Global Assessment of Biomass and Bioproduct Impacts on Socio-economics and Sustainability

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Global-Bio-Pact set of selected socio-economic sustainability criteria and indicators

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Authors: Rocio A Diaz-Chavez, Imperial College London, United Kingdom

Nils Rettenmaier, ifeu – Institut für Energie- und Umweltforschung Heidelberg GmbH, Germany

Dominik Rutz, WIP Renewable Energies, Germany

Rainer Janssen, WIP Renewable Energies, Germany

In collaboration with::

Anni Anni Vuohelainen and Isaac Abban-Mensah from Proforest and the Global-Bio-Pact consortium.

Editor: Rocio A Diaz-Chavez
Imperial College London Centre for Environmental Policy

Contact: Rocio Diaz-Chavez – Imperial College London Centre for Environmental Policy
E-mail: r.diaz-chavez@imperial.ac.uk, Tel: +44 20 75949338
14 Princess Gate South Kensington London
SW7 1NA London, UK

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Abbreviations

C	Community
EAP	Economically Active Population
GBEP	Global Bioenergy Partnership
GDP	Gross domestic product
GHG	Greenhouse gases
G	Government
N	Non-Governmental Organisation
OECD	Organisation for Economic Co-Operation and Development
OSH	Occupational Safety & Health
P	Processing company or plantation
Sis	Sustainability Indicators
UN	United Nations
W	Worker
WTO	World Tourism Organisation

1 Preface

Many efforts for the development of sustainability schemes dedicated or related to bioenergy crops have focused on environmental impacts, such as deforestation, biodiversity loss, water availability and quality, soils, and greenhouse gas (GHG) emissions. However, it is known that the increased use of biomass for biofuels and bioproducts may produce conflicts as well as synergies between socio-economic and environmental impacts, especially in developing countries. Some standards in the agro-forestry commodity sector do include social and economic considerations, although the majority are not bioenergy focused.

The main objective of the EU funded Global-Bio-Pact project is to develop and harmonise global sustainability certification systems for biomass production, conversion systems and trade. To achieve this, the project assesses existing sustainability initiatives as well as those being developed, along with certification schemes that focus on social and economic criteria.

This report presents a “Global-Bio-Pact set of selected socioeconomic sustainability criteria and indicators” synthesized and used for the consideration of inclusion into a European/International certification scheme. This set was produced using the socio-economic sustainability criteria and indicators of previous tasks of the Global-Bio-Pact project. Input was gained from the Global-bio-Pact case studies as well as from dedicated reports on the link between socio-economic and environmental impacts and on existing socio-economic principles, criteria and indicators. All reports are available at the Global-Bio-Pact website.

This set includes criteria and indicators for both, biomass production and conversion chains in order to cover the whole biomass/biofuel/bioproduct life cycle. It shows opportunities and limitations of the inclusion of socio-economic criteria in a European/International certification scheme, especially with respect to some opportunities for small and large companies and with respect to international trade.

2 Introduction

Despite extensive work in the last twenty years on selecting indicators, there is no international consensus on the concepts, theory and methodology for the use and application of indicators. Most experiences have a national or regional focus. Nevertheless, international agreements, such as the Rio Summit, have lead to a generalisation of the use of sustainability indicators, on economic, social and environmental issues (Diaz-Chavez, 2003).

Since the Rio Summit (1992), many initiatives have been undertaken to promote sustainable development and to measure progress towards it. Indicators are useful tools to gain insight into the progress towards achieving sustainable development. Chapter 40 of Agenda 21, for instance, calls for the development of indicators for sustainable development. In particular, it requests that countries at the national level, and international governmental and nongovernmental organizations at the international level develop indicators (UN, 1992). Since then, several meetings have been convened to discuss indicators, such as the meeting in 1994, when the Organisation for Economic Cooperation and Development (OECD) published the "Core Set" of environmental Indicators. In that same year, the World Bank organized a workshop to establish a framework for sustainable development indicators (Diaz-Chavez, 2003).

Indicators have since gained greater importance and have been used for a wide range of purposes (Siniscalo, 2000). They can be used in monitoring to examine trends, that is, in helping to determine rises and falls of a particular condition; they are also useful in identifying challenges, which may require additional resources. However, it is important to remember that indicators and indices1 are only useful, regardless of how carefully chosen, in describing or helping to describe a situation. They do not explain why that situation exists

Indicators and indices are useful for monitoring and examining trends, and changes in a particular process. International and national institutions (e.g. GBEP, 2011; OECD, 2000a, b; UN, 2007) have been using indicators to assess the regional and national performance and development on a number of dimensions, such as income, education, health and welfare (Diaz-Chavez, 2006).

