustainability of their branded products has been measured and four different labels indicating their sustainable performance to internal and external stakeholders have been created. The elaboration of a standardized labelling system on food products, outlining their green, social and ethical credentials, is important to avoid to confuse the consumers and producers.
Jel Code: Q56; C44
Keywords: Food products sustainability; Corporate Social Responsibility; Multi-criteria decision aid; Sustainability labelling

Introduction

The global contemporary competitiveness raises the challenge of creating social and economic value, whilst having a sustainable framework and protecting the consumer. In this context, new concepts of environment and food safety were being developed as these were no longer regarded only as obligations (rules to abide by) but also as a strategy to promote economic and competitive growth of enterprises and the supply chain. This situation has established a common sense of responsibility towards social issues, where ethics produces value (Marotta & Nazzaro, 2012a; 2012b). Hence, new types of socially-conscious behaviour from consumers and producers have been observed. For this purpose, the latter have internalized the environmental and social aspects in their economic and business activities through sustainable innovations which have been introduced through the available policies and advanced research systems. With this practice, producers have moved away from low-impact production models towards green economy models thereby adopting product differentiation strategies and discovering new value creation pathways to meet the new citizens-consumers' demands.
In this framework, operators are believed to

be responsible to produce and supply products that are "safe/healthy, not harming the environment and ensuring responsible supply chain". (GFK Eurisko, 2010).
The main problem for operators is the lack of a common and recognized framework that would allow them to properly evaluate the CSR actions they undertake. The European Commission suggests that the performance of CSR actions should be evaluated, both in terms of current impacts and in terms of progress in reaching its goals by using objectively verifiable indicators (European Commission, 2001).
In several works it has been stated that CSR actions can create reputation and may support differentiation, therefore corporate social responsibility is an influential factor in consumers' socially responsible consumption (Marquina & Morales, 2012).
Over the last few years, a drastic change in consumption behaviour has been catalyzed through more easily available information and the increased awareness of the relationship between the production of goods and their social costs.
As a result, citizens-consumers appear to pay greater attention to social impact in terms of production process, raw materials used, environmental and biodiversity topics and human and workers' rights and social justice aspects. Consequently, this consumption model has indirectly given prominence to the value of labeling food products to indicate their sustainable and socially responsible merits.
In light of this, the demand for eco-sustainability, safety, quality, local specialty/identity and ethics upon the products, are perceived both as intrinsic factors (such as taste, healthiness and look of products) and extrinsic factors (origin, quality labels and brands), which also include attractive factors (such as convenience – ratio between expected quality/price, service – preservability and user friendliness) (Barreiro-Hurlè et al., 2008; Casati, Sali, 2005; Giuca, 2010, Grunert, 2005; Hooker and Caswell, 1996; Mason, 2000).
The extrinsic factors mentioned above are associated with many aspects linked with sustainability issues and working as drivers of ethical consumption, such as the territorial identity of the product, the use of low-impact processing techniques and energy conservation, the protection and promotion of natural resources and the creation of landscape, the reduction of transport lead times (from farm-to-fork and short supply chain), compliance with legislation and product certificates, protection of workers' rights and conditions, inclusion and recovery of local traditions and identities and attention to poverty conditions.
A new model of citizens-consumers, who are socially conscious and responsible, is therefore shaped. They give a different importance to their economic choices from those of the previous model of customer-consumer (Marotta & Nazzaro, 2012a; 2012b). Therefore, this new type of consumers reinterprets the concept of sustainability of goods and services, where it includes also the ethical quality and social responsibility of the manufacturing enterprises.
As a consequence, CSR strategy is linked to brand equity and image (Popoli, 2011) and CSR actions can be communicated through labels and claims (Mueller Loose & Remaud, 2013).

Objectives

The aim of this paper is to develop four different types of sustainable and socially responsible labels based on a multi-criteria decision aid approach. The study has been designed to explore the relevant dimensions through which consumers may perceive differences in sustainability and social respon-

sibility. The design of a label could lead to information overload for consumers and therefore it is important to evaluate the opportunities to introduce adequate labeling on food products outlining their green, social and ethical credentials.
The study is aimed at evaluating the performance in terms of corporate social responsibility of two food companies (food industry and wine cooperatives) that produce oil and wine, respectively, both operating in the Sannio area (South of Italy).

Data and Methods
Data about companies performance have been collected directly at production sites of the two involved enterprises, with the collaboration of the company management, during the period may-june 2013.
In this study, the sustainability of the companies branded products is measured through a set of specific indicators derived from the analysis of the literature. In fact, several criteria and indicators have been defined in previous studies and standards. We decided to use a selection of those suggested in the following sources: Hoefkens C. et al 2012; Verhees F.J.H.M., et al, 2008; Moxey et al., 1998; Molteni M., 2004, OCSE, 1997. We also considered several standards such as SA 8000, 2001; CCPB, 2012; European Commission, 2001; Commission of European Communities, 2000. Each indicator is identified on the basis of its relevance, and we defined the appropriate level of measurement and source of information.
For each indicator, the measured value is converted with a preference function into a score. Through this comprehensive diagnostic framework, is possible to evaluate the sustainability performance of different production processes within the same company, as well as to create a benchmark to compare the performance of different companies.
Collected data can also be used with a multi-criteria decision analysis (MCDA) tool, where the evaluation of sustainability is analysed. MCDA helps decision-makers to take informed policies when several conflicting criteria need to be evaluated. In our analysis, we consider the different type of MCDA problem formulations identified by Roy (1981):
- Choice problem
- Sorting problem
- Ranking problem
- Description problem

These formulations are linked to different outcomes of the analysis and to different ways of aggregating the information processed to make a final decision. In a context of food labeling:
the choice problem can be translated into a "go/no go" decision regarding the possibility to award a quality label
the sorting problem corresponds to the assignment of a food product to a predefined set of ordered groups, such as a traffic light classification
the ranking problem corresponds to the assignment of an overall performance score similarly to the Robert Parker's wine ranking
the description problem displays a summarized information on several main criteria, leaving to the decision maker the task on how to evaluate it, similarly to a nutritional label.
In order to assign weights to criteria and to aggregate the information derived from the application of the diagnostic framework to specific products/companies, a PROMETHEE (Preference Ranking Organization Method of Enrichment Evaluations) multicriteria approach will be applied (Brans & Vincke, 1985; Baourakis et al., 2002; Kalogeras et al., 2005). With the help of the software ap-

plication Visual Promethee 1.4 (VPSolutions, 2013), we also made a decision about the most suitable Promethee preference functions, using the Linear and V-shape functions when appropriate. An ideal and a baseline (anti-ideal) point have been defined. The ideal point is defined as an hypothetical action getting the maximum score on all the indicators, while the baseline is an action getting the minimum score on all the indicators. All the companies/products evaluated are in between these two points. At this stage of the research, the weights assigned to each indicator and the levels defined for the ideal action are arbitrary and all the indicators are equally weighted, therefore the results shown below must be considered as a mere exercise aimed at showing the outputs of the method.

Results

The results of the two products are shown in Figure 1 and Figure 2.

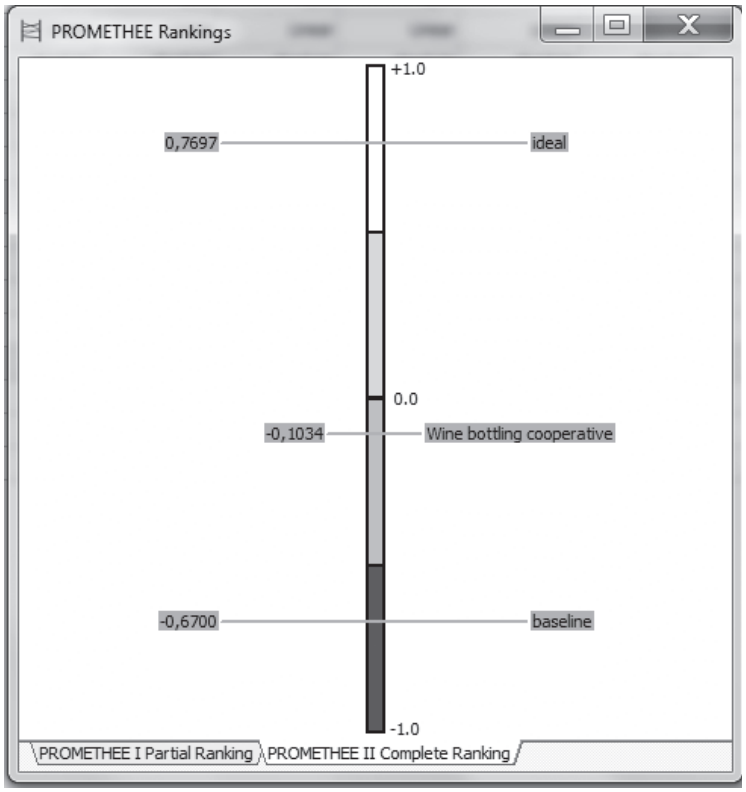

Figure 1. Score of the Wine bottling cooperative.

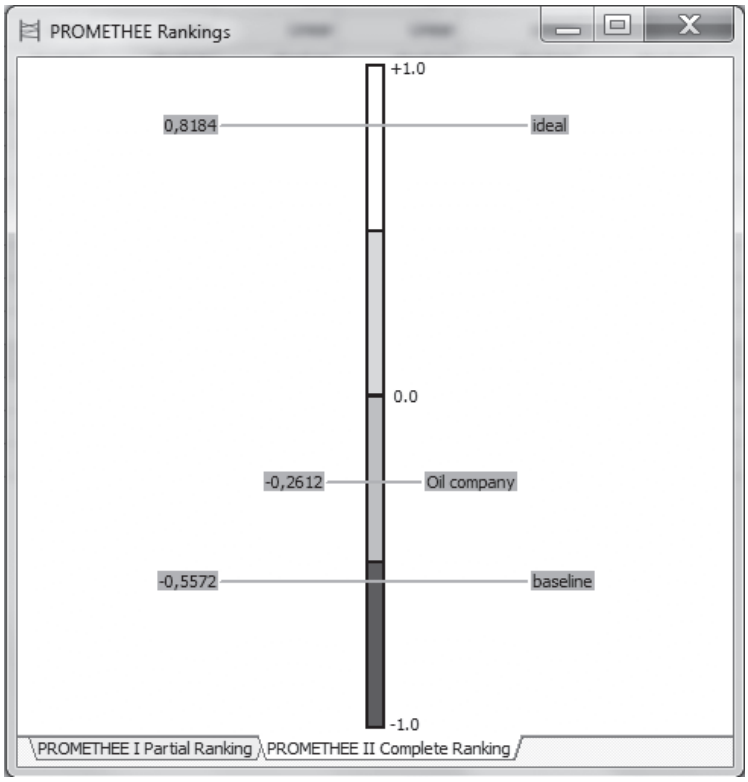

Figure 2. Score of the Olive Oil processing company.

According to the detail presented to the customer, the results can have different forms:
Choice problem:
Both products (Figure 1 and Figure 2) are in the medium low zone of the scale. They have a negative score and therefore they do not currently comply with the minimal requirement to be accredited.
Sorting problem:
Both products (Figure 1 and Figure 2) are in the third quartile of the scale. In case the sorting would be structured in 4 classes with decreasing performance, according to this analysis they both would receive a sustainability label of class 3.

Ranking problem:
The exact score is given on the label. The cooperative winery scores -0.1034 and the Oil processing company is at -0.2612, therefore the former would be performing better than the latter.
Description problem:
The GAIA plan (Figure 3) gives an overall view of the performances of the products. For example, it can be seen that the Olive Oil processing company gets low-medium scores on all indicators. The cooperative winery is particularly strong for the "Agreements and support initiatives" but it is still weak-medium in the other criteria.

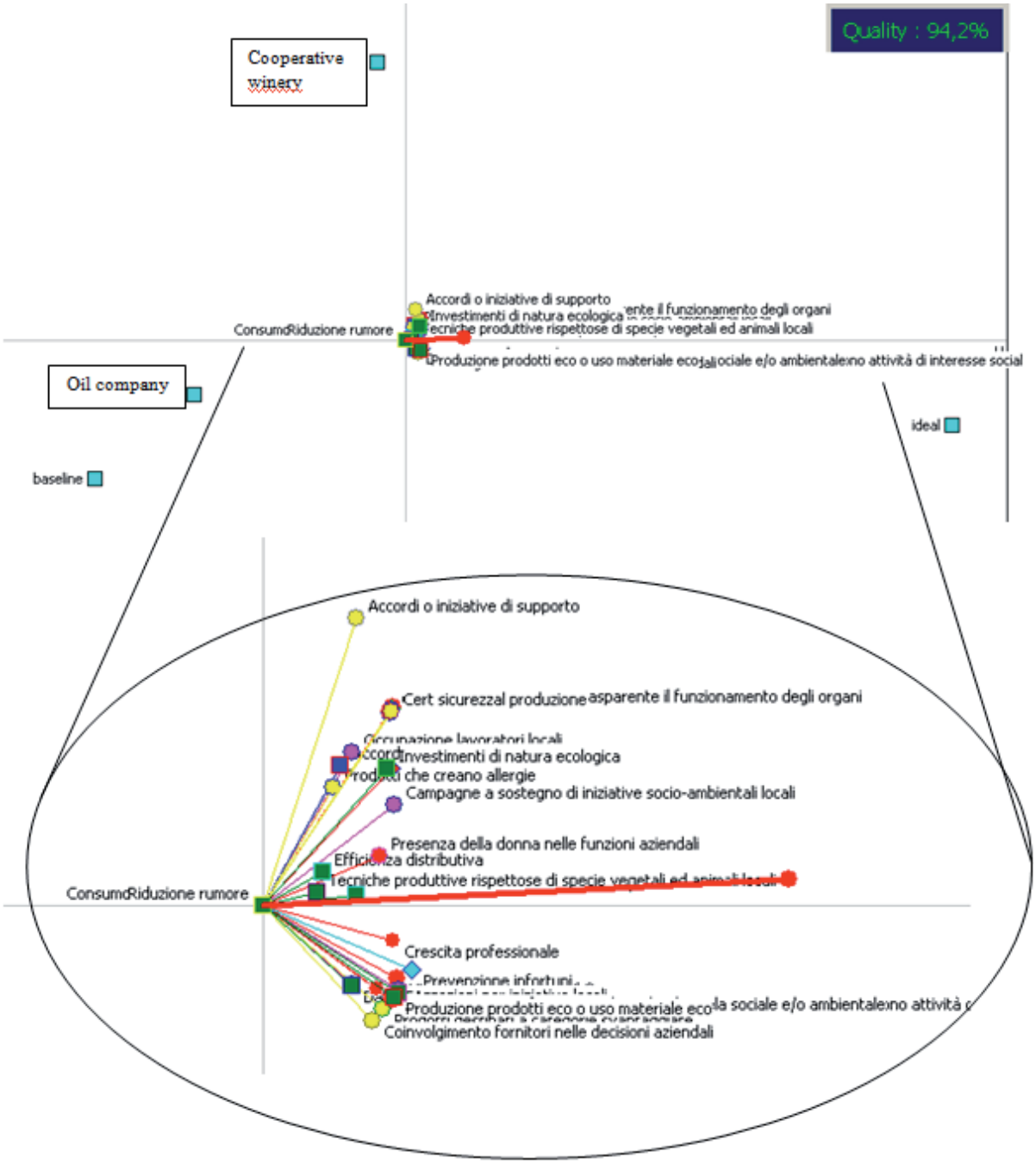

Figure 3. GAIA plan of the products.

