

# **Defining a set of attributes and indicators to evaluate the multidimensional performance of local to global food value chains: thoughts from Switzerland**

Schmitt Emilia<sup>1,2</sup>, Cravero Virginia<sup>2</sup>, Belletti Giovanni<sup>3</sup>, Marescotti Andrea<sup>3</sup>, Brunori Gianluca<sup>4</sup> and Barjolle Dominique<sup>1,2</sup>

<sup>1</sup> *Federal Institute of Technology (ETHZ), Sustainable Agroecosystems Group, Zürich, Switzerland;*

<sup>2</sup> *Research Institute of Organic Agriculture (FiBL), Frick, Switzerland*

<sup>3</sup> *Dipartimento di Scienze per l'Economia e l'Impresa, Università di Firenze, Firenze, Italy*

<sup>4</sup> *University of Pisa, Department of Agriculture, Food and Environment, Pisa, Italy*

**Abstract:** In the context of growing consumers' awareness about the impact of food products on the environment, their health or on social aspects, a careful analysis needs to be conducted to compare the sustainability performance of local VS global food value chains. The EU research project GLAMUR (Global and local food assessment: a multidimensional performance-based approach; [www.glamur.eu](http://www.glamur.eu)) will therefore analyze the performance of food value chains concerning five dimensions that cover the economic, social, environmental, health and ethical fields. Regarding local food value chains, it is known that these have a positive image supported by the perception of reduced negative impacts on the environment and other dimensions. However, a critical analysis of local food chains' performance in comparison with more global ones will help to objectively assess the real benefits and drawbacks of local and global food chains.

In this paper, it is shown the methodology by which a set of attributes of performance was selected to compare the multi-dimensional performance of a local and a global food chain in the milk sector of Switzerland. A specific selection of attributes of performance around the five sustainability dimensions cited above will be used to measure and evaluate some food chains' performances and compare local vs. global chains. These attributes have been listed thanks to the participation of stakeholders involved in food value chains. Secondly, the list of attributes has been reduced to a smaller number of attributes according to their perceived importance for each value chain.

**Keywords:** Local, global, value chains, attributes sustainability indicators

## **Introduction and concepts**

Currently, there is an increasing consumers' awareness about the impact of food products on the environment, on their health or on social aspects. Indeed, consumers' demand for food produced locally has increased significantly as a consequence of their willingness to purchase quality products and to support local economy and local farms (King et al., 2010). For this reason, more accurate scientific answers are needed to understand those impacts. The EU GLAMUR project (Global and local food assessment: a multidimensional performance-based approach) thus adopts a multi-criteria perspective that takes 'measurement' and 'evaluation' in ways that combine qualitative and quantitative impacts.

The overarching objective of the project is to increase the sustainability of food chains through public policies and private strategies. To assess food chains sustainability will be useful to determine which chains (global vs. local) perform better around five dimensions (environment, economy, social, health and ethics). The overall end goal is to achieve a more sustainable consumption of food and thus to increase resiliency and safety of food systems. The project will be conducted through performance assessments of food supply chains in European countries, with particular attention to global-local comparison.

Beretta et al. (2013) define a food value chain as “the system of organizations, people, and activities involved in moving food from its producer (usually the farmer) to the consumer” (Beretta et al., 2013:765). Among other differentiations between types of chains, two kinds of value chains can be distinguished: the global and local ones. It is still difficult to make a distinction between local and global food value chains as the boundary remains very fuzzy (Edwards-Jones, 2010). In addition to the geographical distance separating the production site and the consumer, there are other elements that are important to define a value chain as more local or global. The GLAMUR project uses the following variables to make a distinction between local and global: (i) the physical and geographical distance between production and consumption; (ii) the type of governance and organization of the supply chain (degree of control of “local actors” and “global actors”); (iii) the kind of resources, knowledge and technologies employed; (iv) the way supply chain actors shape product identity with regard to the reference to the territory of production for food plays a relevant role or not. Notwithstanding that the value chains in the real world are, more often on a continuum between global and local aspects, these four criteria can help identify ideal-typical cases of local and global food value chains.