Sustainability indicators can be useful in showing the interconnections between changes in the economy, the environment and society. Their primary function lies in simplification: indicators are a compromise between scientific accuracy and the demand for concise information. Undoubtedly, the applicability of indicators at the local level and under particular conditions is crucial in helping both the public and decision-makers identify and solve problems that hinder the achievement of sustainable development (Diaz-Chavez, 2003).

Most of the attention paid to indicators has focused on environmental issues, as it is the case of environmental indicators, which have been used for ecological purposes for quite some time (e.g. water quality indicators). Less attention has been paid to social and economic indicators (Diaz-Chavez, 2006).

With the growing interest on biomass and co-products for biofuels and bioenergy, the need for standards, as regards sustainability concerns, has become more evident. This means that it needs to be ensured that any particular production system is environmentally, socially and economically sustainable. It should furthermore contribute to the reduction of greenhouse gases (GHG), not create negative impacts (environmental and socio-economic); and contribute to positive social impacts.

In the discussion on sustainability indicators, important terms are often used interchangeably, although there is often conflation. In this report, the following definitions are used.

[1] an index or an aggregated indicator combines values which are expressed as a single value

- A ‘**standard’** refers to a set of principles and criteria to be used consistently as rules, guidelines, or definitions of characteristics to ensure that materials, products, processes and services meet their purpose. The ‘standard’ will also define indicators and methods that are used to measure compliance with principles and criteria.
- ‘**Principles’** are defined as ‘general tenets of sustainable production’
- ‘**Criteria’** are ‘Conditions to be met to achieve these tenets’ and which help to define the indicators to be answered.
- ‘**Indicators’** are the individual questions that show how a farm, producer or company could prove that a particular criterion is met. (Woods and Diaz-Chavez, 2008).
- An ‘**Index’** is a composite indicator is formed when individual indicators are compiles into a single index, on the basis of an underlying model of the multi-dimensional concept that is being measured (OECD, 2012)2

The main purpose of this report is to present the selected set of Global-Bio-Pact indicators to measure socio-economic impacts of bioenergy and bioproduct projects.

2.1 Overview on the use of of indicators

Social impacts tend to be more difficult to monitor and quantify as they require more in-depth studies, normally household surveys, which are time consuming and expensive. Therefore, the implementation of standards might provide an effective link between organisations that are already monitoring impacts and certifying activities. Nevertheless, a key difficulty is that the monitoring refers more to compliance than to the actual impacts.

A further issue is the need to consider the interactions between the environmental and socio-economic indicators when examining impacts (for instance, the link between the use of water for the feedstock production and the use of water by the community). Further examples about this issue can be found in the Global-Bio-Pact “Report on show cases and linkage of environmental impacts to socio-economic impacts” (D5.3).

International and national institutions have been using indicators to assess the regional and national performance and development: income, education, health and welfare. Table 1 provides some examples of socio-economic indicators.

Table 1: Selected social indicators (modified from Jannuzzi, 2001)

Theme	Indicator
Demographic and health	Born rate Demographic increase rate Child mortality rate Life expectancy at birth Rate of death per causes Morbidity and health attendance Under nutrition Malnutrition rate

[2] http://stats.oecd.org/glossary/detail.asp?ID=6278

Theme	Indicator
Educational and cultural	Illiteracy rate Average schooling Information and culture access
Employment (Labour market)	Participation rate (EAP and non-EAP) Unemployment rate Average income
Income and poverty	GDP per capita Average familiar income Gini Index Theil Index Poverty rate
Housing and urban infrastructure	House condition Urban services accessibility Transport infrastructure
Quality of life and Environment	Satisfaction with house, neighbourhood, city and basic infrastructure Crime and homicides Time allocation Environment (air condition, water, waste treatment, garbage collection)
Development	Human Development Index

Socio-economic indicators are used for statistics to analyse a particular social phenomenon or society as whole. They are useful to:

- monitor developments over a period of time (against a baseline)
- be considered along a standard or certification scheme
- employ with qualitative and quantitative data
- apply on a supply chain (feedstock production and conversion)
- employ with certification schemes

Given the diversity of environmental problems and of projects, either causing them or designed to address them, arriving at a set of "universal" indicators (e.g. applicable to all situations) is not feasible. Nor is it practical to develop an exhaustive list of all possible indicators.

