

## **Sustainability indicators: a tool to evaluate and monitor the impacts of agri-chains on sustainability**

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*Abstract: Agribusiness companies are far from representing environmental friendly activities. There is a strong perception that agricultural activities represent a threat not only to the environment, but also to life of people involved in the productive process. Due to these negative impacts, agri-chain companies have changed the productive process towards sustainability. Through the development of sustainability indicators, it is possible to capture the state and the pressures on the environment and on people's quality of life, and the initiatives to reduce the negative impacts of agribusiness companies. Thus, the central question of this paper is how to develop sustainability indicators for agri-chains? The objective is to present a method of developing sustainability indicators. One of the main contributions of this method is the participation of the chain actors' in the process of developing the indicators. Such technique is essential to guarantee that the indicators will reflect the reality of the chain being studied. This also motivates the use of the indicators by the actors, once they perceive that participation is important for a good performance towards sustainability.*

*Keywords: Sustainability; Agri-chains; Method*

### **1 – Introduction**

Agribusiness companies are far from representing environmental friendly activities. There is a strong perception that agricultural activities represent a threat not only to the environment, but also to life of people involved in the production process. Due to these negative impacts several agri-chain companies has changed the productive process towards sustainability.

Agenda 21 called for the development of, among many things, sustainable agriculture and land management, as well as the systems necessary to monitor their achievement. This has led to a wide range of activities, which have sought to define sustainability, and, of particular relevancy for this paper, sustainable agriculture that embraces the three environmental, economic and social dimensions. Sustainable agriculture, over the long term, enhances environmental quality and the resource base on which agriculture depends; provides for basic human food and fiber needs; is economically viable and enhances the quality of life for farmers and society as a whole (AMERICAN SOCIETY OF AGRONOMY, 1989). In short, sustainability in agriculture usually refers to the profitability, environmental stewardship, and quality of life of agri-chains actors and society as a whole.

Although the number of studies of sustainability that explores the environmental, social and economic impacts of different agri-chain production processes is increasing and it is a term that everybody has heard about, it is undoubtedly a vague concept. Based on that, an intriguing question is how can we assess the impacts of agricultural products and how can we bring the vague concept of sustainability into practical arena? Through the development of sustainability indicators, agribusiness companies, researchers, and society as a whole can assess the state and the pressures on the environment and on people's quality of life, and the initiatives to reduce the negative impacts of agri-chain production. In this sense, the development of indicators can create a new and concrete definition about sustainable

agribusiness activities, using previous researches as base and complementing them with new issues. The development of indicators for a particular product chain will at least be helpful in defining a core set of sustainability indicators that is required for the chain actors in order to monitor the changes towards environmental, economical, and social sustainability. Such set of indicators is to be based on a common understanding of the basic issues to be addressed. Besides, some indicators may be essential to one special chain actor whose participation is crucial the whole supply chain. Indicators can be used for chain actors to identify the main bottlenecks and to implement strategies to ameliorate the chain actors' quality of life, economic performance, and the environmental conditions.

The study of chains based on sustainability can focus the internal and external environment. At the internal environment the systemic analysis can study the impacts and contributions of the sectors individually. At the external analysis it can study the legal environment, the fiscalization bodies, the incentives/subsidies, the partnerships, technical assistance, among others.

Sustainability indicators can be used as a tool to study the impact of agri-chains on sustainability. The challenge is to develop better information collection and reporting systems especially for agribusiness activities that can monitor this information about contributions and impacts. The information systems should integrate the environmental, social and economic dimensions for greater sensitivity in planning and decision-making toward sustainable development. In addition, the conditions and trends based on indicators should be reported regularly and reliably. The truth is that the development of sustainability indicators is essential to maintain information about the progress towards sustainability. Thus, the central question of this paper is how to develop sustainability indicators for agri-chains? The objective is to present a method that can be used by agri-chain actors in order to develop a set of sustainability indicators capable of capturing the state of sustainability and monitor it over time. The method presented here was tested in the organic coffee chain in Brazil, more specifically at production and processing stages.