Sustainability represents an important challenge for all food value chains on that continuum as several forces push to increase it: not only consumers’ purchasing preferences but also other stakeholders such as governments, environmental organizations, and value chain actors which are nowadays aware about the need to improve sustainability to face the future challenges of natural resources’ scarcity for example. Five dimensions of sustainability (economic, social, environmental, health, ethical) were chosen to assess the performance of food chains in this project. Performance is here understood as “The degree to which a [...] value chain operates according to specific criteria/standards/ guidelines or achieves results in accordance with stated goals or plans.” (OECD glossary, 2010). These five dimensions of performance rely to the consumers’ concerns, which are a balance between economic determinants (for consumers, as reflected in the prices) and other “attributes of performance” they consider relevant for them, such as health, environment, social aspects, and ethical considerations. This choice of five dimensions is supported by the SCAR 3rd foresight exercise (EU Commission, 2011) on consumption behavior.

### **Existing Methodology of performance assessment for food value chains**

Methods of sustainability assessment already exist, such as life cycle assessment (LCA) that focuses on the environmental impacts of a defined product all along the production chain, or such as the Sustainability Assessment of Food and Agriculture systems (SAFA) Guidelines from the FAO or the Response-inducing sustainability evaluation (RISE), focusing at a farm or firm level assessment. However, these methods still do not include a multidimensional assessment operated at the scale of the entire food value chain (from input suppliers to consumers).

The SAFA guidelines state that there are numerous meanings of sustainability but agree on the need to reconcile environmental, social and economic demands for present and future generations (FAO, 2013). The development of indicators has been realized then to measure this sustainability on food systems as for example in the SAFA guidelines where ‘themes’ and ‘sub-themes’ of sus-

tainability assessment for food and agricultural entities are defined and then turned into qualitative and quantitative indicators for measuring the performance (FAO, 2013).

Indicator as given by SAFA are “quantitative or qualitative factor or variable that provides a simple and reliable means to measure achievement, to reflect the changes connected to an intervention, or to help assess performance (adapted after OECD, 2002).”

Other scientists give also some criteria of feasibility as mentioned in Feenstra et al. (2005). Indicators should all be:

- Quantifiable, that means measurable
- Available to public
- Affordable with a little monetary input
- Truthful, reliable coming from credible sources
- Easy to use and understandable
- Feasible to modify responding to changes

But most important of all, the set of indicators should fulfil the goal that they target, that is to assess the sustainability performance of a food value chain, or a food system. The risk is actually high that the indicators chosen as “measuring values” in the assessment are greatly influenced by other contextual factors that are actually independent from the actions of the food value chain. Such measures would result in the comparison of contexts rather than the comparison of food value chains’ performances. Ericksen (2007) developed in this sense a framework to study the interactions between food systems and global changes. In this framework, he defines three types of food systems characteristics: Food systems ACTIVITIES (e.g. Producing, Processing & Packaging, Distributing & Retailing, Consuming), Food systems OUTCOMES (e.g. Food Utilisation, Food Availability, Social welfare, Food Access, environmental Capital) and DRIVERS (e.g. Socioeconomics like Demographics, Cultural context or environmental like climate). Therefore, in relation to this framework ‘Indicators of performance’ of value chains should help measure the performance of the food system activities, as being made measurable partly through the observation of the food system’s outcomes. The assessment should attentively make the difference between indicators of performance inherent to activities and those influenced by drivers. This is of outmost importance when the performance has then to be compared between different food value chains.

### **Proposed Methodology of performance assessment for food value chains**

There is an actual need to develop a methodological framework both to identify local or global food value chains and then to assess their performance in a comparable way. In comparison with previous methods, this new framework should allow to evaluate the performance of a food value chain in its whole because the existing methods are mostly focusing on single units like farms or firms or on only one dimension.

