Sustainability of Food Products Applying Integrated Life Cycle Tools

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Abstract. The agri-food industry is a significant resource for the European economy. However, the competitiveness of this industry seems to be at risk due to its many structural problems (i.e. extreme fragmentation, energy-related and service issues, low R&D investment levels). In order to boost the sector, European policy-makers have planned a number of actions aimed at promoting a research for a greater sustainability. One of the most significant actions is the use of Life Cycle Thinking tools, which allow for a quantification of the environmental and social impact, and cost of food production. To ensure the adoption of these tools, their application should be simplified, an integrated framework should be created for the measurement of social, economic and environmental impacts, and a vast dissemination of results should be developed. For this purpose, the Ecolabel mark use has also been extended, with the last revision (EC Reg. no. 66/2010), to food products.

Key words: food industry, Life Cycle Thinking, SLCA, LCA, integrated framework.
JEL classification: M14, Q51, L66

1 Introduction

The agri-food industry is one of the most significant sectors of the European economy. In 2008, it reached a turnover of 917 billion euro for the EU-27, thus gaining the second position among top manufacturing corporations, and employed approximately 4.8 million persons, corresponding to 14% of the entire manufacturing industry. However, the European agri-food industry may soon be considerably resized due to some criticalities, most of which are linked with the structure of this industry. As a matter of fact, the agri-food industry is characterized by fragmentation, economically speaking: about 99% of all enterprises in the food sector are small and medium sized enterprises (SMEs). The reduced size of the businesses in this sector sets a limit to their competitiveness in the global market related to the scarcity of new investments in R&D which are primarily connected with the large size. On the demand side, we may observe that while the food expense is covering a progressively smaller portion of the global consumer expense, passing from 26.1% in 1983 to 17.7% in 2007, most of the demand is for high-innovation-content products, such as healthy or novel foods or high-investment food that ensures quality and safety. In particular, we point out that decisions regarding consumption are mostly based on 'credence' like properties, such as production processes, effects on animal wellbeing, the use of pesticides, the impact of agri-food productions on the environment and on labour conditions (Nelson, 1970; Darby et al 1973), which are all elements that can be developed only with huge efforts in research and innovation to obtain sustainable, high-quality, eco-compatible and economically acceptable production solutions. However, said characteristics cannot be checked by consumers either at the time of purchase of a product or after its consumption. Their authenticity is essentially based on the content of the communication conveyed by the producer to the consumer through the label, advertising and promotional activities in general. Although the European legislation regulates this kind of communications rather strictly with the specific purpose of protecting consumers, there are still some gaps concerning credence attributes. There are two critical areas: the first is linked to those characteristics that recall the notion of sustainability and the second is connected with the 'high innovation content food' already

mentioned above. As regards the first issue, the lesser environmental and/or social impact associated with food often depends on the image that the manufacturer has succeeded in creating for its brand, for example through declarations of commitment in protecting the environment or the some particular social conditions, through cause related marketing actions or with the publication of their social balance. The second area of criticality refers to those food products that are modified in the recipe and boast beneficial properties and are advertised through nutrition or health claims. These foods are not meant for persons with specific problems, and therefore they are not therapeutic products; however, if associated to a regular diet and taken for a long period of time, they may increase the probability to obtain those inferential benefits that consumers attribute to them on the basis of the abovementioned claim. A very clear example can be mentioned: 'light' products (Tarabella et al, 2009). All this leads us to think about what the players in the European agri-food market could do to prevent this industry from remaining dominated by a few businesses that, given the greater availability of resources, are capable of drawing continuous profits from the asymmetric information they often create and themselves, even though without violating the legislation. EU administrators have identified the direct support to research for innovation and for the identification of more sustainable manufacturing and marketing practices for food products as the most valuable strategy to foster the development of this industry. To this purpose, agriculture and food have been introduced in the planning of research prepared by the European Union for the VII Framework Programme (2007-2013). This programme is also backed by the European Technology Platform Food for Life, also established by the European Commission with the objective of promoting technological innovation in the Small and Medium Enterprise of the food industry and favour their development and competitiveness. The application of Life Cycle Thinking (LCT) to the agri-food industry, which consists in examining the entire life cycle of a product in order to prevent any transfer of polluting loads from a step to another, is one of the most interesting fields of research promoted by the abovementioned Platform and is related to a study approach that has been repeatedly promoted and backed by the European government, the Integrated Product Policy. Over the last few years, the basic method of the LCT approach, Life Cycle Assessment (LCA), has rapidly spread in the agri-food industry. This tool is capable of supporting the operators of the sector in making decisions concerning alternatives for production, industrial processes and farming, but also in the creation of the most sustainable recipes for the environment. In addition, this method is one of the founding principles of the Environmental Product Declaration, an ecological labelling standard of the ISO 14020 series that required information about the environmental impact of the food product to be provided on a label based on present parameters. In this paper, we will express some considerations on new perspectives for a better use of the LCA tool in the agri-food industry, in order to resolve the critical issues mentioned above.