## **2 - Sustainability Indicators**

### **2.1 - Definitions and users**

Before presenting the method, it is important to define indicators, the desirable properties and characteristics that should be considered when developing a set of sustainability indicators.

Sustainability indicators are tools for assessing the progress towards sustainability and to communicate the achievements (SPANGENBERG, 2002 and MORSE et al. 2001). Sustainability indicators are intended to assess whether a system is moving towards or away from sustainability in all three dimensions embedded in the concept, environmental, social, and economic. Indicators orient decision-makers within a chain whether they are on course or in need of corrective measures. They show outsiders the chain's attitude towards sustainability and its performance in the field of sustainability, which may improve the chain's performance and image (de GROOT, 2002). According to Tschirley (1996) indicators are pointers, which reveal conditions and trends that help in development, planning and decision-making.

Although there is a rapidly development literature on the use of indicators, there are different definitions of what an indicator is and different understandings of the primary roles of indicators. Gallopin (1997) surveys a wide range of literature and reports that in different sources an indicators has been identified as “ *a variable..., a parameter..., a measure..., a statistical measure..., a proxy..., a value..., a meter or measuring instrument..., a fraction..., an index..., a piece of information..., a single quantity..., an empirical model..., a sign...* ”.

The purpose of sustainability indicators is to serve as simplified communication tools helping to guide political decision-making towards sustainable development. To serve communication purposes, they should reduce complexity, be easily understandable and limited in number (SPANGENBERG, 2002). Policy-makers can use the indicators to make better policy choices, to identify failures and to make adjustments to guarantee that the sector would be able (theoretically) to allocate resources more efficiently, and increase profits margins (TSCHIRLEY 1996). According to Pajak (2000) the value of sustainability indicators ultimately will be found in their relevance and effectiveness in helping people make sustainable the natural environments, societies, and decision-making institutions. Sustainability indicators can be useful for companies to develop their corporate sustainability strategies. Moreover, consumers and society as a whole have become more aware about health, product safety, and the adverse social and environmental effects of economic activities.

The institutional and professional capacities of countries and communities, especially the poorer ones, to adapt and apply technology, to promote authentic participation, to empower local groups and to encourage professional staff and extension systems figure prominently in development failures and successes. Thus, a central challenge to technicians, planners and policy-makers is to ensure that indicators and information address these issues.

## **2.2 - Types of information**

Information related to land suitability, pollution impacts and other sustainability considerations is available or can be estimated and included with the costs of production, revenues and the resulting profits which underpin the policy analysis framework. The results are not always as precise as would be desired, but when decisions are being taken without any information, some data and an approach, which can allow for incremental improvements in the quality of decision-making, are needed. Indicators for land, water, soil, biodiversity and other factors can be used along with economic data by constructing scenarios based on available information after identifying gaps and assessing quality.

Social factors such as landlessness, migration to engage in wage labor, rural unemployment, poor access to credit or needed inputs, and weak extension systems can all serve to undermine sustainable development. The challenge is to know when, to what extent, and under what conditions, these factors interact with economic and environmental factors to work against sustainability (TSCHIRLEY, 1996).

Policies with respect to trade, spending, exchange rates, labor markets, and inputs are included in the analysis and impinge on the natural resources base. Policy objectives are realized through the introduction of new technologies, diversifying or specializing production, which raises or lowers prices for consumers or producers, through taxes, restrictions, subsidies, guarantees, and income supplements.

Policy failures, from the point of view of sustainable development, arise when instruments inadvertently lead to misuse of natural resources. Whereas a government objective may be to increase production of a commodity, such as soy or coffee or cotton in order to generate foreign exchange, and the policy instrument used are favorable credit terms or price guarantees. An unforeseen result may be increased soil erosion, mining of soil nutrients, misuse of pesticides or fertilizers, or a variety of negative impacts that represent long-term costs to the government and, especially, to the producer.

These externalities or indirect costs are seldom calculated or even identified in policy analysis and planning even though they may create direct costs to the agriculture sector and reduce the GDP of a country. As a general rule, indirect costs and externalities should be included in economic planning and analysis to the extent that the benefits obtained are equal

or exceed the costs of obtaining them. Thus, the ability to accurately value such costs and benefits looms large in the economic component of sustainability analysis (Tschirley 1996).