In this paper, it is shown the methodology by which a set of attributes of performance was selected to compare the multi-dimensional performance of a local and a global food chain in the dairy sector of Switzerland. Attributes are “areas of possible impacts on sustainability exerted by the local/global features of a food chain”. E.g. Animal welfare is an attribute (GLAMUR WP2, 2014).

More practically, an attribute of performance, as used in this approach, is the category of assessment that is between the overall sustainability performance assessment and the direct measure done by indicators. Attributes are a sub-level of dimensions, regrouping indicators into sustainability themes.

The methodology described here follows the following steps:

1. Listing attributes: In the GLAMUR project, this has been done in each participating country on the basis of a systematic literature and media review (scientific and grey literature), plus interviews with key-respondents, completed by a DELPHI-survey conducted with key-experts. The high number of sources found was analyzed through software of qualitative data analysis that can identify most frequent words for example. Most frequent items in literature and interviews are grouped in 'themes', which are a preliminary kind of attributes. Each of them is thoroughly described and justified. Actors' point of view on these themes and their articulation in the value chains can be done through the interviews and a preliminary analysis of the value chains.
2. Selecting the most important attributes in order to focus on the relevant indicators: To complete this 'filtering' process of the relevant attributes, preliminary observation of the cases under study and early interviews are essential to grasp the main issues at stake. The challenging part in applying this assessment framework to empirical cases is to choose the appropriate attributes.
3. Measuring performances: the performance is measured for local and global chains by choosing performance indicators; not only indicators in a traditional sense, but also participatory comparisons involving stakeholders, etc. The relevant list of indicators will inform the selected most relevant attributes. Existing lists of indicators (SAFA, RISE, etc) should be used as they also give insights about how such indicators have been measured before and what are the benchmarks usually applied to them, but can be adapted to each case. Further indicators should be created according to the case and participating stakeholders. Additional indicators will be collected relating to the context surrounding the case and they are called 'descriptors'. These special indicators relate to the 'drivers' in Ericksen's paper (2007). They concern agricultural politics, tax and subsidies' systems, food regulations or natural conditions. These food chain descriptors are not to be used to assess the performance but to describe and further define the chain and its context and will help in the comparison of the different cases.
4. Data collection and calculations: This is made in parallel with the definition of the indicators as difficulties in collecting data can in return necessitate a new formulation or transformation of the initial indicators. After entry of the data into a database, the performance based on the indicators is calculated for the local chain and the global chain and can afterwards be compared. For the calculation of performance, each indicator must contain a scale of performance represented with benchmarks of minimum and maximum performance. These benchmarks are either available from standardized indicators (see step 3 above) or can be adjusted according to context justification and strong integration of stakeholders.
5. Analysis: the last step consists in analyzing the differences of performance in each indicator and by attributes between the local and the global chains. Performance as measured with the benchmarks can be converted on a percentage scale for comparisons.