2 Life Cycle Thinking methodologies: perspectives of integration and improvement of the information potential

The standardization of the LCA method, as defined by ISO 14040, whose first edition dates back to 1997, allowed its rapid dissemination in a larger user base, which also included the small and medium size businesses (Frankl, Rubik, 1999) that had not been enabled to benefit from any such method until then due to a lack of specific knowledge. Some researchers (Welford, 1996) had made a further step forward when they stated that the underlying logic of this tool - breaking down and managing environmental problems and identifying the related impact responsibilities - could be definitely considered as a tool itself for daily use in the consumer's rational purchase choices. So, we may state that, over time, LCA has been

transformed from an analysis system to be used to resolve (technical) problems to a model which may help, the different parties involved, in gaining awareness of the shared responsibility they have in generating an environmental impact with a given product or service. Within this framework, considering that this method emphasizes consumption, the consumers themselves should be among the main users of its results. The importance of this tool lies precisely in its capacity to make a quantitative and comparative assessment of the functions of a product for the consumer (Benoit, Norris et al, 2009). Therefore, while the identification of production strategies with a reduced environmental impact remains a primary purpose of LCA, today the even more important goal of this tool is to drive consumption choices towards globally more sustainable alternatives (De Leeuw, 2005). Only consumers, through appropriate information, can prevent the continued use of unsustainable production practices. Some of the proposal developments of LCA-based methods move towards this direction with the specific objective of simplifying and making the results of these analyses more easily intelligible by an average public (Nissinen et al, 2007). Furthermore, research on the product life cycle assessment method is also evolving towards some possible paths for integration with tools that are capable of detecting economic and social impacts as well (Finnveden et al, 2009). According to the Triple Bottom Line approach, an organization is defined as sustainable only when it manages to reconcile its profitability objectives with environment protection and social equity. Similarly, LCA-based models as well, precisely due to their repercussions on consumption choices, are expected to provide a complete picture of the sustainability of a product, and therefore also evaluate the economic and social issues of the product's life cycle. This is mentioned among the aims of the Society of Environmental Toxicology and Chemistry (SETAC) in the Workshop Report called "A Conceptual Framework for Life Cycle Impact Assessment" (Fava et al, 1993), the organization that has mostly contributed to the development and theory of LCA. As a matter of fact, SETAC has recently published the first guidelines on the Social LCA (SLCA) (Benoit et al, 2009) and an overview on the Life Cycle Costing (LCC) (Hunkeler et al, 2008). This latter method has been used recently in support of investment decisions, because it allows for a calculation of the total cost of a product, process or any other activity throughout its life cycle, including the costs connected with the demands that are not expressed in product price on the market as the cost of emission reduction. Companies' decisions regarding demands for better environmental impacts are difficult because the demands differ and implementation is uncertain (Krozer, 2006). In many economic sectors it's important to analyse the economic aspect as systematically as the environment is analysed with an LCA, then it may be important to analyse the integration between LCC and LCA. Moreover, it is a great advantage if the systems studied with the economic analysis and the LCA have the same system boundaries, in order for the two analyses to supplement each other in the decision process (Reich, 2005). The Kroser's analysis of ten cases of life-cycle management (environmental and also economic), for example, suggested that innovative and preventive environmental strategies can help companies to save costs of emission reduction in comparison with the compliance strategy and improve the product quality: three case studies were on agri-food products and agri-food industrial products. These results are concrete evidence of the usefulness, for companies and consumers, of an environmental management system based on life cycle. However, the integration of LCC into LCA can be hampered by the lack of a standardised LCC methodology and difficulties in defining some of the cost factors. Furthermore, it's hard to find reliable and adequate data (Jeswani et al, 2010). In particular LCC needs to define specific system boundaries, and functional units, compatible with LCA, and make a clear statement on externalities (Hunkler et al, 2005). With regard