### **2.3 – Properties**

Once the definitions about indicators are numerous it is useful to identify the desirable properties. Sustainability indicators should provide both the chain actors and its outsiders with important information that can simplify the reality. According to Veleva and Ellenbecker (2000), to make sustainability indicators useful, a number of desirable qualities can be identified:

Sustainability indicators should be appropriate to the task. This means that the indicator should directly relate environmental pollution to the particular actor environmental performance.

Sustainability indicators allow for comparisons between chains. This means that a certain degree of standardization is required. Data on which the sustainability indicators are based should be available and accurate. It is advisable to start with simple indicators based on existing, easily collectable data (e.g. use of agrochemicals, energy use, lost workdays), which may be extended with more sophisticated measures overtime.

A set of indicators is preferable to a single indicator that misses valuable information. A set of indicators should consist of a manageable number. Too many indicators make the method difficult to use, whereas too few may miss important information. Simplicity and meaningfulness should be well balanced. The discrepancy between these two characteristics is that a meaningful indicator may be relatively complex and information demanding while an operational indicator needs to be simple, easily understood and based on relatively accessible data.

Both quantitative and qualitative indicators should be used. Quantifiable indicators are the most objectives one but they may miss critical information that is not directly quantifiable.

Consistency should exist between the actors' sustainability indicators, and chain, national and international sustainability indicators. The participation of relevant actors of the supply chain is essential for the development and evaluation of successful indicators.

The qualities defined above, among others, have largely been developed by "expert" users, whereas Guijt (1996), argues that good indicators should also be user derived, implying a more community or participatory involvement. She summarizes good indicators as those, which are policy relevant, user derived, and, highly aggregated. Following Tunstall (1992, 1994) and Gallopin (1997), the functions of indicators are to assess conditions and changes; to compare across place and situations; to assess conditions and trends in relation to goals and targets; to provide early warning information; and, to anticipate future conditions and trends.

### **2.4 - People developing indicators**

The background of the people involved in the development of sustainability indicators is important because it will reflect in the final result. Studies on sustainability assessment and the development of indicators frequently produce long lists of indicators. These lists often reflect technical background and the number of those developing the lists, and tend to become lists of what researchers would like to know, and not necessarily need to know. Thus, a key question when developing indicators is who identifies the indicators. Some previous researches suggest that external and internal actors may identify the indicators. External actors can be project researchers, and internal actors can be the chain actors or stakeholders themselves. The latter group would include farmers, households, communities, and local agencies, such as NGO's. The ideal is that the set of indicators may be agreed upon by both researchers and community members (RIGBY, HOWLETT, and WOODHOUSE, 2000). Regarding the number of indicators, it is essential to keep the actual number of indicators to

the minimum sufficient that is also capable of reflecting the different dimensions of sustainability (RIGBY, HOWLETT, and WOODHOUSE, 2000).

### **2.5 - Monitoring the information**

Time is also a key issue to be considered when developing sustainability indicators. The question is whether indicators are to be constructed and monitored between sites at a single point in time, monitored over time, or both. Ideally, indicators of both types should be measured because it is fundamental to know what have changed (RIGBY, HOWLETT, and WOODHOUSE, 2000). With a focus on farming level this requires an understanding of what has happened to the biophysical environment; how have people's perceptions, management and livelihood strategies changed; how have policies and institutions changed; and how have these affected each other? However, monitoring over time is more problematic, as information from external sources is generally required.

The determination of trends over time can be done using two alternative sources of information. The first possibility is to use secondary historical sources as a point of comparison and possible trending. This includes public records, resource surveys, aerial photographs and satellite images, farmers' and extension agents' own knowledge, past academic studies, among others. If these secondary sources consist of only a one-off observation then any trends inferred can only be linear and used with some caution. In addition, great care must be taken when using such secondary sources since "data from different sources often have slightly different definitions, even when supposedly describing the same thing". In addition, "different data items from different data sources are often reported for different spatial...frames and scales, making their collation and combination difficult" (MOXEY, 1998). The second type of source is the biophysical information from sites, which were previously of a similar type to other study sites, but have been cultivated or otherwise used in a different manner over a recent, known time-period. In this way measurements taken at the same moment in time can be treated as observations at differing time points. In this way, a baseline site can be paired with other sites.