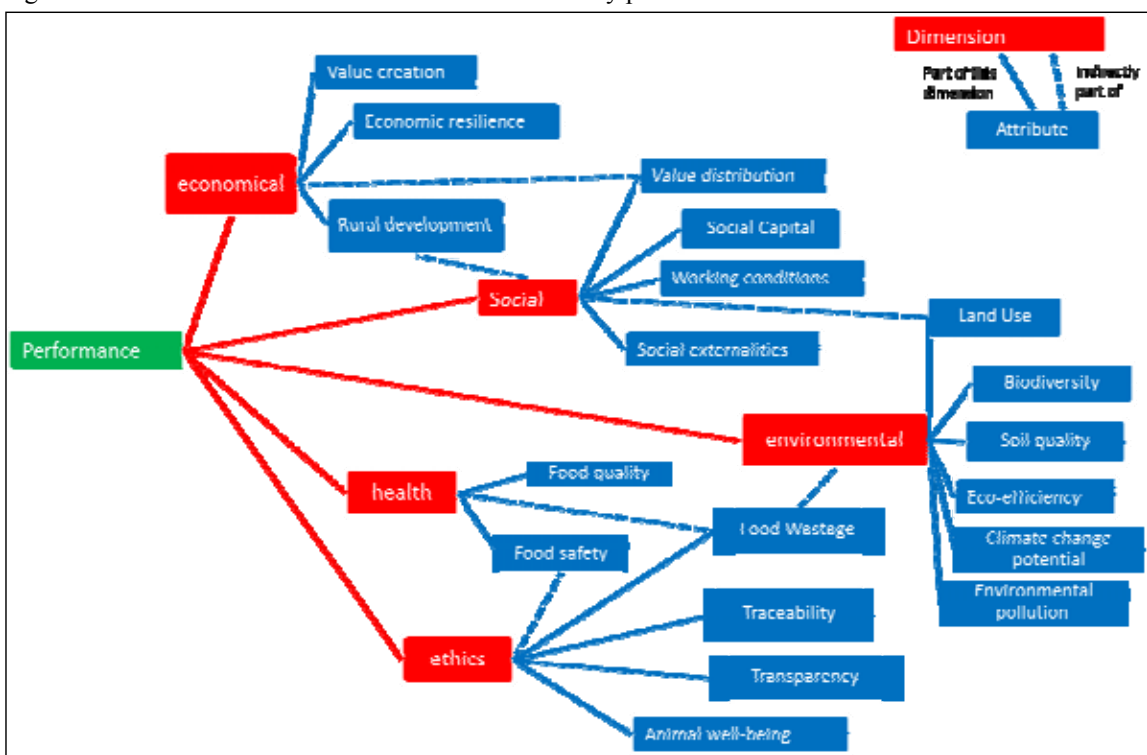
We aim in this paper to compare a local and a global value chain in the case of milk value chain in Switzerland. Our methodological proposal is to focus only on the most relevant attributes of impact in order to downsize the list of data to be collected and nevertheless being able to compare the performance of different value chains and the first results are presented in the next section.

## First results about the identification and selection of attributes in the case study of Swiss Dairy industry

In Switzerland, the first step of the approach was to conduct a desk-review of different categories of documents, including scientific papers, policy documentations, market reports, press articles and internet contents such as specialized blogs related to the performance assessment of food value chains. The first qualitative analysis of the 75 sources was made with the software N’Vivo that can analyze the most frequently quoted words. This analysis gave a first selection of 48 scores, which were grouped in 19 attributes within the five dimensions (environment-social-economical-health-ethical).

In order to complete this multi-dimensional performance assessment, the selection of 19 attributes shown on figure 1 was finally settled. On the figure, the five sustainability dimensions are represented with all the attributes of performance directly linked to them. Some attributes are also part of a second dimension, represented with the dotted lines.

Figure 1: Final set of attributes to assess the sustainability performance of food value chains



This list was in the process submitted to 12 experts and stakeholders during interviews. Experts were from Switzerland and worked in different food sectors (cooperatives, policy, extension services, and researchers). In addition to qualitative improvements, their task with the attributes was to rank them by degree of importance concerning the attribute’s ability to translate/show/highlight/value the performance of a food value chain. They also contributed to understand the major issues and challenges at stake in the dairy food chains of Switzerland. The goal of this process is to sort out a smaller selection of attributes, that should in the end cover the major issues of the supply chains and be sufficient to compare a local vs. a global food chain in a precise sector.

In the context of Switzerland, what appears as a major attribute that actors quote most often as most important is the traceability in food value chains. This attribute is also mentioned as being a main issue in global food value chains and perceived as something performed better in local chains. A second major attribute that is often considered as very important is ‘Land Use’. This is