This information is the most difficult to present to consumers as it is, while it could be used, with appropriate explanations, to the company managers as a source of information useful to define the actions that can be undertaken to implement the company's corporate social responsibility strategy.

Conclusion

The results of this study are manifold. First, the use of the comprehensive diagnostic framework provide a detailed information for self-evaluation, which will serve as a fundamental starting point for the adoption of an increasingly socially responsible behavior of companies.

Second, the diagnostic tool provide the information to evaluate the product performance in terms of sustainability according to the pre-defined set of sustainability dimensions. This appraisal can be used to elaborate three different types of sustainability labels: 1) a quality seal for the brands that reach at least a certain threshold in the overall sustainability score, 2) a traffic light sustainability label that will divide the products among three levels (green, yellow, red), 3) an overall sustainability score, and 4) a sustainability facts label, in which the performance of each brand/product will be reported using a simplified multidimensional framework, similarly to a nutrition facts label.

The results of this research will be the used in a follow-up study, which aim at analyzing the preferences of consumers for food products labeled according to their performance in terms of sustainability and to compare the effect on the willingness-to-pay for the different type of labels (Tootelian et al, 2000).

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PUBLIC INTERVENTION AND SUSTAINABILITY OF RURAL AREAS

Sustainable development in rural areas: a comparison on governance among some European experiences

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Abstract
The communication comes from a research based on the comparison among cases of italian agricultural districts and other European experiences that - integrating European and national policies - have supported paths for sustainable rural development. The main objective of the comparison is to study the various methodologies used and the role of local actors in the governance processes used for spatial planning and its implementation through the coordinated use of resources from the rural development policy and other policies from national or regional level. It also seeks to highlight the persistence of common methodological elements, in order to verify the concrete activity of a methodological model similar to the one at the base of the concept of Community-led Local Development (CLLD) proposed for the period 2014-2020.
JEL:Q18, R58
Keywords:
Multilevel governance; agricultural districts; sustainability; innovation; CLLD (Community-led local development)

Introduction

This paper states the results of a first consideration which links the paths of two still ongoing surveys [1] (Toccaceli D. 2012a; Pacciani A. Toccaceli D. 2013) and focuses on the comparison among the ways the governance methodologies are applied in cases of Italian rural districts and other European case studies which – by integrating European and national policies for agriculture and rural development – supported ways of sustainable development.
The main target is to study, within these governance processes, the methodological models able to allow the environmental, eco-

1. The first research on the districts in agriculture in Italy was promoted by the National Rural Network ten years after the "guidance law in agriculture" and was conducted as part of the Task Force Integrated Planning. The first part of this study (Toccaceli D. 2012a) actually aimed at laying the basis for a method to compare the very different regional experiences. This paper also makes some references to the second part of the study, aiming at carrying out an on-going research in field on the main social and economic profiles of districts. According to this up-dating, there are already more than 80 acknowledged districts and in several Regions the procedures to acknowledge new districts are still being applied. The second study, promoted by the Laboratory of Rural Studies "GAIA" of the Georgofili Academy aims to make a comparison among some experiences of governance in European rural areas. The results of the first phase of the research, which involved case studies in Spain, France, Belgium and Luxembourg are presented in the course of the Study Day "Paths of governance for the development of rural areas with a view to reform of European policy '(Florence 11 January 2013, http://www.georgofili.it/detail.asp?idn=1254) and are being published in the Acts. Also this research is still in progress, to expand the type and the number of examined cases, and then to deepen the analysis through targeted empirical tests.

nomic and social sustainability of the taken directions with a reference to the policy of rural development and to its implementation at local level by means of participatory methods.
In particular, we want to emphasize the role local stakeholders played in the governance for a territorial planning and for its execution through the effective and coordinated use of resources resulting from rural development policy and from other policies at European, national or regional level. Finally, we want to highlight, as for the effectiveness of the cases, that there are elements shared with the methodological approach the concept of Community-led Local Development (CLLD) is based upon, suggested for the next planning period.
The survey makes part of a context of deep change, at global level, of the technological paradigm from *fuel-based* to *bio-based* (OECD 2009), in order to ensure satisfactory replies to the inevitable environmental, social, economic and above all food challenges that are in sight for the years to come. From this point of view, several conditions put again agriculture in a leading position as a strategic sector: the global demographic growth, the fast economic growth of the BRIC countries and the consequent change of models of food consumption, the growing demand for functional food and nutraceuticals in the health sector (Arundel A., Sawaya D., Valeanu I., 2009), the demand for agricultural and forestry products to produce energy from renewable sources. Moreover, several variables may have an impact on the outline of the eventual scenarios concerning the *food (in)security* issues (Paillard S., Treyer S., Dorin B., 2011); among them those directly related are the following ones: the climate change, the depletion of many resources, the real availability of cultivable lands, the productivity of agriculture and the *consumption trends*.
The European Union has focused on these issues the new strategy for 2020 (Commissione Europea 2010) which should lead the "old continent" from the current crisis to the beginning of a new smart, sustainable and inclusive (bio)economy characterized by higher rates of employment, productivity and social cohesion, based upon biotechnologies (Commissione Europea 2012a) and supported by the EU framework program for research and innovation (Horizon 2020, Commissione Europea, 2011).
CAP, in its confirmed two- pillar formulation, will play therefore a key role in the new European strategy and the above mentioned issues were essential for the debate to reformulate it (De Castro 2010, De Castro P., La Via G., Adinolfi F., Marangon F., 2011, European Council 2013), as it was the case for the debate on the reform of the structural policies which are now suggesting a new governance (Barca F, 2009, European Commision 2010) aiming at allowing a more effective and synergic execution of policies by means of the Common Strategic Framework (Commissione Europea 2012b) and the right application of the partnership principle for its implementation (Commissione Europea 2012 c).
According to the new planning for structural policies, the local scale plays again a strategic role in order to execute interventions aiming at supporting the participatory local development, based upon the multi-level governance (Committee of Regions, 2009) and making use of an expansion of the method of the LEADER kind in order to implement *community-led* and multi-fund strategies. (European Commission 2013b: artt.28-31 and European Commission 2013a).
In addition to that, we also have to take into

account that European policies will be implemented in each Country, by integrating themselves with different national measures, too, aiming at achieving similar goals. This paper focuses on the chances and ways to implement this integrated utilization of tools having very different "political" origins; it aims to offer a first conceptual and methodological organization focusing in particular on the mechanisms to realize the governance processes in the analyzed case studies.

Methodology

We considered the methodological approach of Italian rural districts as a term of comparison in order to analyze the different governance methodologies applied to the European case studies as well as the local stakeholders' role in the territorial planning.

We identified experiences referable to national tools having a *local* approach[2] and based upon a participatory method in order to make a comparison with the European case studies. In particular, this paper makes reference to the cases dealt with by the long-term experiences of French Pays and of the Spanish PRODER, which meet these requirements and were widely spread.

First of all an in-depth study was carried out in order to explain the terms of comparison and it concerned the typical features of the methodologies the different tools applied.

The methodological approach of Italian rural districts (DA)

Districts in agriculture (DAs), unlike the industrial ones the idea of district was borrowed from, are a phenomena resulting from a ultra-twenty-year layering of national rules[3] which gave the incipit to several Regions to shape a quite wide, diversified survey of DAs adapted to different geographical and social and economic contexts, having variable purposes. Regional law makers employed DAs with a great flexibility; they defined the rules for their functioning in very different times and ways. That made the interpretation of this phenomenon be very complex at national level. In order to develop the research on this issue and to make it be less complex, a methodological approach (Toccaceli D. 2012a) was worked out; the research this paper makes reference to is based upon it, too. This approach is based on the observation that, although this pathway was characterised by deep changes of vision and of political guidance, the legislation on DAs kept however some common elements[4]. In fact, the *neutrality of a methodological approach* emerged with regards to different sectors, territories and economic targets DAs were defined for and employed in, over the time. Thanks to this interpretation, it was possible to deduce a *methodological definition* of DAs from the legislative sources; it defines them as a method of intervention at local level, based upon multi-level governance dynamics. This definition focuses on the complex

2. The idea of local employed in the survey does not make simply reference to a geographical and administrative scale, which is however at sub-regional level (sub-NUTS2), but it results from the regulation: either according to the application of specific parameters (as it is the case of zonings which allowed to identify eligible areas for the LEADER implementation); or through the identity, wherever the national regulation allowed local communities – which can be identified in any case – to take the initiative.

3. Taking into account the main legal basis, the national law maker has modified, by multiplying them over the time, the definitions referable to the concept of district. For more details, see: Toccaceli D. 2012a:37-50.

4. In particular, the methodological organization of the first intervention on industrial districts is still the core of all the laws on DAs.

system of relations which exist among several stakeholders at local level as well as between this level and the above-ordered ones, in order to develop and to implement a strategic project at local level:

- the establishment of a local partnership which expresses a specific strategic district planning, ensuring participatory procedures respecting all the involved subjects and guaranteeing the implementation of the strategy by means of projects to innovate and to re-qualify the production system that are actually achievable;
- the introduction of these projects at above-ordered regional, state and EU planning levels (by means of negotiated planning tools, too), implementing the principles of vertical and horizontal subsidiarity;
- at over-local level, the preferred partner for the district is without any doubt the Region specific functions are assigned to in order to identify and to regulate the DAs' working as well as to assess their planning character as for the targets of policies and as for its planning.

The district defined in this way, given the principles supporting it, is consistent with the local participatory approach based upon multi-level *governance* provided by the policy of rural development post-2013 with a greater emphasis than in the past and as a scale of relevant intervention for the EU structural funds.

As far as the Italian cases are concerned, today eighty rural districts were identified in the fourteen Regions and in the independent Province of Trento which legislated with regards to this issue (Toccaceli D. 2012a: 51-67).

The methodological approach of French Pays

The French regulations on Pays include an approach similar to the one of DAs (Albisinni F. 2002 a e 2010, Toccaceli D. 2012a: 28-30, Toccaceli D. 2012b); the first form of these regulations dates back to 1975[5], when they were worked out with the aim to hinder the exodus from the countryside and to preserve the economic and social viability of rural places, by means of actions aimed at supporting the employment, at keeping the public services and at improving the standards of living. By means of the following interventions, the policy of Pays became more and more European, more and more regional, more and more oriented to the sustainability of local development processes and of the strengthening of local democracy by means of participatory processes (Nemery, 2005). Furthermore, in order to guarantee equal opportunities on the territory for each citizen, a *taxation of Pays* was also provided. It is interesting to notice that also in Italy (with the Financial Act 2006) a "district taxation" was acknowledged – of any kind, not only rural one – although that is very far away from the establishment of those "rural free zones" considered as a useful tool to stimulate again the economies facing problems of structural developments. (Marotta G., Nazzaro C., 2007).

The Pays are defined as *territories of geographical, cultural, economic or social cohesion* and, likewise Italian DAs, the homogeneity of the historical and cultural identity

5. After a first application, the same tool found a revitalization thanks to three following legislative interventions which made its purpose be updated and strengthened its efficacy; the Pasqua Law (1995, *Loi d'orientation pour l'aménagement et le développement du territoire*), the Voynet Law (1999, *Loi d'orientation pour l'aménagement et le développement durable du territoire*), the Loi Urbanisme et Habitat (2003).

component[6] prevails on any type of other criterion to pre-define the area of Pays which correspond to an *action space* (*Conseil de développement*) where the representatives of economic, social, association and institutional local stakeholders express themselves to define their medium term (three years) project of local development (*Charte de Pays*). The Municipalities represent the local administrative level at the core of the *Pays* device which is not a new legal subject, but which may have a legal status in different ways[7].

Therefore, the *Pays* presents itself as a flexible structure adaptable to different local situations which does not coincide with an administrative level, but it opens a dialogue among the several administrative, economic, political and social components.