In sum, sustainability indicators should provide both the chain actors and its outsiders with an accurate reproduction of reality. Thus, the development and the monitoring of a set of indicators may be more effective if these measures regarding the characteristics and quality of the indicators are taken into account before developing the indicators.

### **3 - Methodology**

The method presented in this paper was tested in the organic coffee chain in Brazil, more specifically at production and processing stages. A case study design was used to test the analytical approach in a real-life situation. The case method takes a holistic perspective on real life events with all of their potentially rich and meaningful characteristics intact, facilitates the exploration of complex social processes (Barton, 1990). Eisenhardt (1989) pointed out that case study is a research strategy, which focuses on understanding the dynamics present within single settings. This case study focuses on the existent organic coffee growers and processing plants from Minas Gerais State, where we find the largest production of Brazilian Organic Coffee. In total, we interviewed 23 individuals among organic coffee growers, cooperatives, roaster industry, certification body, exporters, government, researchers, and NGO's. The respondents were selected based on their importance in the supply chain. The majority of the people interviewed are either recognized leaders or key participants in the ongoing work to promote sustainable coffee in principle and in practice. We selected the most important growers' associations, certification bodies, processing plants, among others actors of the organic coffee chain in Brazil.

A semi-structured questionnaire based on the indicators was applied with growers and processing plants. The respondents identified the indicators that are relevant for the Brazilian case and they included some indicators based on their practical experience. The indicators are presented according to the respondents' perception. Some indicators were not selected because they did not show any relevancy for the growers and processing plants that were interviewed. In general, there was a common perception about which indicators are relevant to assess organic coffee sustainability for growers and for processing plants. However, some indicators were pointed by only one respondent as being relevant. In this case, as the respondent is the eldest organic coffee grower, the indicators were selected because in the future they can be relevant for other growers. In the case of the processing plants, the individuals interviewed presented similar perception about the relevancy of the proposed indicators. Sometimes, they only suggested changes in some words but the objective of the indicators were preserved.

Secondary data to complement the research were gathered from magazines, books, scientific journals, and report from the government and other research institutes.

#### **4 – A Method to Develop Sustainability Indicators for Agri-Chains**

The method to develop sustainability indicators described in this paper has been based on the review of current practices in indicators' development and consultation with the chain actors.

The method is composed of four stages:

a) *Literature review* on specific chain and sustainability indicators. In order to develop indicators for a specific chain it is important to delimitate the chain that is being studied and to analyze the negative and positive impacts of the chain regarding social, environmental and economic dimensions of sustainability. The review of existing researches on indicators undertaken worldwide could provide information on the range of existing approaches, on indicators that can be applied to agri-chains. In other words, through literature reviews it is possible to capture information about the scope of issues to be considered. Some initiatives such as the World Bank Indicators, the indicators to assess sustainability within K2 from FAO (United Nations Food and Agriculture Organization), the environmental indicators of World Resource Institute (WRI), the World Bank indicators, the European Environmental Agency (EEA) indicators, among others, present essential information that can be used to develop a set of sustainability indicators for a specific chain.

b) *Preparation of a check-list* with a set of indicators. The first step in order to have a checklist with social, environmental and economic dimensions is to develop a group of categories. The categories represent the aspects of the environment, of the social and economic arena related to agri-chains activities that influence the sustainability, in a positive or negative way. Each group represents the information that should be monitored in each dimension. The development of categories can facilitate the selection of indicators that will be tested. It is important, at this point, to focus on categories that can be applied for agri-chains in general. Some categories used in previous studies are presented in table 1.