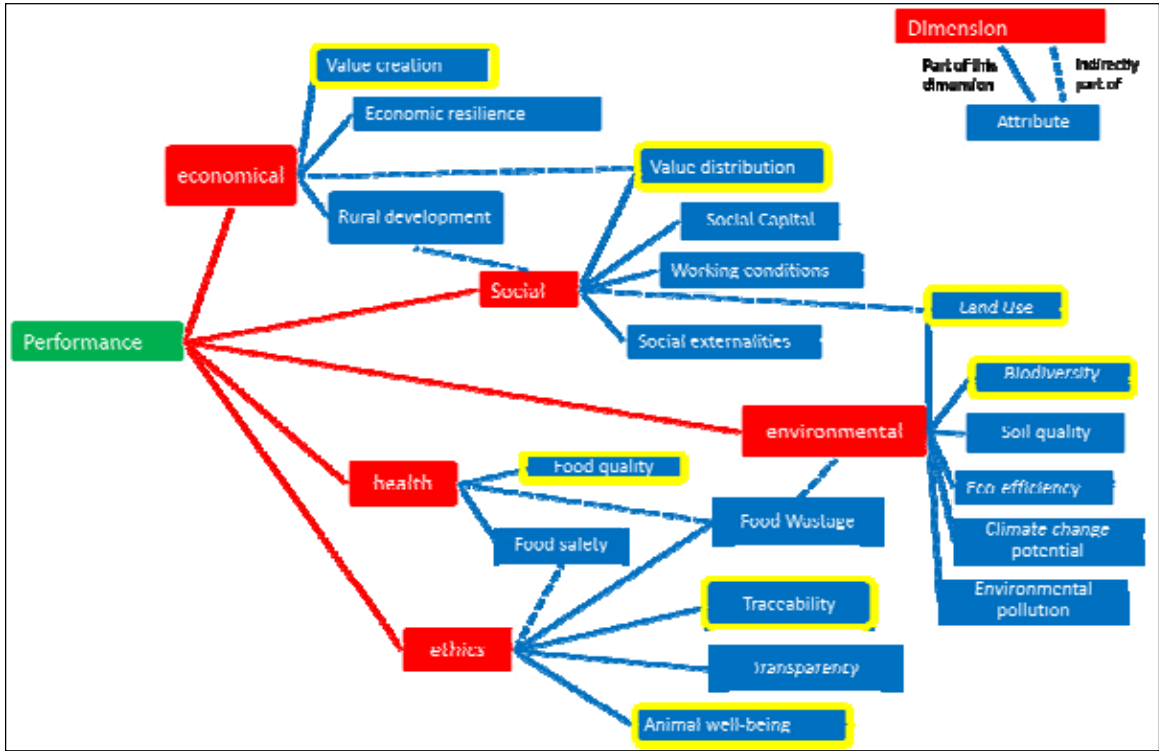
most pertinent in link with the Swiss context as a major component of subsidies for farmers is based on their land management and the debate between intensive and extensive production is especially active in the agricultural sector. It is moreover a very burning question in a country where the density of population is high in the low land and where urban sprawl is constantly taking over good agricultural land. On the other hand, mountain areas where only pasture would be practicable, land is lost to forests as farmers decide to intensify their production and use concentrate or foreign feed instead of high-land pasture.

At the third position of importance come two other attributes, one particularly linked to land use as well, that is ‘biodiversity’ and then ‘Food quality’. Food quality, when linked to taste is most often perceived as better performing in local food value chain although one expert advanced that it is on the contrary better on the global level as large-scale processors and retailers are more rigorous with controls and safety measures. Thus, global food chains might perform better in some areas of the health dimension, but this remains to be assessed. Furthermore, some interviewees mentioned a higher quality of the fat content of the milk in case of more grazing, which is typical of more local food chains.

The two most important attributes relating to socio-economic dimensions are “value creation” and “value distribution” as almost all stakeholders without exceptions mention that the biggest challenge is usually to create added value surrounding a product and communicate quality to the consumers in order to generate revenues. The second challenge is then to allocate this added value to all steps of the value chain in an equitable way. The last important attribute selected is animal well-being as this is highly relevant in the dairy sector when taking into account the differences in cattle management practices in the two types of chains. The differences are mainly in the time cows can spend on pasture, their health and also their average life time.

In summary, the relevant attributes that we could select for a case study in the milk sector of Switzerland were (as highlighted in Figure 2): Traceability, Land Use, Biodiversity, Food Quality, Animal well-being, Value creation and Value distribution.