The Charter is the project for sustainable development which is based upon the analysis of the territory and upon a strategic vision that is worked upon during a consultation. The Charter has no legal value, but has a political value and it paves the way for the bargaining with the Region or with the State (or with both) for the Contract (*Contrat de Pays),* which translates the strategic trends into a long-term program of initiatives of activities and integrated and intersectorial investments. The Contract, which is the typical tool, identifies the sources of fund and coordinates the financial interventions by the State, the Regions, by the Provinces *(Département),* which become in this way the partners of the local communities.

Thanks to the introduction of the Contract, the establishment of Pays and the signature of Cdps spread more and more till the end of 2010[8], when the new reform denied any chance to establish new Pays, although the acknowledged 370 Pays [9] may keep on working.

The Pays also played a significant role in implementing the national policy of *pôles d'excellence rurale* which are innovative projects for the development of rural areas and which are the beneficiaries of a specific funding by the State. In pursuant of th 2005 law which established it, the label of *pôle d'excellence rurale* is acknowledged for projects of economic development based upon the planned action by a partnership of local communities and private enterprises, only. Therefore, no wonder if the Pays widely made use of this tool also, both its first generation (2005-2008) where out of 379 projects 115 were submitted by Pays, and its second generation (2010), where 19 projects out of 115 are by the Pays. The Pays were also strongly connected with the implementation of other tools of sustainable rural development, such as Agenda 21. In particular, compared with LEADER+, in 2005 it resulted that out 140 GAL, 129 concerned a Pays (Némery, 2005).

Up till now the debate on the Pays is not over at all and the new government is trying to recover this tool[10] by underlining its special

6. Which has to be acknowledged by means of a series of geographical, sociological, economic indicators able to identify a space characterized by a consistent identity.

7. For instance as a Group of Public interest for the local development or as Mixed Union or, more simply, as an Association.

8. Law n°2006-1563 of 16th December 2010 for the reform of the Territorial Communities, which repeals art. 25 or the Voynet Law.

9. According to the Association of Promotion and Federation of Pays-APFP, in 2009, last year when new Pays were acknowledged, we reached this figure involving 84% of the French territory and 50% of the French population.

10. During the latest weeks, several references may be understood in the French press. For example, from www.info-maire.com: "25 juin 2013-Marylise Lebranchu veut relancer les pays

function to make the access to services in rural areas be more effective; according to the French vision and instruments, rather the Italian ones, this aspect is closely connected with the creation of conditions of competitiveness of territories.

The methodological approach PRODER in Spain

PRODER is an operational program promoted by the Spanish government during the years 1995-1999 (PRODER I) and during the years 2000-2006 (PRODER II); among its main aims the promotion of the endogenous and sustainable development of the Spanish rural province (*Comarca*), by means of the economic diversification, and also the contrast to the rural exodus and to depopulation. Although it is a national initiative, PRODER adopted the LEADER methodology and purposes[11], with the aim to support those provinces facing the main difficulties in developing (mostly objective 1).

PRODER, in both periods, was a multi-fund program which allowed the integrated utilization of national, regional or local financial resources and the EU framework of support of the Structural Funds, in particular FESR and FEOGA-O (ERDF and EAGGF-Guarantee). Provinces were responsible for the management of the programs while the Ministry of Agriculture, Fishing and Food was responsible for their coordination; according to the latter one during the first cycles 101 PRODER programs were implemented (1996-1999) and 162 during the following cycle[12].

The PRODER program acted in a complementary way with LEADER, succeeding in achieving specific targets for the Spanish rural scenario: to emphasize the local scale as an *action space* (Plaza Gutiérrez J. I. 2005) *to unite the local interests* and, at the same time, to develop the role of Comarca (province). The territoriality of strategies – in this case as well as in the French one – goes beyond the mere economic level and extends to the territorial cooperation aimed to the overall development of the rural heritage in a broad sense.

Nowadays the observation of the way this

au travers des pôles ruraux- La ministre de la Réforme de l'Etat, de la Décentralisation et de la Fonction publique, Marylise Lebranchu, a défendu hier le concept de pays pour mutualiser les services publics. Les pays, dont la création a été interdite par la loi de Réforme des collectivités territoriales de décembre 2010, pourraient être relancés au travers des pôles ruraux d'aménagement et de coopération ajoutés au projet de loi sur la réforme territoriale lors de la première lecture du texte au Sénat. […]« Le pays a depuis plus de 15 ans montré son utilité. Si la loi de 2010 a mis fin à la création de nouveaux pays, je crois qu'ils gardent toute leur pertinence, et que plutôt de les supprimer il convient de leur permettre de se régénérer,d'évoluer aussi », a affirmé Marylise Lebranchu. Les pays, a-t-elle aussi rappelé n'ont vocation « ni à remplacer ni à se superposer aux intercommunalités, (ils n'ont) pas la même finalité. C'est la mutualisation au niveau d'une aire géographique ad hoc qui est pertinente pour construire un projet ». "

11. LEADER II for the first cycle PRODER I, afterwards the *Real decreto2/2002 of 11th January 2002* ruled in a contextual way the EU initiative LEADER Plus and "*los programas de desarollo endògeno de grupos de acciòn local, incluidos en los Programas Operativos Integrados y en los Programas de desarollo Rural (PRODER)"*. The features of the LEADER methodology, given its wide dissemination and the wide provided literature, are here considered as footnotes and are not the subject of a specific description.

12. Concerning up to 3.658 Municipios, a rural population of more than 8 milion people and a rural territory of 7,5 Km2 , with an overall investment during that time of 827 milion euros (63% of EU source, mostly FEOGA-O) (http://www.magrama.gob.es)

form of "developed LEADER" works is actual once again in view of the policies to be applied since 2014.

The elements of comparison

Besides the already supposed local and participatory approach, an essential coincidence of some key elements resulted from the comparison of different methodological approaches:

- Strategic Local Planning
- Multi-level *Governance*
- Capacity Building
- Concentration and Coordination of Policies and Financial Resources
- Cooperation with other rural areas and/or between urban and rural areas.

The survey methodology is based upon the analysis of case studies through direct surveys, focus groups with stakeholders of the territory and interviews to qualified witnesses.

The selected cases

The Italian cases take into account some rural districts characterized by a more marked territorial value compared with quality agricultural and food districts and agro industrial districts that, on the contrary, concern specific rural supply chains. In particular, we examined the application of the district method in the rural sector as for two very different case studies: the rural districts of the metropolitan area of Milan and the rural district of Maremma.

In the city and the metropolitan area of Milan four rural districts have been recently identified aiming to harmonize the relations between the city and the countryside in order to safeguard the environment, the culture and the landscape typical of those places, by protecting the rural activity and its multi-functional value. The Milan rural district (DAM), the rural district of Alta Valle Olona (DAVO) and the rural district "Riso e rane" (Manzoni P. 2012) ("Rice and Frogs") are located in the municipality of Milan (the second rural city after Rome), while the new rural district of the three streams of Milan (DINAMO) is located in the urbanized countryside westward the city defined by three rivers (Canale Villoresi, Ticino and Naviglio Pavese) and it includes farms that are located within the sixty-nine municipalities of the metropolitan area.

We should notice that these are pretty "young" district experiences, started since 2010 coinciding with the legislative initiative of the Lombardy Region (Petrovich B., Manzoni P. 2010).

The common approach, problems and the recent effort by the districts as well as by the Region to organize their initiatives into a system lead us to consider the four districts as one single case study.

We thought it was appropriate to compare this first case with a very different district initiative that, on the contrary, is located in a rural province with a low demographic density and with a long rural tradition: the province of Grosseto where, since 1996, the first district experience in agriculture was been tested and set up, the rural district of Maremma. This initiative, which is already mentioned in economic literature (Becattini 2000, Becattini G., Bellandi M., Dei Ottati G., Sforzi F. (ed.) 2001, Albisinni 2002 and 2002a, Cecchi C., Grando S., Sabatini F.2008, Pacciani A. 1997, 2002 and 2003, Belletti G., Marescotti A., 2007 and 2010, Toccaceli D., 2006 and 2012a, Gulisano G., Marcianò C. (ed.) 2008, Pacciani A. Toccaceli D. (ed.)2010 and 2011), represented one of the reference points to define theoretically the district methodological model (Albisinni 2002, Toccaceli D. 2012a, Pacciani 2013, Toccaceli 2013) .

The European cases were also identified with a careful selection of experiences in territories with well distinguished features if we take into account the historical-geographical and the social-economic contexts where they took place as well as their environmental characteristics and the implemented spatial dynamics.
In Spain the case of ADESIMAN (Federaciòn para el Desarollo rural de la Sierra y Mancha Coquense) was selected, based at Cuenca, established in 1997 (Gallego Moreno F.J.,2012) – coinciding with the PRODER I program- as a no profit federation in the form of a Group of rural development (Gruppo de Desarollo Rurale) which gathers three associations of the territory. The area where ADESIMAN works counts just 11,3 inhabitants per square kilometre after a strong depopulation; agriculture still plays a key role for the economy and the environmental balance of the territory. ADESIMAN aims to work for the integrated, endogenous and sustainable development of the area where it intervenes, thus helping to improve the living conditions of the rural population as well as of the environment.
In France, instead, a case concerning a territory in Brittany was selected: the economic and demographic dynamics are much more lively despite the recent strong crisis of the industrial sector. Pays of Fougères is located in an area where agriculture stands out above all for its zoo technical sector which is important at national level; for this sector the population submitted specific requests to match again production methods, environment and the quality of citizens' lifestyles (Sol et Civilisation 2010, Pham T.G., Aubert F., 2013).
The cases, whose experiences showed us the practical efficiency of the methodological model, are deliberately different in order to enrich the possible considerations, although the examined areas are just a few.

Results
We noticed the converging of the following elements in all the analysed cases:
Achievement of the production, employment, income and multi-functional role played by agriculture as well as its successful integration with other economic activities;
Working out of large scale integrated territorial strategies, able to understand the diversified needs of rural population aiming at:

- Safeguarding and enhancing the environment and the whole of endogenous resources the development dynamics are connected with (environmental and economic sustainability);
- Re-evaluating and being interested in the social capital involved to be an active part in the decision making processes aiming to build again a future for the territory (social sustainability).

Despite the wide range of social and economic, historic and institutional contexts, of environmental conditions and spatial dynamics, it was possible to notice that:
Although agriculture and the agricultural and food system play a significant role in all the cases, the new sustainable development ways were achieved by means of strategies which enhanced diversified resources.
The methodological principles, which were applied to make this comparison, were employed, for many years too, for application solutions adapted to different situations.
In short, with regards to the identified methodological principles, it resulted what follows:

Planning
For all cases a planning was developed and it was *strategic*, since it aimed to anticipate and to hinder imminent threads; *integrated,* because it was based upon the interdependence and the complementarity among eco-

nomic sectors and among several resources of the territory or upon the strengthening of rural production sectors; *sustainable*, because the environmental sustainability – as well as the economic and social one – was always a prerequisite for action in all the examined territory; oriented to the innovation of territorial organizational solutions or development issues.

Multi-level Governance
In all cases, the governance process was *participatory* in encouraging local stakeholders to join in the project working out as well as in the initiatives taken to implement it. The practical organizations of the partnership do not share formal features, since it was indifferently an association, a company or entirely informal, following specific regulatory provisions wherever they exist. The initiative itself was taken by different subjects: by the province administration in the case of the rural district of Maremma, by the Pays in the case of Fougères, by the group of the farms in the case of Milan rural districts and by a group of territorial public-private associations in the Spanish case. In all cases we noticed, even if in different ways, the development of an inter-institutional or vertical governance (in particular towards the Regions and the State) aiming at linking the local planning and the policies to be implemented as well as at finding the financial resources. We noticed that the success of several initiatives depended on a rich Networking characterized by a strong interaction, at local level, among several subjects such as GAL, development agencies no matter how denominated, Parks and system of enterprises;

Capacity Building
The projects, which was worked out for the analysed cases, are characterized not only by sustainability, but also by innovation and qualification of the production systems and of the territory. It resulted that the building up of new and specific skills and the upgrading of existing competences in the territory played an essential role for each strategy. In the Milan case, in particular, the skill building played a specific role to establish strong relations with the city and this building was carried out by means of very targeted initiatives. Generally, we observed a strong attention for the qualification of human resources, both in terms of innovation of professional competences, with regards to new set up development ways, and in terms of training to social dialogue – for the management, too.

Concentration and coordination in employing financial resources.
In three cases[13] out of the analysed ones, resources, which often resulted from many European and national sources, were employed in a coordinated manner and consistently with the implementation of the initiatives launched to implement a sustainable territorial project.

Cooperation with other rural areas and/or between urban and rural areas
In all the analysed cases, the territorial and cross-border cooperation played a significant role, even if in very different ways and with very distinct purposes. In the case of Milan rural districts, although they are now starting their district experience, the need to coordinate their action immediately stood out, by working out – together with the provisions of the regional regulation – a tool of negotiated planning in order to consolidate at the same time the relation between the Provinces and the Lombardia Region, too. Furthermore,

13. Since the Milan districts have not fully implemented their projects yet.

this experience is starting within the European Territorial Cooperation Program (Alpine) through the project RURBANCE[14]. Maybe, it is worthy to remember that the research we carried out encouraged exchanges and comparisons the analysed territories acquired afterwards.
Witnesses self-assessed all the cases as successful experiences which had a significant impact to establish the requirements for a new course of sustainable growth, broadly speaking.