Table 1: Categories of indicators for economic, ecological and social dimensions

ECONOMIC DIMENSION	SOCIAL DIMENSION	ENVIRONMENTAL DIMENSION
<p><b>Market Conditions</b></p> <p>Community Development Demand Commercialization Impacts on Stakeholders Export Ability Financial Support</p> <p><b>Business Economic Performance</b></p> <p>Productivity Income Benefits Costs Distribution Product and Process Innovation Quality</p>	<p><b>Sustainable Livelihood</b></p> <p>Labor Practices Education and training Participation and equity Human Rights</p>	<p><b>Ecosystem and Wildlife Conservation</b></p> <p>Ecosystem and Species <b>Air</b> Climate Change Ozone Layer Depletion Air Quality</p> <p><b>Water Conservation and Protection</b></p> <p>Water Quantity Water Quality</p> <p><b>Energy Conservation</b></p> <p>Energy Use</p> <p><b>Waste Management</b></p> <p>Waste Production and Management</p> <p><b>Soil Conservation</b></p> <p>Uses of soil Inputs Soil Quality</p> <p><b>Pest and Disease Management</b></p> <p>Chemical Use: fertilizers and pesticides Employees' Health and Safety</p> <p><b>Environmental Performance</b></p> <p>Environmental Management System</p>

Source: adapted from Claro e Claro, 2004.

After that, some indicators for each category can be selected from literature review. It is important to have a list of indicators instead of a small number of indicators because they can miss valuable information. Some indicators should be designed to serve for several chains. It is important in order to allow for comparisons between chains, so they should be more general, such as monthly income. This means that a certain degree of standardization is required. However, other indicators are more chain specific, especially environmental indicators. It is also important to develop indicators based on information that are available and that are accurate. It is advisable to start with simple indicators based on existing, easily collectable data (e.g. use of agrochemicals, energy use, lost workdays), which may be extended with more sophisticated measures overtime. It is also important to develop indicators that are understandable in that they are clear, simple, and unambiguous. Another characteristic is that the set of indicators should be realizable within the capacities of the actors involved given their logistic, time, technical and other constraints, because they will have to use it as a management tool to move towards sustainability.

c) *Chain actors' analysis* in order to check the relevancy of the indicators. Chain actors' analysis can be defined as an approach for understanding a supply chain by identifying the key actors in the chain, and assessing their respective interests in that supply chain.

Chain actor analysis can be compared with stakeholder analysis. The difference is that in the stakeholder analysis the focus is on the organization and its holders while in the chain actors' analysis the focus is on the supply chain and its actors. Chain actors include all those who affect, and are affected by policies, decisions, and actions of the whole supply chain. The actors can be individuals, organizations, communities, social groups or institutions of any size, aggregation or level in society. According to Elzen (2002) "*they are all actors who are seen to be capable of having a substantial influence on the chain's economic and social position*".

The two general key objectives of a chain actor analysis are, according to Grimble et al. (1995): (1) improve the effectiveness of policies and projects on the ground, by explicitly

considering actors' interests and the challenges they may present, identifying and dealing with (before they arise) conflicts over natural resources between stakeholder groups, and considering the potential for cooperation and compromise; and (2) to better address the distributional and social impacts of policies and projects by breaking down the analysis to assess separately the interests of, and impacts of intervention on, different actors.

Consideration is also given to trade-offs between different policy objectives and priorities (in particular between environmental, economic and equity considerations). The results of the chain actors' analysis can be used to make changes in the coordination of the chain, to decrease the differences between the actors. These changes could make the coffee chain sustainable and can bring better opportunities for all actors involved. In addition, the results of the chain actor's analysis can be used for policy purposes as well as for the evaluation of consumer wishes regarding sustainable products. The importance of the chain actors' analysis regards the consistency of the indicators because they will be selected by actors based on their relevancy for that specific chain. It is important in order to capture the perception of the chain actors' about environmental, economic and social impacts of the chain activities.

The actors should be asked about the applicability of the indicators of the check-list previously selected by the researcher. Actors should be encouraged to include or exclude indicators from the test list depending on the particularities of the stage being studied. Such technique is essential to guarantee that the indicators will reflect the reality of the stage being studied. This also motivates the use of the indicators by the actors, once they perceive that participation is important for a good performance towards sustainability. The result of the chain actors' analysis is the final list of indicators.