Figure 2: Selection of the relevant attributes for the evaluation of the case study



These attributes of performance have then to be measured concretely on the case studies in order to assess a difference in performance between local and global chains. In order to do so, each of the attribute is divided into a set of precise indicators, which should also fulfill the list of applicability criteria from Feenstra et al (2005). Each attributes will be described by two to eight indicators. This selection of indicators is however specifically adapted to a Swiss context and concerns a dairy sector, it is thus not adapted for a cereal or fruits sector in another country but could be adapted. This work of selecting precise indicators is still ongoing in the context of the GLAMUR project. As research is ongoing, it remains to be verified through the measurement of the indicators if local food value chains perform better in those attributes in this specific sector of Switzerland, or not, and why. Furthermore, the same evaluation procedure will be conducted on a dozen case studies in European countries for comparison of performance within sectors.

## **Discussion**

Several authors have in the last years stressed the need to set up metrics, such as indicators, to assess the sustainability of food systems (Ericksen, 2007; Van der Vorst, 2006, etc). In their article “the top 100 questions of importance to the future of global agriculture”, Pretty et al. (2010) even enounce the question: “How can we develop agreed metrics to monitor progress towards sustainability in different agricultural systems that are appropriate for, and acceptable to, different agroecological, social, economic and political contexts?” which means that such systems of attributes of performance should also be transposable to other countries and contexts, in addition to being objective (Born and Purcell, 2006), holistic and multidimensional.

As we chose an approach of definition of the attributes that is ‘bottom-up’ and integrates directly the stakeholders, it is inevitably context-dependent as stakeholders tend to give importance to what is relevant in their daily activities. This approach has however the advantage of being truly iterative, adaptable and transdisciplinary. Because the sustainability assessment should be holistic and multidimensional, experts from socio-economical to natural sciences and stakeholders from the FSC are needed to define attributes and afterwards benchmarks of these attributes to truly assess sustainability performance. The multidimensional aspect of sustainability requires transdisciplinarity in the practice of attributes’ definition as a very broad and precise knowledge about the food system under study is necessary for a holistic assessment.

This knowledge is especially required in the further steps of the assessment (not yet conducted at this stage of research). For some indicators, as for example pesticide residues in the attribute food safety, it is clear that the scale of performance goes in one direction, as in this example, the less the better. For other indicators however, the benchmarking contains a lot of uncertainties as many of crucial questions on what is the most performing or sustainable system remains unanswered (Pretty et al., 2010). That is why the integration of experts of the food sector remains so crucial. One of the main challenges remains to be independent from contextual or ideological discourses that surround the evaluation of performance of any agro-ecological system, because these discourses determine the goals and the state of the system that should be achieved, and thus the benchmarks. For example, there are contradictions in the environmental dimensions between one discourse promoting the increase of agricultural production by no less than 70% until 2050 (Godfray et al., 2010) and another discourse promoting conservation of biodiversity, land quality and water (FAO, 2009). The contradiction between the two views is that the second one promotes land management and practices that often deliver less food outputs by unit of land, time and inputs. There are thus some indicators that show a good performance in one discourse but could indicate a restriction of performance in the other discourse. This is also the reason why such a system of assessment through attributes will mainly help identifying trade-offs between dimen-

sions. To evaluate the overall performance of a food system will require weighing on which attributes are more important and that will be very difficult without entering some ideological discourse in the definition of the benchmarking, at least in the environmental dimension.

## **Conclusion**

As seen in this example of developing a set of attributes of performance for food value chains comparison, the process of selecting the appropriate data to measure is particularly challenging. There is often a trade-off between the precision of data that researchers can collect and the multidimensionality of an evaluation. We try here to overcome this challenge by downsizing the amount of attributes according to their relevance in the specific context of the dairy sector, while keeping some precise indicators. An in-depth exploration of the context and the participation of stakeholders in an iterative process are thus required to define the attributes. Hopefully, the ongoing collection of data measuring the attributes of performance on two comparable food value chains in the milk sector of Switzerland will allow to improve the method and furthermore in the project to elaborate a framework applicable to multiple other cases in Europe.



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