Conclusion

By means of the examined case studies we verified the real effectiveness of the principles being the basis for the methodological approach resulting from the rural districts in Italy, consistent with LEADER/PRODER and with French Pays. In particular, we pointed out that these principles supported the implementation of pathways of sustainable development at local level, in territorial contexts with very different features.
In short, we can draw useful conclusions with regards the policies which will be implemented during the next planning period:
LEADER has been a unifying method within the European Union and its spreading to all the Structural Funds confirms its potentials (ENRD 2013). However, LEADER should be taken into account for its "contaminations", too, which, directly or indirectly, tightly link it to the other tools. This circumstance is direct and evident in the case of PRODER, while it is indirect but clearly mentioned in the cases of rural districts which "evolve" from GAL[15]

The reasoning on methodologies allowed to consider policies from a more "lay" point of view. In particular the Das methodology presented itself as *neutral, homogeneous and flexible*. The current French debate on the "recovery" of Pays also emphasizes the – implicit – presence of these features.
The effectiveness of the methodological principles has been assessed through experiences started in different moments and also rather widely separated, thus having the chance to visualize their evolution. Therefore we noticed that for each case, even the most recent one, it being understood the basic principles, newer and newer tools, solutions and pathways have been worked out underlining a process of adjustment over the time and of integration between old and new tools of policy, resulting from a real process of collective and institutional learning.
By applying the identical methodological principles, the different territories may track totally *autonomous* pathways because they do not depend on the applied method and

14. Project RURBANCE - Rural-Urban inclusive governance strategies and tools for the sustainable development of deeply transforming Alpine territories

15. There are cases of DA which evolve into DA, for example the Lombardy case of GAL Golem/rural district Franciacorta, Sebino, Valtrompia or the Calabria cases of GAL Sila/rural district of Sila and of GAL Serre Calabresi/Rural District of Serre Calabresi and the Upper Locride very recently approuved. There are cases of active collaboration and complementarity between DA and GAL, for example the Rural Distrct of Maremma (Belletti and Marescotti 2007) or the quality food and agricultural district Castelli Romani and Prenestini. There i salso the case of the choice made *a priori* by the Piedmont REgion which acknowledged the LEADER planning as a "substitute" of the one of the rural districts and as a matter of fact it acknowledged quality food and agricultural districts, only. The The LEADER and DA ratio shares several points, which have already been partly studied (Rete Rurale Nazionale 2007, Toccaceli D. 2012a:27-28; 67-72) but in the future it will be possible to usefully study them in depth.

because they are able to enhance local specific features and many diversities the European rural nature reveals itself (Ciolos D. 2013[16]).
According to these conclusions, we could wish the *generalization* of a *lay* attitude towards the tools to implement policies at local level, actually in favor of a simplification of language and tools.
Instead of emphasizing the creation of newer and newer tools, for the future planning period, we could focus, in a more useful way, on the need to check the "pre-conditions to development" exist (Marotta G. Nazzaro C., 2007) binding the revitalization of the human and social capital. In Italy we started to draw the attention on these problems by means of the "strategies for inland areas" (Governo Italiano - Ministro per la Coesione Territoriale 2012a).
Although the multi-level governance plays a key role in the remarks we made, it is however valid the notice that in implementing a participatory methodology there is still the intrinsic difficulty to start and to carry out successfully a social dialogue as well as among economic and institutional stakeholders, which is both constructive and connected with real targets. None of the analyzed tools, in fact, can ensure to actually achieve the creation of value in the rural areas where it can be applied, because of the evident weakness of governance compared with the "government" (Di Iacovo F., Scarpellini P. 2006, Jessop R. 2006).
The principles characterizing the methodological model of this survey are also confirmed by the by now consolidated reform guidelines for the CAP and for the European structural policies as well as by the indications, basic but essential, the Commission wanted to give to the Member States (Commission 2012c) as for the principles to respect in order to build up an effective multi-level governance by means of the Partnership Agreement, already subject matter of an advanced debate in Italy, too (Governo Italiano - Ministro per la Coesione Territoriale 2012b). In particular we make reference to the future application of the new CLLD approach; while I am finishing to write this short paper, a wide debate is ongoing on the procedures to include it into the Partnership Agreement. This tool which is fully based upon the LEADER methodology and consequently should not represent a problem – encouraged the Commission services, jointly, to issue some guidelines to show its possible applications in different rural, urban and coast contexts, the most convenient procedures to include it in the Partnership Agreement. The most recent challenge is without any doubt linked with the duty/need to set up a single-fund or pluri-fund strategy.
The analyzed cases show that, in Italy as well as in other Member States, there may be specific local situations which have already developed such an experience and knowledge to apply fruitfully the new CLLD approach.

16. "The new CAP responds to an objective which came out very clearly in the public debate: turning the diversity of farming into a strength".

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The sustainability of rural diversification into tourism: a study in the Italian regions of the «convergence» objective*

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Abstract
This paper deals with the issue of the sustainability of policies of agricultural diversification towards tourism which is emphasised in the programmes of rural development in many agricultural regions, like those of the convergence objective on which the analysis concentrated. In the paper it is pointed out that the way the regional authorities incentivate or assist farms to diversify into tourism could have implications for sustainability, examined in this study thorough the presence of five indicators. The weight of these per region, obtained from the combination of structural variables (number of accommodation facilities and of beds) and of flows (arrivals and presences) registered in farm tourism, was estimated by applying Index Decomposition Analysis (IDA) to the variation in presences recorded in the period 2002-2011. By introducing the institutional aspect of the sustainability of rural development processes, the paper also identifies "integrated rural tourism" as the most effective model of tourism diversification for farms, since this brings the focus back onto the local food producing system.
JEL: Q18; Q01; R58.
Keywords:
Farm tourism; Institutional sustainability; Farm diversification; Index Decomposition Analysis; Rural development policy.

Introduction

Diversification is generally considered a strategy of adaptation adopted by businesses in times of lasting crisis and/or when there are structural reductions in profits. In agriculture, however, diversification has mainly taken on the meaning of a survival strategy, with particular reference to small businesses located in the most outlying, disadvantaged rural areas (Lange et al., 2013). At first the European rural development policy seemed likely to give this strategy an extremely important role, but its potential was reduced by the resistance of the established PAC players and the obsession with the market, leaving it with a marginal role confined to situations where any other kind of intervention in sup-

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port of production and competitiveness was inapplicable.
Of the various forms of economic diversification for agriculture, rural tourism seemed the most suitable for a rapid increase in the prosperity of rural areas (Hernandez-Mogollon et al., 2011) and it was therefore explicitly included amongst the measures of the third axis of the rural development policy concerning the diversification of the rural economy. However, the visitor presences in rural areas brought by tourism are considered by many to be a possible threat to the integrity of the place. This has led to a growing insistence on the issue of the sustainability of rural tourism, requiring considerations not only on economic aspects, but also of a cultural, environmental and social kind. This approach has raised interest in the quality of tourist spending, especially that on food, which if steered in the right direction, could reduce the impact of the process of diversification into tourism or make it more positive (Sims, 2010). This link between food and rural tourism is summed up in the concept of «integrated rural tourism» (Saxena and Ilbery, 2010, p.261), where the key element is the networks based on relations (strong, weak, formal or informal) between the different local players, as well as on their respective traditions and models of behavior. This theoretical approach is naturally reflected in the chosen policy model, based on participation, or on the direct involvement of the various players and local interests in the attempt to trigger amongst them discussion processes designed to resolve or attenuate conflicts.
The choice of tourism in agricultural diversification processes has also been influenced by two other factors. The first is related to the growing interest shown in rural culture by the population living in metropolitan contexts, which has given rise to a new tourist demand of a non-conventional kind based on "hands-on" experience (Garrod et al., 2006). The second, on the other hand, is related to the rural tourism's ability to spark other key objectives in agricultural policy, such as organic farming (Kuo et al., 2006), the reorganization of food supply chains (Belliggiano and De Rubertis, 2012) and the defence of the countryside (Marangon, 2006). The latter issue is strongly emphasised in the national strategic plan (MiPAF, 2010), considering the countryside's characteristic of protecting biodiversity and at the same time being the basis of local processes of identity reinforcement which embody the local area's main competitive advantage.
Therefore, since the aim of the European policies for rural development was to encourage the integration of tourism and food production activities in order to promote economic growth in marginal areas and, in broader terms, to enable them to achieve sustainable development, in this paper it is assumed that reaching this objective, by gradual approximation, can be reflected in the increase in tourist presences. Breaking them down into various factors linked to the different aspects of sustainability with the use of *Index Decomposition Analysis* (IDA), could enable the assessment of both the quality/intensity of the phenomenon, and also of the sustainability of the growth of tourism in terms of the (local and non-local) objectives of local development. Therefore, after briefly outlining the multidimensional nature of the concept of sustainability and its implications for policies of agricultural diversification into tourism (section 2), the methodology adopted will be illustrated (sect.3) and the results of the four Italian regions of the «convergence» objective[1] will be presented (sect. 4)

1. According to the EU, the convergence objective applies to regions with a development lag

in order to assess the sustainability in these areas of agricultural diversification into tourism supported by rural development policies (sect.5).

The institutional sustainability of rural tourism and the role of the food production system

The idea of rural development that since Agenda 2000 has been gaining force in European policies is based on the need to bring new activities into farms alongside the traditional ones, in order to generate new sources of income without distorting their original socioeconomic role, in keeping with the tenets of sustainability. Sustainability is one of the most interesting innovations to emerge in the recent past in political-institutional debate. Discourses on sustainability however have almost always appealed to the ecological side of the management of natural resources, over-simplifying a far more complex and many-sided concept (Pearce et al., 1989). Sustainability should be seen, in fact, as a system's capacity to reproduce itself over time without causing erosion not only in environmental capital, but also in the social, economic and institutional capital on which it is based (Spangenberg et al. 2002; Spangenberg, 2004; Pfhal, 2005). Viewing sustainability purely in an environmental key therefore risks neglecting the most innovative aspect of the paradigm, which is the search for the proper balance between different aspects, objectives and interests involved in development processes (Valentin and Spangenberg, 1999). It is in this line of thinking that great emphasis has recently been placed on the concept of institutional sustainability which, despite having spread rapidly in various contexts (Hill 2008), is still lacking in rural development discourses. However, this concept, used erroneously as a synonym of "institutional development", seems to have found support in participative policy models like LEADER. In actual fact the concept of institutional sustainability attempts to verify an institution's strength and capacity to survive and develop in order to perform its role with constancy, even with increasing levels of external support. So even when rural development policies are expressly oriented to sustainability this may not always correspond to institutions that are in fact sustainable (Lanzalaco, 2009). Moreover, in policies of tourism diversification for rural economies, along with the issue of institutional and organizational changes, institutional sustainability poses the problem of the functional burden that such institutions can actually bear in designing and implementing these interventions, with particular reference to their ability to reconcile conflicts amongst different local interests (Donolo, 2005; Dente and Lewanski, 2002; Fighera, 2009).

This institutional aspect of sustainability is implicit in the concept of «integrated rural tourism» (Saxena et al., 2007, pp. 347-352). By recalling the links between the economic, social, cultural and environmental resources of an area, it commits the community's various players to the same strategy, pushing them to implement networks of cooperation that can increase the success of the activities in which each one is individually involved. Amongst these activities a salient role is given to traditional food production (Rastoin, 2010), which is recognised as having properties that can increase the overall sustainability of the process (Sims, 2009). These include: the dynamic effect on the local food industry of the increase in domestic demand; the reduction of the carbon footprint combined with the use of local raw materials and products (Petrini, 2013); the enhancement

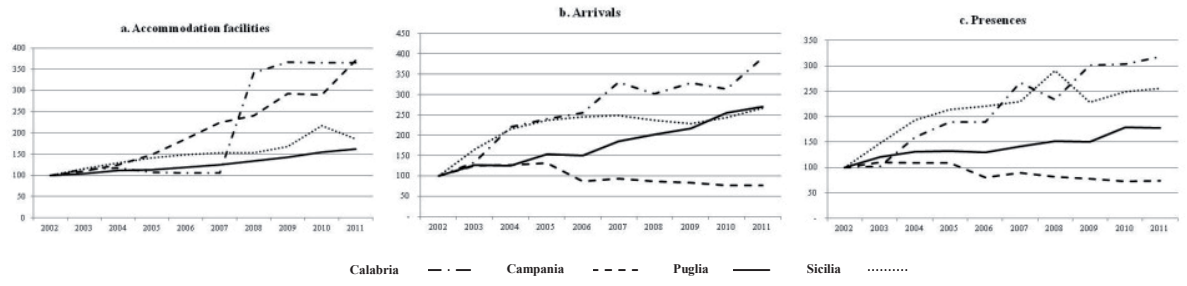
where the GDP per capita is less than 75% of the EU average.

of tourist appeal through the symbolic affirmation of the local identity thanks to food (Szlanyinka, 2010). From this point of view, typical food products prove to be an important source of positive externality that rural tourism will be able to internalize according to the stakeholders' capacity to control the process (Ohe and Kurihara, 2013), i.e. their ability to identify and exploit the economies of scope that might accompany the use of these local resources. The problem remains however of how to integrate at territorial level, the separate policy fields, institutional instruments and decision-making arenas, which often reflect potentially conflicting ways of thinking.

Methodology

In the perspective of the development of integrated rural tourism, in view of what has been said above, the growth of tourism could be regulated so as to amplify the multiplier effects on the added demand for the products of the local food industry, achieving the aims of sustainability both in socio-economic terms (fair distribution of the wealth produced), ecological (safeguarding and improving the environment) and cultural terms (minimizing identity interferences). For these reasons policies that incentivize the diversification of rural economies into tourism have been reiterated and expanded in regional development programmes, usually generating positive trends in rural tourism. By arbitrarily reducing the latter to the category of farm tourism (Nilsson et al., 2002), found in official Italian sources as «agro-tourism and other hospitality facilities of rural tourism» (ISTAT, several years; I.Stat, 2013) it can be seen that the regions of the convergence objective have shown during the past two periods of European programming (2002-2011) significant increases in both accommodation facilities and, with the exception of Campania, in arrivals and presences (graph 1a-c).