At this point, it is important to characterize the indicators according to a frame that is capable of showing the interrelationship among the indicators. The Driving Force-State-Response (DSR) is a framework that interrelates the information about the indicators.

A **Driving Force** indicator encompasses human activities, processes and patterns that impact on sustainable development. **State** indicators refer to the state of sustainable development while **Response** indicators highlight policy options and other responses to changes in the state of sustainable development. The framework is illustrated below (figure 1).

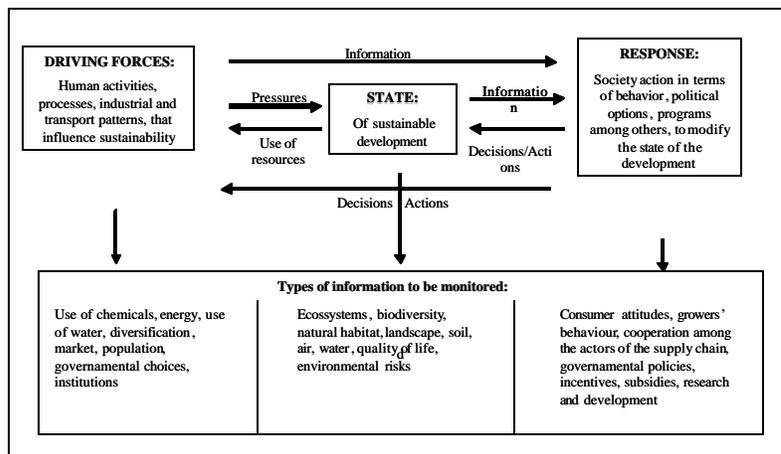


Figure 1: Driving Force-State-Response Framework

Source: adapted from the United Nations (1998).

The use of the DSR framework does not mean that it is possible, at this stage, to identify any causal relationships between Driving Force, State and Response indicators. Rather it should be seen as a way of categorizing indicators to fit the needs of users after some experience with collecting data on indicators (UNSD, 2002). Nevertheless, as time series data are collected, and analyzed, patterns and relationships that highlight connections and interactions among indicators may emerge. Experience may also show that some indicators tell us nothing about progress towards sustainable development and these indicators will need to be discarded and others tried out. It is a process of trial and error, of testing and retesting until a set of indicators is available that can more accurately measure progress along the road to sustainable development. It involves successive approximation both in terms of being able to define what constitutes sustainable development in a given context as well as developing the analytical skills needed to measure progress towards it. It will eventually involve moving from linear to dynamic models of sustainable development.

d) *Implementation of a pilot* to obtain information about the indicators in order to evaluate the sustainability of the agri-chain. The information about the indicators can be collected in different times and it will show what is changing in terms of environmental, economic and social aspects. It can show what has happened to the biophysical environment, how people's perception and livelihoods strategies changed, how policies and institutions changed, and how have these changes affected each other.

This type of research is characterized as longitudinal (MALHOTRA, 1999). A fixed sample of population elements is measured repeatedly providing a picture that give an in-depth view of the situation and the changes that take place over time. Often, the term panel is used interchangeably with the term longitudinal research. Panel consists of a sample of respondents, generally households that have agreed to provide information at specific interval over an extended period (MALHOTRA, 1999).

We suggest that in the follow up research the lists of indicators should be implemented in different times with chain actors to monitor whether or not the changes that are happening is leading them towards sustainability in all three dimensions. Generally, improvements (a positive trend or change) in the indicators will indicate reduced environmental stress from chain stages, and better "quality of life" for the chain actors. Declines (negative trends or change) in the indicators will indicate the reverse. We suggest, based on case study with coffee chain, the collection of data in an initial time ( $t_0$ ). The second data collection can take place after one year ( $t_1$ ), and so on. Depending on the objectives of using the indicators these intervals can expand or diminish.

The data collection on the indicators will allow the assessment of sustainability within the actors involved in the project. It will be possible to assess the state of the indicators, the changes in human activities, the changes in process and patterns that impact on sustainable development, and the policy options and other responses to the changes. It can show whether or not the decisions of the chain actors regarding production processes, marketing strategies, among others, influences the performance of whole chain in the achievement of environmental, economic, and social sustainability.