to the SLCA, to date there are few case studies on a concrete application of this method because it poses several problems including the definition of stakeholders, the need for qualitative assessments and the importance of localization (regional impact). The publication of guidelines has helped to identify a common methodology, based on LC tool; however, it must be fully implemented in practice to show its validity and usability. In spite the methodological difficulties about the application of LCC and SLCA, many authors have highlighted the need for integrated and harmonized methodology for assessing the environmental and economic impacts generated by a product throughout its life cycle with also the social ones (Hunkler et al, 2005, Gauthier, 2005, Schmidt et al, 2004). We address the case study analysed by Hunkler (2006) about the comparison between two detergents: he proposed a methodology of Social LCA (and also LCC) derived from life cycle inventory data; so, the analyses have identical system boundaries and functional units. The same European Commission has focused on the option to integrate the assessment of economic and social impacts in the LCA method (CALCAS, 2008; Patel, 2009). The similarity between the three models favours synergies, and consequently the construction of a single method to be used to interpret the level of sustainability of a product/service. However, creating an integrated model may worsen the present complexity of the LCA method. Some studies have already been started to simplify the LCA method, such as the spreading and use of existing databases to produce reliable data available in shorter times and at acceptable costs (Hur et al, 2005). Such an experience may be effectively repeated once a common framework for LCA, SLCA, and LCC has been created. The benefits that would be derived by a common framework for the three methods are multiple and easy to understand. First of all, the combined analysis of the environmental, social and economic hot spots of the product and of the related impacts in connection with the abovementioned three dimensions would allow useful results to be obtained in terms of global – i.e. economic, social and environmental - efficiency (Udo de Haes et al, 2004; Jeswani et al, 2010). The businessmen would be provided with a complete tool in support of their decision-making process and, similarly, policy-makers may also draw many benefits from this tool for a more effective planning of public policies and for the control of environmental and social regulations. On top of this, the results of these analyses, provided that they be adequately notified, as expected by the recent studies mentioned above, would be even more important for consumers, who would possess the necessary information to make more responsible and sustainable consumption choices. In particular, visualizing the global impacts generated by a given product on the label or the promotion claims (Otto H.E., 2003; Nissinen et al, 2007) would allow consumers to objectively see the image of sustainability proclaimed by a food producer, thus reducing information asymmetries in some credence attributes (Henson, Reardon, 2005) that often influence consumption choices. The three players – the industry, policy-makers and consumers – may activate a virtuous cycle towards sustainability in a co-makership logic. It is only through the external visibility, to the community and consumers, of the commitment undertaken by a business in fulfilling environmental sustainability that the spreading of increasingly sustainable practices can be fostered in the industry.

3 Conclusions

The LCA method has been identified, even by the same European governmental bodies, as one of the most effective tools to tackle the criticalities of this sector. However, the delicate balance between the availability of raw materials, transformation processes and, simultaneously, consumer protection, as well as environment, territory and landscape protection, that lie at the basis of the food industry, makes it necessary to identify an integrated approach in the triple bottom line assessment of

sustainability and in the identification of the possible development and growth paths. Therefore, we have identified a need to further investigate the possibilities of using LCA in the agri-food industry with two perspectives: the first aims at refining the tool as regards the characteristics and requirements of this sector, also considering the scarce economic resources available to SMEs, and the second aims at creating a single tool capable of detecting globally the environmental, economic and social impacts of a food product during its life cycle. The latter perspective, in particular, shows many opportunities, but also some methodological issues. Indeed, the integration of LCA with LCC and Social LCA may worsen the present complexity of the LCA method, in consideration of some problems that regard, on the one side, the fact that SLCA is still going through an experimental stage bound by subjective judgement and, on the other side, the challenge of defining cost factors with LCC. However, these difficulties could be overcome through increased testing of the integrated model that takes into account of:

- the simplification of LCA method;
- the need for a LCC standard;
- the greater dissemination and application of SLCA to concrete case studies.

In addition, the results of an integrated LC method should be better reflected in the label to be stuck on the product, in view of eliminating or, at least, reducing the barriers between SMEs and the large corporations that can afford huge investments on building the image of sustainability of their products. In fact, the development of labelling systems for showing the results of an integrated LC method capable of providing information schematically and simply on the three levels of sustainability of the product, including the use of result benchmarking tools, can be certainly seen as tools to be provided to consumers in order to enable them to evaluate actual quality, and therefore the value of some innovative kinds of food, in order to make rational and conscious purchases.

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