Graph 1:Facilities and flows of farm tourism in the "convergence" regions (2002-2011)



Source: our elaboration of ISTAT data

However, it cannot be taken for granted that the phenomenon has a positive effect on the aspects of sustainability discussed earlier, which instead need to be verified by adopting other indicators obtained from the combination of the same variables. For example tourists' average stay (presences/arrivals, L), the size of the accommodation facilities

(beds/facilities, C) and their margin of utilization (arrivals/beds, I) could be significant indicators in verifying socio-economic sustainability, just as the variation in the number of facilities (N), their size (C) as well as the increase in presences (D) could be important in verifying ecological sustainability. It seems more difficult to link cultural sustainability to specific accommodation or arrivals indicators, although such sustainability might be influenced above all by phenomena of local specialization (facilities in the i-th province/regional facilities, S), which, underpinning a reinforcement of relations, could also promote institutional sustainability.

An estimate of these indicators can be made by applying the IDA to the variation in presences (Q) recorded by every region in a certain time span (2002-2011[2]). This methodology, as we know, «provides a linkage between an aggregate and the original raw data whereby information of interest is captured in a concise and usable form» (Ang and Zhang, 2000, p. 1160). Therefore, starting from the following expression:

$$D = Q^T/Q^0 = D_N \cdot D_S \cdot D_C \cdot D_I \cdot D_L$$

The weight of every indicator on rural tourism growth in the convergence regions – which, while starting from the same initial development problems, have opted for different forms of axis 3 in the rural development policy (De Rubertis et al., 2012) – can be measured with the approach of the *Logarithmic Mean Divisia Index* (LMDI) model I (Ang, 2005) by solving the following equations:

$$D_N = exp\left(\sum_i (\bar{Q}_i/\bar{Q}) \ln(N^T/N^0)\right);$$

$$D_S = exp\left(\sum_i (\bar{Q}_i/\bar{Q}) \ln(S_i^T/S_i^0)\right);$$

$$D_C = exp\left(\sum_i (\bar{Q}_i/\bar{Q}) \ln(C_i^T/C_i^0)\right);$$

$$D_I = exp\left(\sum_i (\bar{Q}_i/\bar{Q}) \ln(I_i^T/I_i^0)\right);$$

$$D_L = exp\left(\sum_i (\bar{Q}_i/\bar{Q}) \ln(L_i^T/L_i^0)\right);$$

where $\bar{Q}_i = \frac{Q_i^T - Q_i^0}{\ln Q_i^T - \ln Q_i^0}$

As well as indicating the main factors driving the variation in presences recorded in every region, the value of the factors can therefore provide an interpretation of the sustainability of this variation.

Although the IDA has been called a «new framework for tourism flow analysis» (Belzentis et al., 2012, p.1), this methodology has been in use for some time especially in energy and environmental studies (Ang and Zhang, 2000).

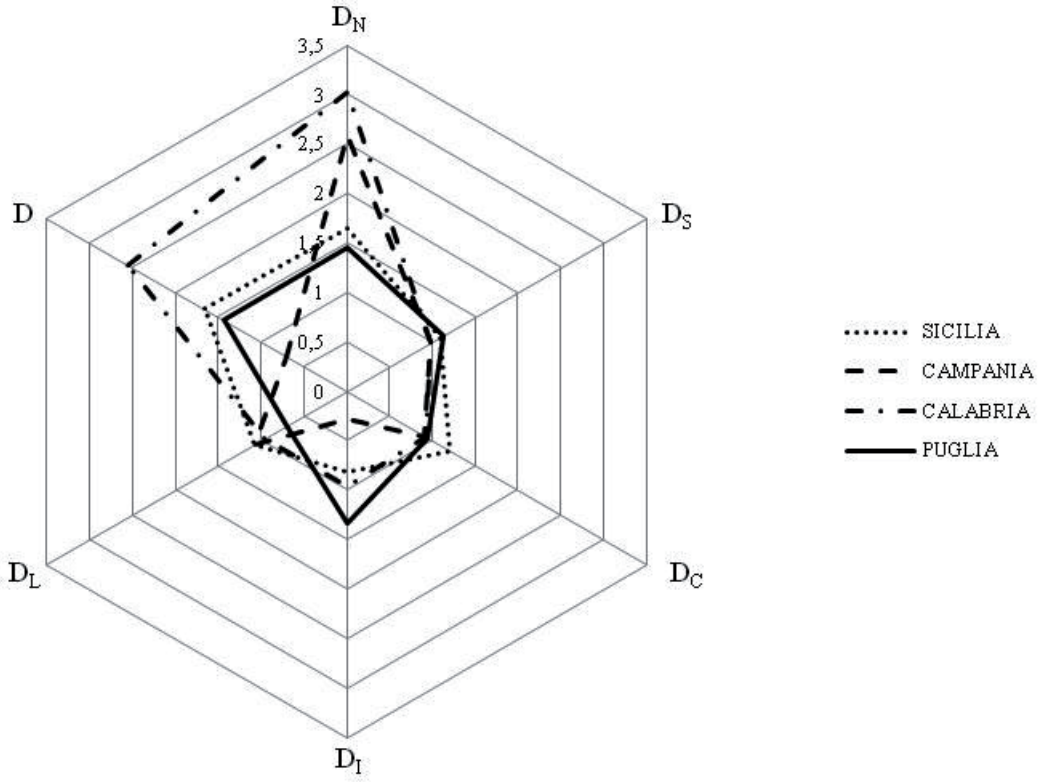
Results

The representation of the results in graph 2 (see following page) shows that the dynamics of presences in farm-tourism in the «convergence» regions was influenced by different factors which most likely reflect specific regional approaches to rural development policy.

As can be seen from the graph, the weight of factor N (D_N) was significant in all the regions, especially in Calabria and Campania. However, while in the first case the value is coherent, though more than proportional, with the substantial increase in presences (D) recorded in the region, in the second case the value is not coherent in that it is accompanied by a major downsizing in the number of presences in the same period. This phenomenon could therefore conceal unwise decisions on tourism diversifica-

2. The calculations were done on the three-year averages of the bottom (2002/04) and top end (2009/11) of the interval considered.

Graph 2. Breakdown of farm tourism flows (2002-2011) in the "convergence" regions



Source: Our elaboration of ISTAT data

tion influenced by incentive policies which might have distracted farms from considering other possible forms of diversification which would be more economically rewarding.

Factor S (D_S), in a clockwise direction, shows the same weight and only a slight influence in all the regions, suggesting that there is no territorial polarization of the phenomenon, something that should be checked however using analyses on a smaller scale than the provincial level.

Factor C (D_C) showed a positive influence in Sicilia where policies for the improvement of accommodation obviously had more success than those for its expansion. By contrast, in all the other regions this factor had an impact that was not very significant, being slightly negative.

The levels recorded for factor I (D_I) highlight the position of Puglia, where the improvement of accommodation facilities was coherent with the increase in tourism flows. The lower levels, below 1, in all the other regions especially in Campania would confirm the tendency to follow established paths in tourist diversification, a direction taken by businesses or policy-makers even when it would be more advantageous to consider other ways of diversifying farm activity.

This would also seem to be confirmed by the

levels recorded for factor L (D_L), since farm tourism should be exclusively characterized by the fact that it supplies services responding to the cultural expectations of tourists seeking alternative or "hands-on" experiences (Belliggiano, 2012). This is expressed in programmes set up on the spot based on the activities offered by various small farms in the same area (Bachleitner and Zins, 1999; Nilsson, 2002; Lane, 1994; Oppermann, 1996). Agro-tourism has instead often been interpreted as a form of hotel-standard accommodation and high quality landscape features, in which the agricultural component has been greatly reduced and along with it also the potential for local development (Ohe and Ciani, 2011). However, if the dynamics of tourist flows benefit from a longer average on-farm stay, as has been seen in Campania and Sicilia, this will lead rural tourism in an "industrial" direction. Besides reducing the positive externalities on the local area, in the long run this generates processes of loss of appeal implicitly impacting on the sustainability of the process. In Puglia, and less significantly in Calabria, the levels of D_L would instead confirm that there is greater application of policies based on more sustainable tourism diversification models.

Conclusions

Having identified the factors with the greatest influence on the variations in presences in the «convergence» regions, it would be necessary to establish what their weight should be for purposes of sustainability, comparing their effects both with the objectives of the European policies designed for the diversification of the rural economy (PAC axis 3, pillar 2), and with the objectives of local development, without losing sight of the cultural motives and desire for experience underlying rural tourism.

On the first point, three sub-aims, referring to the need for integration and coordination among the various policy areas, can be considered: equal distribution of the wealth produced; reduction of the environmental impact; control over tourism interfering with local culture. As regards the first sub-aim, it must be said that although the increase in tourist presences (D) is a necessary but not a sufficient condition for the increase in wealth, connecting tourism to local production chains could lead to better distributive effects. Direct tourist participation in normal farm activities (milking, grape-picking, bread-baking, etc.) would in fact fully satisfy tourists' requests for knowledge and hands-on experience and also allow smaller, less organized farms to find new opportunities to supplement their income. More arrivals and a shorter average stay (L) could further encourage the multiplier process provided that tourist spending on food can be oriented thanks to appropriate forms of information and the presentation of local products. Intensifying the promotion of local food traditions through direct individual tourist involvement (on-farm tastings, food and wine tours, etc.), along with the geo-referencing of products, could improve the market opportunities of niche products.

The second sub-aim, linked above all to the levels of factors N, C and S, means that the expansion or improvement of local accommodation must come about without increasing the built-on surface area. It also requires that the overall pressure of presences (demand for spaces, goods and services) and mobility services is sustainable for local and non-local ecosystems.

Lastly, the third sub-aim, linked mainly to levels of I, raises the issue of the interference created by growing tourist flows on local culture and customs. Awareness of this issue is

shown in the compatibility of local customs with the changes expected and espoused in plans for local development.

In the light of the study's findings, Puglia appears to be the «convergence» region best fitted to follow the path just marked out. However, considering the limitations of the method due to the small number of variables used, further investigation would be needed, preferably with multidisciplinary approaches, to study the relation between rural tourism and territorial capital (OECD, 2001; European Commission, 2005). Some aspects of the latter included in the so-called «innovative cross» of Camagni (2008, p.33), such as «governance on land and cultural resources», «collective goods», «relational capital» and «receptivity enhancing tools» (Camagni, 2008, pp.34-40) could be possible strands for further research. Indeed, the actual effects of the growth in farm-tourism on local development goals still remain to be seen. On this point, common practices do not seem satisfactory. The qualities of the local areas, seen as the combined outcome of physical and social aspects (Dematteis, 1985, 1995; De Matteis and Ferlaino, 2003; Fiori, 2003; Paasi 2003; Banini, 2011), are usually identified merely by listing the anthropic and non-anthropic elements, ignoring the importance of the laws, customs and traditions that govern the community's behavior and help to determine the organization and therefore the identity of the place. Such extremely reductionist territorial representations are repeatedly put forward along with models of local development of the same kind, which are unlikely to reflect shared local feeling. The social sustainability and also the institutional sustainability of processes of diversifying agriculture, and more generally the rural economy, into tourism will therefore depend on the quality of the participation processes implemented when setting the aims.

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Urban systems, urbanization dynamics and land use in Lombardy region: evidence from a spatial analysis

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Abstract
Sustainability of agriculture is challenged by increasing sprawl in urban agglomerations. Under increasing agglomeration economies in large and even medium size cities, more and more soil is being subtracted to agriculture, depriving agricultural activities of its main production factor. To what extent expanding urbanization threatens agricultural development depends on urban spatial structure, however. In this work it is empirically investigated how the relation between soil use and soil consumption is shaped by the compactness of cities. For the population of LAU1 main cities in Lombardy region (Italy), compactness is measured as the density gradient and estimated using Central Business District models. It is found that more compact cities exhibit relatively lower-than-expected soil consumption in the period 1999-2007. Results suggest that agglomeration economies are not enemies of agricultural activities per se. Nonetheless, urbanization needs to be accompanied by urban fringe containment.
JEL: Q15; R14; R52.
Keywords: Land Use; Land Take, Central Business District, Spatial Size of Cities, Spatial Econometrics

Introduction

The increased awareness on issues related to competition on soil use has driven the attention of policy makers on the future challenges European agriculture will be faced with in the period after the ongoing reform. Sustainability of agriculture is faced by land take which is in turn promoted by increasing urbanization pressures. Alongside sustainability of agriculture, in terms of natural resources and, hence, land, consideration is given to the promotion of agricultural diversification with the objective to preserve territorial-specific characters of local agriculture. It is not surprising that academic and policy discussion about land use policies turns central in the discussion about the future of rural development actions in Europe (MIPAAF 2011; European Commission 2012). In fact different modes of urban expansion have provoked differentiated land use patterns with related consequences on agricultures, especially in rural territories at the margins of large agglomeration. Central appears, therefore, to establish a connection between spatial structure and the use of land. Unfortunately land use data are scarce, on the one side. On the other side it is not as easy to provide a classification of urban spatial structure allowing comparison across heterogeneous territories.
In an attempt to produce a territorial characterization of local agricultures, the traditional approach followed in agricultural economics literature has been based on multivariate statistical analysis (Cannata, 1985, 1995; Anania & Tarsitano, 1995; Cannata & Forleo, 1998). In these studies, at a national level, the ter-

ritorial characterization has been pursued by introducing socio-environmental and economic variable in the statistical analysis. In this way, the synthetic output was capable of representing the rural dimension of territories alongside other dimensions closely related to agriculture. Building on this framework, some other studies have proposed detailed classification of territories at a more local, usually regional scale (Esposti, 2000; Gallego, 2004; Vard et al. 2005; Anania & Tenuta, 2008; Asciuto et al, 2008), frequently with more emphasis on some particular variables to capture local specificities of that territory. The focus of this stream of literature is, however, more on the territorial characterization of local agro-economic systems. Few is said about the relation between urban structure and use of resources in general and, more specifically, of land. This is because, on the one side, the methodological approach (multivariate analysis) does not allow to move beyond the evidence suggested by statistical association. In other words, no causal link can be established between socio-agri-economic characters and land use. On the other side, the output of a multivariate statistical analysis is usually an indicator expressing the degree of urbanization. The relation between urbanization and land use is then implicitly assumed and not further investigated.