## **5 – The Experience in Developing Indicators for Agri-Chains**

Developing indicators is not an easy task. It involves different disciplines, people, priorities and experiences. Based on the experience of developing indicators for coffee chain in Brazil, we could observe that one of the most important things is the integration of the dimensions of sustainability in order to get information that can be transformed in knowledge and then be used to make changes towards sustainability.

It is important to understand agribusiness activities from an environmental perspective in terms of nutrient and energy dynamics, and interactions among plants, animals, insects and other organisms in agro ecosystems and then balance it with profit, quality of life, community and consumer needs. For instance, a positive change in the farm income can affect positively the housing conditions of the family of the grower or/and can affect positively the adoption of strategies to conserve forests. Once the income increases, growers will have more money to invest or to spend with basic goods, influencing then the social and environmental sustainability. Based on this, the Driving Force-State-Response framework is a good choice because it makes possible to visualize the interrelationship among the indicators and information they represent.

Although, it is important to develop indicators for all stages in a chain, the experience with the coffee chain has showed that it is important to define, in a first moment, the most critical stages of the chain, in terms of social, economic and environmental impacts of production processes, due to a lack of time and financial limitations.

## **6 – Conclusio ns**

The new paradigm of sustainability has changed profoundly the way companies operate. The changes in processes should be monitored and communicated to all stakeholders in order to show the improvements or deterioration towards sustainability. Collecting data on sustainability using indicators can allow the assessment of the state of the environment, the changes in human activities, the changes in process and patterns that impact on sustainable development, and the policy options and other responses to the changes.

Moreover, sustainability indicators can be used as a base to build up a code of conduct linked to sustainability for agri-chains. Such a code would establish environmental, social, and economic guidelines for chain actors in order to achieve sustainability. Public concerns have given rise to various voluntary codes of conduct for corporate social and environmental responsibility. These codes are becoming important levelers of corporate activity and provide useful guidelines for social reporting. Examples include the Amnesty International Principles for International Business, the SA8000 and AA1000 Accreditation Scheme, the World Bank's Environmental Guidelines and Participation Handbook and the International Chamber of Commerce's Business Charter for Sustainability. Voluntary codes of conduct exist at the sector level also – for example, the mining sector has the International Council on Mining and Metals (formerly the International Council on Metals and the Environment). It was established in October 2001 with a focus of providing sustainable development leadership for the mining industry and promoting the uptake of best practice standards.

Sustainability is part and not apart of the business administration today. Being so, there is no doubt that sustainability indicators are new instruments of business activities and can become in future, a limitation to progress and survival of the company in the market. Thus, developing the indicators to be used is an essential task not only for police-makers and researchers but also to managers. As sustainability is a multidisciplinary concept the method used to develop indicators should integrate social, economic and environmental dimensions. Moreover, the manager or researcher developing the indicators should take into account the information and knowledge of people involved in the productive process. Such an attitude can reflect the reality as it is, and can influence positively the use of indicators by agribusiness companies.

The method proposed by this paper to develop sustainability indicators was tested in a research of the coffee chain in Brazil but it could be used by agri-chains in general. Although, there is space for creativity and flexibility to adjust the different scenarios, we identified some critical success factors in developing indicators. First, the development of the list should be based in indicators that are relevant for a specific country and specific critical stage of an agri-

chain in terms of environmental, economic, and social dimensions. Second, they should be conceptually well founded and understandable in that they are clear, simple, and unambiguous. The validity of this method resides on the fact that multiple sources of evidence were used in order to establish a chain of evidence. The possibility of using the result of the case study, the list of indicators, with other chains or countries also contributes positively to the validity of the case.

We suggest regional workshops and capacity-building programs in order to facilitate the use of the method. Moreover, testing of the method in three to four different chains and stages could be performed to gain experience and further developing the method.

Finally, we recommend future work to elaborate more on critical success factors that should be taken into account in the development of sustainability indicators.

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