In this paper we take a different perspective. By focusing solely on land as a production factor, the work is aimed at constructing a link between land use patterns and urban spatial structure. Although the analysis belongs, in methods and contents, to the urban and regional studies literature, the issues discussed in this work are closely connected with agriculture. Actually, land is a primary input in the agricultural production and, within the more general discussion on sustainability of rural development, urbanization density is likely the best predictor of a variety of territorial characters ultimately connected with agriculture and with rural development, such as, for instance, population density, income, provision of services. In fact, recent research has shown that land use patterns provide the best characterization of the territories in relation to their urban/rural structure (Pareglio e Pozzi, 2013). Finally, it is worth to recap that land is the most important resource for which the urban and the rural economy compete in the same territory.

With respect to the methodology we aim at detecting a clear relation between urban spatial structure and land use/take and, for this reason, we do not rely on multivariate statistical analysis. Admittedly, the most noteworthy effort in this work is the attempt to estimate the urban structure as the density degree of urbanized area in available land. Thus, the methodological approach is arranged in a two step procedure. To approximate urban spatial structure we use Central Business District Theory and estimate the density gradient. This is taken and interpreted as a measure of city compactness, hence when the density gradient is high the city is compact and when the density gradient is low the urban spatial structure is more characterized by sprawl. Once density gradient is estimated, in the second step, we build a relation between land use, measured as the urban to total land ratio at the municipality level, land take, measured as the change of this ration between two periods, and urban spatial structure, described by the density gradient.

The analysis is based on municipality data for the Lombardy region. All data come from the statistical office of the Region and are made available to the public through the *geoportal*[3]. Available data provide measures

3. http://www.cartografia.regione.lombardia.it/geoportale.

of urbanized land and hence allow to determine the urbanized to total land ratio and its, chance over time. More precisely data is available for the year 1999 and 2007. Density gradient is estimated at the provincial level using the share of urbanized area as dependent variable and, for robustness check only, using population density.
Results provide clear evidence that lower than expected land take is associated with a more compact urban structure. The remaining of the paper is organized as follows. Next section describes the methodology used to estimated the density gradient. Estimation results are presented and discussed in section three together with the figure relating urban structure to land use and land take. Follow conclusion.

Methodology
This section briefly introduces econometric methodologies used for the empirical analyses. Presented methods are considered the standard workhorse of the economic literature investigating urban spatial structure and the objective is that of measuring the linkage between the degree of urbanization and the distance from the main centre of economic activity (Central Business District).
After seminal works of Alonso (1964), Mills (1967) and Muth (1969) Central Business District (CBD) has become the main reference for theoretical as well as empirical analysis of urbanization patterns. From a theoretical viewpoint the model provides a simple and treatable tool to explain urbanization dynamics and, at the same time, it offers meaningful insights than can be easily tested empirically. Probably this is the reason why, after 40 years, CBD continues to represent a key reference for the analysis of urban structure (McMillen 2006; Paulsen 2012).
The main implication of a mono-centric urban structure is that urbanization density exponentially declines with increasing distance from CBD. Such prediction can be used, in fact, to explain a variety of phenomena related to urbanization such as, for instance, variation in housing prices, in land values and in population and employment densities.
Rarely studies have considered the share of urbanized area as a proxy for urbanization density. This is probably to be attributed to the lack of consistent and comparable measures of land use. This might appear surprising, at least considering that land use conversion pushed by urbanization pressures is a considerably warning phenomenon related to population and income growth (Brueckner 2000).
The main objective of CBD literature is the estimation of density gradient, hence the model parameter how urbanization density varies at varying distances from CBD. This is a simple but meaningful indicator of urban spatial structure. In fact, large coefficients indicate a compact urban structure while low coefficients can be interpreted as evidence of urban sprawl. Following the standard empirical specification in equation (1), the density gradient can be measured as the absolute value of the b parameter.

$$\log\left(U_i\right) = a + bD_i + e_i \quad (1)$$

This empirical specification has become very common, provided that the complex non linear dynamic predicted by the theoretical model is simplified into a linear model to be estimated with common methodologies. In equation (1) U_i is the urban density, in this case the ratio of urbanized to total area while D_i is the geographical distance separating the municipality from the CBD (assumed to be the main city in the province). Finally a is the estimate of the log of urbanization

density in CBD and e_i is the stochastic disturbance.

Following this stream of literature, this work is concerned with estimation of density gradients for the provinces in the Lombardy region. The availability of a unique data source at the regional level allows the comparison of results and, hence, of the different urban structures dominating urbanization patterns in the provinces of Lombardy. For the purpose of our empirical analysis, the estimated density gradient are use, in a second step, to relate urban structure to land use and land take.

Concerning estimation of the density gradient, a common problem in cross sectional studies is the violation of the independence hypothesis made about the error term (Anselin, 1988a; 1988b). This is particularly the case of urbanization density, since land use decisions are known to be affected by external environmental conditions which are usually unobservable and therefore omitted, causing spatially related regression residuals. Based on Anselin's works, correction can be implemented by either assuming that the dependent variable follows a mixed regressive-spatial autoregressive process (Spatial Lag model) or by allowing a spatial structure in the error term (Spatial Error model). In the specific case of density gradient estimation McMillen (2003) has shown that the Spatial Error specification is to be preferred provided that spatially auto-correlated residuals are likely caused by the omission of information related to neigbourhood characteristics.

The model in equation 1 is modified accordingly and the final specification is expressed as follows:

$$(2) \quad \begin{cases} \log\left(U_i\right) = a + bD_i + e_i \\ e_i = \lambda W e_i + u_i \end{cases}$$

The W matrix in equation (2) is a row-standardized contiguity matrix expressing the contiguity relations between municipalities in the same province. The contiguity relations are defined using the threshold distance criterion, according to which municipalities are said to be neighbouring if the distance separating them is below a given threshold. By time to time the threshold at the provincial level is defined in a way to allow each municipality to have at least one neighbour.

Results

Estimation results based on equation (2) are summarized in table 1. Results are obtained by using the urban to total ratio of lan as a proxy of urbanization density. Since the largest part of related literature makes use of population density to proxy urbanization density (Baumont et al. 2004; Rodríguez-Gámez and Dall'erba 2012), our result are also replicated using population density to ensure consistency with previous literature. These second results are provided also in the appendix.

Model parameters have been estimated for both the available years in the dataset, 1999 and 2007. The coefficient a, the model intercept, is to be interpreted as the log of urbanization density in the main municipality (capoluogo di provincia). Results, in first and fourth columns of table 1, indicate a high value of the parameter in the cases of Milano, Monza, Varese, Como and Bergamo. This suggests the good predictive capacity of the model. As a further indication of the model capacity to fit the data, the estimated values of 2007 are always larger than those in 1999. This is coherent with evidence that average share of urbanized area has increased over time in all these cities.

By focusing the attention to the coefficient b it is possible to observe that results largely confirm the model's prediction. The expected value of the coefficient is in fact negative,

assuming a distance decay effect. Estimates show that this is the case in a majority of municipalities, with the exclusion of Cremona, where such a relation seems inverted and of Lecco, Mantova and Sondrio, where the estimated coefficient is not significant.
Both in terms of coefficient slopes and statistical significance, the relation between urbanization density and distance from CBD is unchanged comparing 1999 and 2007. In both years, high density gradients appear in the cases of Bergamo, Brescia Como and Varese while especially low values appear in Milano, Lodi and Monza and Brianza.

Table 1 - CBD Estimates (1999 and 2007) based on the share of urbanized area

	1999			2007		
	a	*b*	I	*a*	*b*	I
BERGAMO	2.534***	-0.124***	0.744***	2.629***	-0.124***	0.754***
	(5.537)	(-6.422)	(13.143)	(5.581)	(-6.241)	(13.699)
BRESCIA	0.764**	-0.065***	0.727***	0.878***	-0.065***	0.741***
	(1.925)	(-5.7)	(12.346)	(2.116)	(-5.455)	(13.037)
COMO	2.347***	-0.108***	0.71***	2.425***	-0.109***	0.708***
	(5.474)	(-5.335)	(11.926)	(5.637)	(-5.38)	(11.807)
CREMONA	1.172***	0.024***	0.521***	-1.064***	0.25***	0.509***
	(4.264)	(2.599)	(5.373)	(-4.004)	(2.843)	(5.171)
LECCO	0.28	-0.006	0.784***	0.284	-0.001	0.787***
	(0.289)	(-0.105)	(12.396)	(0.295)	(-0.017)	(12.587)
LODI	0.28	-0.029***	0.166	0.434**	-0.03***	0.21*
	(1.269)	(2.345)	(1.273)	(1.851)	(2.278)	(1.65)
MANTOVA	1.364***	0.011	0.046	-1.145***	0.01	0.059
	(6.725)	(1.362)	(0.299)	(-5.42)	(1.16)	(0.386)
MILANO	1.682***	-0.035**	0.851***	1.805***	-0.035**	0.846***
	(2.533)	(-1.872)	(10.151)	(2.796)	(-1.896)	(9.848)
MONZA E BRIANZA	2.344***	-0.033	-0.079	2.403***	-0.03	-0.114
	(10.314)	(1.595)	(-0.395)	(10.935)	(-1.529)	(-0.559)
PAVIA	0.482***	-0.048***	0.489***	0.621***	-0.05***	0.485***
	(2.144)	(-5.58)	(6.104)	(2.726)	(5.67)	(6.022)
SONDRIO	-1.708***	-0.039	0.507***	-1.553***	-0.04	0.518***
	(-2.315)	(-1.517)	(3.82)	(-2.057)	(-1.55)	(3.97)
VARESE	1.898***	-0.06***	0.543***	1.953***	-0.06***	0.546***
	(5.385)	(-2.725)	(6.414)	(5.505)	(2.704)	(6.481)

z-stat in parenthesis. ***, ** and * denote significance at 99%, 95% e 90% respectively.

Finally, for what concerns the spatial autocorrelation coefficient I , this is always positive and significance with the only exception of Mantova. Based on existing evidence, the result in this empirical analysis confirm the prominence of spatial relations for the urbanization process. It is possible to infer that urbanization pattern at the municipality level is affected also by forces operating at a larger spatial scale.

Once the density gradient, a summary measure of the compactness of cities, has been estimated, it is possible to construct a relation between land use (the urbanized to total land ratio in 1999), land take (variation in urbanized to total land ration between 1999 and 2007) and urban structure (compactness). The purpose of this part of analysis is to see whether spatial structure can affect land use and its change. The three measures have been plotted together and the result is presented in the figure 1.

In the vertical axis it is indicated the average (at the provincial level) land take between 1999 and 2007, while average land use (at the provincial level) is indicated in the horizontal axis. Again, based on average data, the provinces of Milano, Monza and Brianza, and to a lower extent also Como, Bergamo, Lecco and Varese, exhibit a high value of land use. By the opposite the highest land take has happened in provinces of Mantova, Lodi and Cremona, and in Milan to a lower extent.

The negative line has been obtained by interpolation of average data. Immediately the relation between land take and land use appears negative, meaning that a large land take has characterized areas with lower scarcity of land. In fact, the phenomenon of land use change and hence reconversion of land use from agriculture to urban, is a character of areas in which urbanization density was lower in 1999.

In the figure, the dimension of the circle associated to each province represents the value of the density gradient previously estimated. The larger the circle, the more compact is the urban spatial structure.

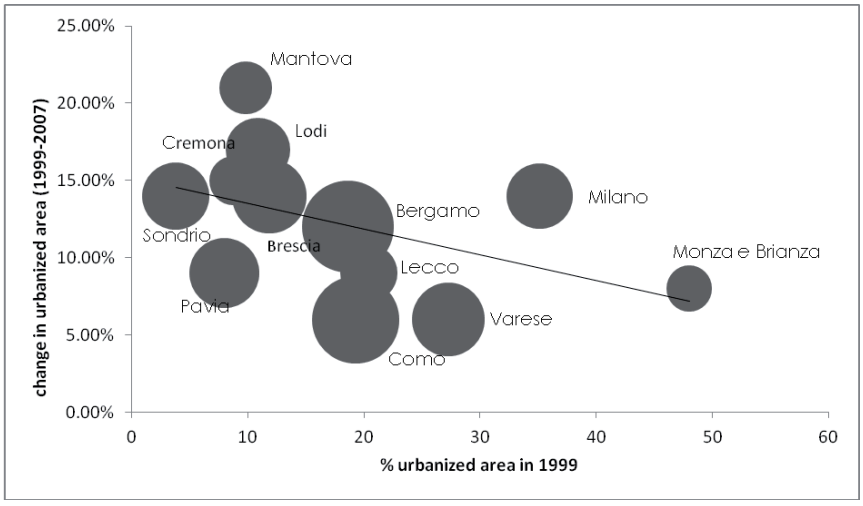

Figure 1. Land Use, Land Consumption and compactness of urban spatial structure..

Provided the negative evidence between land take and land use, it is worth paying attention to the fact that more compact urban structures have generated a lover than expected value of land take. This appears clearly by noting that provinces where the density gradient is high reported values of land take lower or at least equal to the value expected from the negative relation. In the case of territories where land take was initially high, this is the case of Bergamo, Como and Varese, which are located under the black line in the figure. By the opposite Milano and Monza and Brianza are located above the line. In the case of territories where land take was initially low, this is the case of Pavia, which is below the line. By the opposite Cremona, Lodi and Mantova are above the line.

Conclusion

This empirical work has been concerned with the relation between land use, land take and urban spatial structure. The issue is of particular relevance for agricultural policies to the extent that a correct use of land, scarce by definition, represents nowadays a necessary condition for the effective implementation of sustainable rural development programs. Development cannot be considered as sustainable if economic and population growth subtract resources to agriculture, hence impeding rural development. Subtraction of resources to agriculture is a central issue in the debate about the future of agricultural and rural policies in Europe. In particular, given that economic growth requires a certain degree of urban development, which urban structure is more effective with respect to the objective of preserving land?

In an attempt to provide a different viewpoint on the issue, this paper presents empirical analysis on the relation between urban spatial structure and land use/take. Differently from the traditional approach to the territorial analysis of urbanization, based on multivariate statistical analysis on a number of different indicators, this work focuses on a single variable (urbanized area) for the territorial analysis. This variable is related to the urban spatial structure, as measured by the compactness degree of the urbanized area within the territory of the province.

To describe the urbanization pattern, a density gradient is estimated, following the empirical literature on CBD. A higher value of the density gradient identifies a more compact urban spatial structure while low values indicate sprawl.

The scene pictured by the result of the analysis, using data for 1999 and 2007 is the following. Urban agglomerations structured in a compact manner around a single economic centre have prevented excessive consumption of agricultural land through its conversion for urbanization purposes. This general result need to be further declined considering the different levels of urbanization in the region. Hence, in the most urbanized part of the region, territories characterized by urban sprawl such as Milano and Monza e Brianza, have experienced a larger than expected land take while a lower than expected land take has been noted in more compact cities.

Appendix

Table 2 - CBD model estimates (1999 and 2007) based on population density

	1999			2007		
	a	*b*	I	*a*	*b*	I
BERGAMO	7.431***	-0.101***	0.82***	7.555***	-0.104***	0.836***
	(18.42)	(-6.191)	(18.452)	(17.446)	(-6.023)	(19.975)
BRESCIA	6.399***	-0.047***	0.765***	6.576***	-0.05***	0.779***
	(21.425)	(-5.602)	(14.371)	(20.646)	(-5.627)	(15.294)
COMO	7.012***	-0.078***	0.795***	7.138***	-0.083***	0.795***
	(19.011)	(-4.618)	(16.979)	(18.81)	(-4.759)	(16.988)
CREMONA	4.27***	0.019***	0.043***	4.331***	0.02***	0.507***
	(18.316)	(2.48)	(4.038)	(16.312)	(2.265)	(5.139)
LECCO	5.529***	0.007	0.8***	5.577***	0.008	0.8***
	(7.905)	(0.172)	(13.41)	(7.785)	(0.207)	(13.424)
LODI	5.755***	-0.042***	0.325***	6.051***	-0.052***	0.359***
	(23.356)	(-3.034)	(2.727)	(23.415)	(-3.583)	(3.093)
MANTOVA	5.13***	-0.012	0.301***	5.228***	-0.013	0.365***
	(26.883)	(-1.545)	(2.23)	(24.813)	(-1.55)	(2.84)
MILANO	8.26***	-0.073***	0.935***	8.291***	-0.07***	0.935***
	(8.454)	(-4.884)	(22.66)	(8.911)	(-4.942)	(22.6)
MONZA E BRIANZA	8.093***	-0.074***	0.765***	8.156***	-0.07***	0.75***
	(26.399)	(-3.035)	(9.306)	(28.352)	(-3.02)	(8.719)
PAVIA	5.435***	-0.038***	0.337***	5.68***	-0.045***	0.395***
	(31.671)	(-5.79)	(3.635)	(30.049)	(-6.194)	(4.475)
SONDRIO	4.528***	-0.024**	0.271	4.516***	-0.024*	0.281*
	(12.281)	(-1.88)	(1.588)	(11.79)	(-1.767)	(1.656)
VARESE	6.452***	-0.033	0.779***	6.553***	-0.036	0.795***
	(14.744)	(-1.304)	(14.964)	(14.617)	(-1.394)	(16.098)

z-stat in parenthesis. ***, ** and * denote significance at 99%, 95% e 90% respectively.

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Networking practices involving local small firms: a case of rural innovation in Friuli Venezia Giulia (Italy)*

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Abstract
Consistent with the Europe 2020 strategy, the next CAP will contribute in the promotion of innovative models for agricultural and rural development. The RD legal framework underlines the need to support social innovation and bolster co-operation in rural areas. The aim of the paper is to investigate which practices could be adopted to nourish networking processes. The focus is on how effective training intervention is in reinforcing network awareness and capabilities among rural actors. In 2011 a Mountain Community carried out a project seeking to bolster the creation of a firm network. It involved a group of local firms in a training programme and focused on relational training in order to improve communication, firm interaction and group management. The research results and the project outcomes reinforce the concept that sustainable rural development policies should also underpin relational skills, in order to increase the chances that the network functions in the long term.
JEL classification: D85 - O18 - R11
Key words: Firm networks - Rural innovation - Sustainable rural development

Introduction

Innovation is widely recognised as a major source of improved productivity, competitiveness, and economic growth throughout advanced and emerging economies. It also plays an important role in creating jobs, generating income, alleviating poverty and driving social development. Aside from a strong capacity in R&D, the ability to innovate is often related to collective action, coordination, exchange of knowledge among diverse actors, incentives and resources available to form partnerships and develop businesses, and conditions that make it possible for entrepreneurs, e.g. farmers, to use innovation (World Bank, 2012).
Consistent with the Europe 2020 strategy which focuses on smart, sustainable and inclusive growth (European Commission, 2010), the next CAP will contribute in promoting sustainable and innovative models for agricultural and rural development. The Rural Development Policy legal framework

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underlines the need to support social innovation and specifically to bolster economic, environmental and social co-operation between a variety of potential beneficiaries; Leader and other networking initiatives will continue to play a key role in the spreading of innovation and the development of rural areas. In this framework rural networking should relate to: co-operation among small actors in the agriculture and food chain, in the forestry sector and among other rural operators in organising joint work processes, sharing facilities and resources; promotional activities in a local context relating to the development of short supply chains and local markets; collective approaches to environmental projects and on-going environmental practices; etc. (European Commission, 2011).

Assuming that co-operation among local actors could be an effective pattern for enhancing sustainable development in rural areas, the aim of the paper is to investigate which practices could be adopted to nourish networking processes among rural firms. Specifically, the paper focuses on the effectiveness of training intervention in creating or reinforcing network awareness and capability among rural actors.

Networking and rural innovation

The most successful rural economies have emerged in those areas that hold a rich and diverse array of economic and social forms. This has led to some rethinking of agricultural and rural development policies and has prompted an interest in networks: supportive policies for sustainable development do not just support individual farms; this support is also directed towards collective projects and local firm networks which may contribute to agricultural and rural sustainable development. In rural networks the nodes are primarily small local firms, often spatially proximate and related to each other. Frequently marginal areas, such as many rural areas, don't have strong and dynamic network relationships. However supportive policies can improve structured interactions allowing the companies to define collective goals, better coordinate the value chain, exchange knowledge and know-how, etc. (Murdoch, 2000; Oerlemans and Assouline, 2004). Based on the theory of networks, the firms engaged in collective action may derive some important benefits[1] over those acting in isolation: lower production and transaction costs, higher input and dynamic efficiency, integration of competitive and co-operative relationships, valorisation of each firm's independence and reinforcement of economic, social and territorial links (Brunori and Rossi, 2000; Hakansson and Ford, 2002; Lamprinopoulou et al., 2006; Vakoufaris et al., 2007).

Studies show that collective action is facilitated by social capital which contributes not only to enhance firms' socio-economic performance, but as important in fostering agricultural and rural innovation. According to Ostrom (1999), social capital is "the shared knowledge, understanding, norms, rules, and expectations about patterns of interactions that groups of individuals bring to a recurrent activity". This includes both bonding ties among a group and bridging ties between different groups, which influence information flow and how actors access information (Meinzen-Dick et al., 2004). Such social ties are a form of capital on a par with natural, physical, financial, human and political capital, and a potential instrument for building these other forms of capital (Neu-

1. For an overview of the limits and conflicts characterising small local firm networks see Tregear (2011).

meier, 2012; Ostrom, 1994, 1999; Putnam et al., 1993; Shaw et al., 2011).

Innovation is widely recognised as a major source of socio-economic development. Moreover innovation studies increasingly underline that innovation is not only taking place at firm level, but also has systemic nature being closely related to information flows, learning and social interaction (Clark, 2010; Knickel et al., 2009; Leeuwis 2006; Spielman, 2006). According to the World Bank (2012), an innovation system is a network of actors who voluntarily contribute knowledge and other resources (money, equipment, land, etc.) to jointly develop or improve a social or economic process or product. Actions to foster the emergence of innovation networks seek to create trust among potential partners, identify common goals, establish the bases of collaboration, and develop innovation capabilities. To support the emergence and consolidation of innovation networks it is crucial to facilitate the formation of partnerships through, for instance, training, exchange visits, meetings, and developing communication skills and facilities.

Some practices directly or indirectly can be effective in scaling-up networking processes. The data presented by Pronyk et al. (2008) suggests that through training intervention plausible shifts had taken place in social capital: the authors found positive effects on social capital with evidence of expanded social group membership and solidarity within the group. A project funded under the Programme for Cross-Border Co-operation Italy-Slovenia 2007-2013 focuses on a training methodology called "study circles" to support local development action in rural areas (www.study-circles.eu). This approach is used in non-formal adult education and is recognised for its inclusiveness, ability to stimulate active participation and strong orientation towards community development. Study circles help participants to discuss specific and priority topics and define common understanding. In addition, they can help participants in building relationships of trust which lead to more co-operative efforts (Cummins et al., 2012; Larsson and Nordvall, 2010). Action Research aims to resolve the concrete problems of individuals or groups by triggering co-operative mechanisms between the actors involved, leading to a desirable and shared solution. Some experiences suggest that this methodology can strengthen rural community capacity to develop their institutions, skills and networks for participatory governance (Packham and Sriskandarajah, 2005; Sanginga et al., 2010).

In networking processes there is a tendency to focus mainly on practices and artefacts that bring the network together (e.g. marketing a product). However, in the process of building, maintaining or expanding a network there is also the need to support the management of the group and the learning process itself. Oerlemans and Assouline (2004) highlighted that little interest in management aspects, such as balanced leadership, collective responsibility, coherence of the group and enrolling capacity may hamper the realisation of the goals of the network in the long term. Moreover, while recognising that the characteristics of a network very much depend on the pre-existing context, (rural) development can be supported by working with and reinforcing the capacity of individuals and groups within their communities. This approach seeks to strengthen communities through enhancing people's confidence, knowledge and skills, and their ability to work together (Clark, 2010; Lee et al., 2005).

Case study

Setting

In 2011 the Mountain Community of Gemonese, Canal del Ferro and Val Canale, a development agency for a rural alpine area in the Friuli Venezia Giulia region (Italy), in collaboration with the University of Udine carried out a pilot project seeking to promote the creation of a local small firm network offering tourism and healthcare services to the local community.

The study area is a rural alpine space rich in noteworthy economic, social and environmental resources, with tourist attractiveness, but characterised also by low entrepreneurial viability and dynamism. It includes three municipalities - Tarvisio, Malborghetto-Valbruna and Resia - in which 558 enterprises are located. They are mostly small and micro firms, as defined by the Commission Recommendation 2003/361/EC, and operate in agriculture (16.7%), public catering, i.e. hotels, restaurants and bars (16.3%), trade (50.4%), crafts (9.9%) and construction (6.8%). These are the most relevant sectors in the local economy.

On the basis of four criteria coherent with the purpose of the pilot project, 42 companies were selected. The selection criteria were the following: supply of tourism and/or healthcare services, female employment, youth employment, and participation in other local development projects. The first criterion was consistent with the aim of the pilot project to create a network for the provision of such services, indicated as inadequate albeit relevant for the local community by different local development agenda (e.g. LAG Open Leader Programme, RDP-FVG 2007-2013). The second and third criteria were adopted to promote female and youth participation in a project that could provide, in the medium and long term, job opportunities mainly for these population segments. Finally, the fourth criterion was decided on to involve mainly firms already responsive to innovation issues.

All the selected firms were invited to participate in the pilot project; 17 decided to join. Most of these were farms, hotels and restaurants (Table 1). Before the project started, their eligibility, that is their (potential) capacity to offer tourism and healthcare services and thus to be part of a firm network offering those services, was assessed.

Sector	Municipality			Total
	Tarvisio	Malborghetto-Valbruna	Resia	
Agriculture	3	1	1	5
Public catering	4	2	1	7
Trade	2	1	--	3
Crafts	2	--	--	2
Total	11	4	2	17

Table 1. Firms participating in the pilot project by productive sector and municipality

Training programme

To contribute to the creation or strengthening of structured relationships among the participant firms, they were involved in a training programme carried out in April-June 2011[2]. This intervention was designed for (i) enhancing firms' awareness about the importance of collaborative relationships with other companies in order to find those resources not available at individual level within the network and to achieve some of the collective action benefits (network awareness) and (ii) improving their relational capabilities aiming at making their communication more effective and improving some network management aspects, such as collective responsibility, coherence of the group, balanced leadership, etc. (network capability).

The training programme was structured as follows: seminars aimed at increasing knowledge and know-how in the fields of rural development and multifunctional agriculture (agritourisms, educational and social farms, etc.), private landscape management, territorial management, common property institutions (e.g. Consorzi vicinali of Val Canale), and official status of inter-firm organisations (10 hours); company visits to two inter-firm organisations operating in tourism and healthcare services (approx 6 hours); and relational coaching workshops, aimed at developing and enhancing communication and networking skills (23 hours).

2. The pilot project also included: i) the study of the participating firms' relational system, in terms of degree of mutual awareness, typology and intensity of business ties, extension and localisation of economic and social interaction (Bassi et al., 2014); and ii) the analysis of the role of common property institutions, namely Consorzi vicinali of Val Canale, in collective management of local resources (Bassi, Carestiato and Piani, paper under review).

It is important to underline that to support the networking process among the participant firms, the training programme focused on relational training both directly through the workshops, that covered more than half of the total number of hours, and indirectly through the participation of the coach (a psychologist) in all other training activities.

Survey

Methodology

A survey was carried out in order to examine participants' co-operative disposition, their expectations for and satisfaction degree with the training programme. Data was collected via a questionnaire filled in by the owners or managers of each firm.

The participants' co-operative disposition (first section of the questionnaire) was investigated collecting data on the perceived usefulness (on a 10-point scale) of i) having some kind of relationship with local actors; ii) having links with firms and/or other organisations located in the same municipality or nearby; and iii) conducting collective activities with other enterprises. Data was collected both at the beginning and at the end of the training programme in order to detect possible changes after the intervention.

To investigate participants' initial expectations (second section of the questionnaire) and satisfaction degree (third section), two distinct sets of items coherent with the aim and the contents of the training programme were planned (Tables 2 and 3). The respondents were asked, at the beginning, to explain their decision to take part in the training and, at the end, to indicate their degree of satisfaction by assigning a value on a 10-point scale to each item. For expectation and satisfaction data, the questionnaire was anonymous in order to increase response

rates and reliability.
General information on interviewees (gender, age and qualification) and firms (official status, establishment date and occupational size; the sector of activity was already known) was recorded too.
Given the characteristics of the sample - a purposefully selected sample of 17 units - the data collected was statistically analysed by descriptive statistics including the Wilcoxon signed-rank test, Anova and Pearson correlation.

Findings
Consistent with the selection criteria, the owners of these companies are mainly women (81.3%) and young people (25% under 40 and 50% between 40 and 49). Most of them have a higher education qualification (68.8% high school diploma and 6.3% university degree).
Regarding the official status of the companies, most of the firms (12) are owned by individuals and 1 is a cooperative. Almost half of the firms were established after 2000; among the rest, 5 companies were launched in the previous decade and 4 of them before 1990. All are micro firms whose average employment size is 2.4 units; the majority (11 companies) employ 1-4 people[3]. Taking all 17 firms together, they have an occupational size of 40 units.
The survey indicates the high level of participants' co-operative disposition. Before the training programme started, the answers for the three distinct items reported very high scores for all participants, with average values equal to 8.5, 8.9 and 8.5, revealing that interviewees assigned relevance to collaboration in handling their own business (Figure 1). At the end of the project the respondents assigned even more importance to collaboration with others actors in handling their business. The average scores reported for the three items rose to 8.9, 9.4 and 8.8 respectively, with a positive statistically significant difference with respect to the average values declared in the first interview (Wilcoxon signed-rank test, significance level 0.05.).

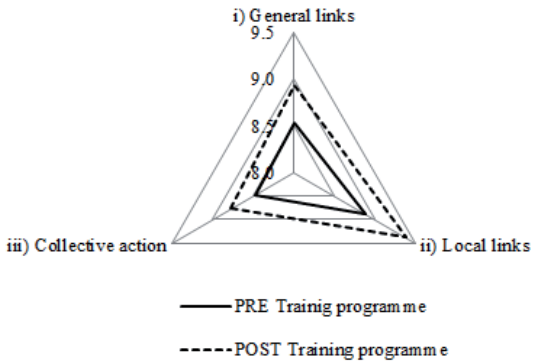

Figure 1. Co-operative disposition: mean values

Anova was carried out in order to detect possible group variability considering some specific characteristics of the company surveyed: activity sector and official status of the firm; age range and qualification of the interviewee. In general, the results indicate that the values are not influenced by groups (significance level 0.05). There are some statistically significant cases concerning only some post-intervention values (e.g. item iii) collective action, which is influenced by official status and age groups). Nevertheless further investigation is needed in order to assess the implication of these results for the pilot project.
The analysis of initial expectation reveals the interest of the respondents in participating in

3. Turnover or annual balance-sheet was not recorded, given the reluctance of small companies to provide this data. Nevertheless, the empirical knowledge of the area suggests that the economic or financial dimension of these firms does not exceed € 2m.

the training programme primarily to acquire new business skills, including the management of relationships with other (new) agents (companies, customers, etc.) and the collaboration in collective activities (items 2, 4 and 6). Table 2 shows that: only for items 1 and 5 the minimum value assigned is lower than 5; in all cases at least once the maximum value of 10 has been assigned and the number of observations that appear more frequently (mode) does not fall below 7; except for the two cases already mentioned, the average value is greater than 8 (Figure 2), with a low standard deviation. Some respondents also reported that they decided to participate out of curiosity, to know other local companies, to have the opportunity to compare themselves with other firms, and because they consider this kind of project useful for their business growth and territorial development.

Items	Min	Max	Mode	Median	Mean	St.dev.
I decided to participate in the programme because:						
1) I was invited to participate	1	10	7	5.0	5.1	2.841
2) It could offer my company some useful skills	7	10	10	8.5	8.7	1.221
3) It could offer some useful skills in dealing with other companies, associations, institutions, customers, etc. I already know	5	10	8	8.0	8.0	1.512
4) It could offer some useful skills in dealing with companies, associations, institutions, customers, etc.	5	10	10	8.0	8.4	1.545
5) The project includes an ITC platform (website, blog, etc.)	2	10	8	7.0	6.4	2.647
6) The programme is useful for collective activities with other firms	5	10	10	8.0	8.4	1.716
7) This is a pilot project and I would like to be within the group of innovators	5	10	8	8.0	8.1	1.730

Table 2. Initial expectations: items and statistics

As for satisfaction the findings show high levels for most of the items (Figure 3). Regarding knowledge and skills acquired (Part A, Table 3), the training programme primarily contributed to bolstering links with other companies, organisations, etc., in particular with those participating in the programme, and starting new collaborative relationships. Among the planned training activities (Part B), the workshops on communication skills

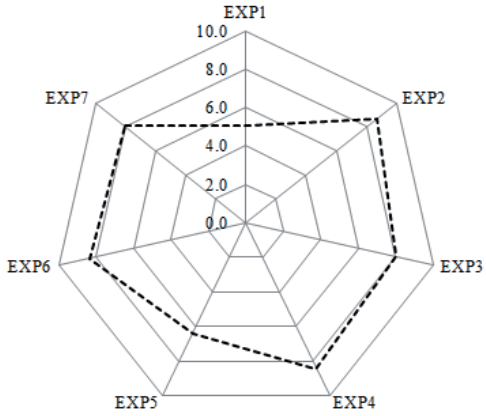

Figure 2. Initial expectations: mean values.

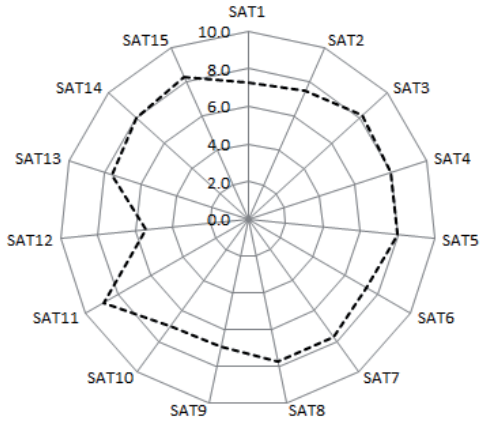

Figure 3. Satisfaction degree: mean values.

gained the highest values. This result is very important because it matches the purpose of the pilot project and the focus of the training programme. Finally, the respondents declared that the programme allowed them to acquire the expected expertise; the level of general satisfaction was high (Part C). It is noteworthy that some companies have not expressed a high interest in the company visit to a social inter-firm organisation, which is a consortium of cooperatives, some of which are farms, involved in the social integration of disadvantaged people. The respondents explained the low satisfaction level with the fact that this experience is not relevant to their socio-economic context and therefore difficult to replicate in their own business and local area.

Pearson correlation was carried out, separately for expectations and satisfaction degree, for evaluating possible association between variables. The analysis returned some statistically significant cases (significance level 0.05) particularly regarding satisfaction items, most of which are positively correlated to each other. However, these results need to be assessed further in order to detect their practical implications.

Project outcome

The training programme produced some notable outcomes. After its conclusion in June 2011, some firms among those who more actively participated in the seminars, workshops, etc., expressed their need to continue with the training. The request was granted by the Mountain Community which supported the implementation of a new set of workshops concerning planning and communication topics. The purpose of the workshops was to bolster participants' knowledge and know-how in the management of funding applications for development projects (e.g. Rural development funds) and, having participated in the training programme, to further improve interpersonal communication and network management skills. The workshops were carried out in September-November 2011, through co-hosting. An expert oversaw the section related to project management tools (Project Cycle Management and Logical Framework Approach); the psychologist already involved in the training programme deepened some communication methods.

By the end of this second training intervention, the participants were able to define and

Items	Min	Max	Mode	Median	Mean	St.dev.
Part A - Do you think that knowledge and skills acquired are useful to:						
1) Develop firm management and organisation	1	10	8	8.0	7.3	2.119
2) Improve relationships with employees (intra-firm relations)	1	10	7	8.0	7.5	2.135
3) Foster relationships with other companies participating in the programme	3	10	8	8.0	8.2	1.698
4) Increase ties with other firms, organisations, customers, etc.	3	10	8	8.0	8.0	1.648
5) Initiate interactions with new firms, organisations, customers, etc.	3	10	10	8.0	8.0	1.881
Part B - How useful are the proposed training activities for your own business:						
6) Seminar: "Rural Development and Multifunctional Agriculture"	4	10	7	7.0	7.3	1.785
7) Seminar: "Private landscape management"	4	10	8	8.0	7.7	1.588
8) Seminar: "Territorial management"	3	10	8	8.0	7.7	1.911
9) Seminar: "Official status of inter-firm organisations"	3	8	8	8.0	6.9	1.564
10) Seminar: "The role of common property institutions in local development"	2	9	8	8.0	6.9	1.881
11) Relational coaching workshops	6	10	10	9.0	8.9	1.245
12) Company visit to a social inter-firm org.	1	8	8	6.0	5.4	2.611
13) Company visit to a tourism inter-firm org.	4	10	8	8.0	7.6	1.678
Part C - In general:						
14) The programme has provided you with the expected knowledge and skills?	5	10	8	8.0	8.0	1.414
15) What is the level of your general satisfaction?	5	10	10	8.0	8.3	1.599

Table 3. Satisfaction degree: items and statistics.

share a common goal, namely the collective promotion of the local milk produced by two farms within the group of participants. This is a mountain product, according to the Regulation (EC) 1151/2012, considered a vital resource for the local economy and society. Moreover they shared an interest in continuing the networking process and identified some of the activities to be undertaken to pursue this common goal, involving the participants themselves, mostly bars and restaurants, and eventually other local companies. Currently (2013) they are still involved in the implementation of this collective project supported by Leader funds (RDP-FVG 2007-2013).

Conclusions

The Mountain Community pilot project adopted a network approach to improve the skills necessary for structured relationships and promote the creation of a small local firm network offering tourism and healthcare services to the local community. Given the role of training in the formation of partnerships, the project involved a group of local firms in a training programme. It primarily focused on relational training activities in order to make communication more effective, improve both interpersonal and firm interaction, and manage group dynamics. Other topics consistent with the aim of the project were also considered.

While recognising that the size of the area (for project constraints) and the size of the participants' group does not allow us to infer the research results, it is still possible to highlight some points that could be useful in designing projects focusing on networking processes. Firstly, it is important to highlight that even before the training programme started, the interviewees assigned relevance to collaboration with others actors in handling their own business. This co-operative disposition represents a suitable base on which to start building collective action among the firms. Their participation in the training programme, primarily based on the need to acquire new business skills, including relational capabilities, strengthens their network awareness. This result matches the relevance they gave to the relational coaching workshops. A few other activities did not receive the same level of satisfaction, suggesting the need to change some scheduled topics or contents in future projects.

The bottom-up request to continue with the training activities is an important outcome for the pilot project. It can be seen as an effective indicator of the need and interest towards training in supporting local development. The other outcome, namely the capacity of the firm group, whose size is significant from a rural development perspective, to make a conscious and shared decision on a collective goal and how to reach it, could represent the first step towards the implementation of a network officially organised in a suitable form.

To conclude, the research results and project outcome have reinforced the concept that supportive policies for rural development should also be directed to scale-up networking processes. Training focusing on the improvement of network awareness and capability can be an effective tool in these processes. The reinforcement of relational skills should precede the establishment of a partnership, in order to increase network empowerment and the chances that the network functions in the long term.

Future research should focus on other networking practices and involve larger groups of firms, in order to compare the effects of different methods and to detect the influence of some company characteristics on the most significant results.

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