Indicators are expressed in real values, or they can be expressed in binary units such as zero or one. This mode is often used to depict the presence or absence of a circumstance or event. Often, several indicators are used together. When their combined values are expressed as a single value, these indicators are said to form an index or an aggregated indicator. Indices can be complicated by ascribing (or not), weights to their components (Webber and Alexander, 1997).

Quantitative indicators are useful as they may provide additional information rather than just the state of the environment (Segnestam, 1999). Information that can be collected and presented as a ratio or percentage is of more value than presenting absolute numbers in isolation. Once an indicator or an index is chosen for use, the methods used to collect, examine or disseminate information must be considered. Seasonality is also important as they can show trends and changes over time. Other important factors include the ability to set targets for an indicator or an index, and the ability to intervene. Targets may be long or short-term (Webber and Alexander, 1997).

The measurability of indicators is actually placed along a continuum, from indicators which cannot be measured at all, to those which would be measurable if the organization had more resources, through to indicators where the process is of measurement itself. In other words, some components may be of more importance than others and should therefore be weighted more heavily (Hart, 1999). However, it is extremely difficult to determine a weighting which is reliable and valid (Webber and Alexander, 1997).

2.2 Indicators and Sustainable Development

During the last decade sustainability and sustainable development have become catchwords. The definition of sustainability is elusive. In general, there is a greater focus on economic and/or environmental components than on social and cultural aspects. Agenda 21 (UN, 2012) considers the functions of indicators to provide solid bases for decision making at all levels and to contribute to a self-regulating sustainability of integrated environment and development systems. A sustainability indicator can serve thus as a tool to infer the capacity of the local environment and the biosphere to sustain human activities over a long period.

Following the article 40 of Agenda 21[3], Saldívar et al. (1998) state that life quality, education and the participatory process of civil society are among key principles of Sustainable Development. These principles are useful in the planning process including public participation. However, to achieve this in the medium term local government must assume this as a primary objective (Saldívar, 1998).

There exist two types of initiatives in the development and application of Sustainability Indicators (SIs), one where institutions deliver the development (institutional sustainability) and those where community participation is the bedrock (Bell and Morse, 1999). In this last case, sustainable community indicators link the long term economic, social, and environmental health of a community. As with any indicator, community SIs should be relevant, understandable, reliable and timely (Hart, 1999).

2.3 Choosing an appropriate indicator

No universal set of indicators exists which would be equally applicable in all cases (Segnestam, 1999). The value of an indicator relies on the quality of the data it contains. Therefore, the indicatormust be carefully selected. It should also be remembered that they provide a tool for evaluations and need to be supported by quantitative, qualitative and scientific information. The applicable criteria will change according to the objectives pursued. Different authors recommend specific considerations, according to what indicators should contain, their technical requirements and the characteristics of the data used (Avérous, 1997; INE, 1997; OECD, 1998).

The selection must be based on sound criteria and not on subjective appeal. Even though some factors such as availability of information, or human and economic resources for collecting data may influence the selection, it must not be the only reason. It is necessary to use real data, available data or easily calculated data (Webber and Alexander, 1997). Some authors suggest different factors to consider during the selection of the indicators (Avérous,

[3] Re-affirmed at the United Nations Conference on Sustainable Development in the Rio +20 meeting in the document called "The Future We Want.

1997; Webber and Alexander, 1997; OECD, 1998; Hart, 1999; Segnestam, 1999). These factors are summarised in Table 2.

Table 2: Synthesis of factors to consider when selecting indicators. Source: Diaz-Chavez, 2003

Factors	Description
Reliability and quality	The accuracy of the data; a measure of the information collected. Based on theory and science when possible.
Validity	Whether the indicator truly measures what it is supposed to measure
Realistic and practical	The collection of the data or information should be accurate and easily collectable, assuming the costs of collection.
Spatial and temporality	Consider temporal and spatial scale as well as changes over time
Simplicity and clarity	Clarity in design and simple in format; understandable for any person
Comparability	To allow comparisons at the adequate level
Consensus	Among different actors (local, national, international, sound groups)
Measurability	According to the data they are interpreting (qualitative/quantitative)
Reviewed	Considerations to update the information
Limitation and balance	In number. Extensive sets of indicators are not in use any more. They should be short in number and balanced in the three dimensions of sustainability.
Links	To show casual links among indicators or relevant data (even processes) and to strengthen links among institutions.
Relevance	Direct relevance to the goal or objectives of the set of indicators
Cost/benefit	To show a relationship

One criteria that must always be born in mind is that the ideal indicator does not exist. When selecting data for indicators, a second-best proxy is often used to develop an indicator a practice that which is thought to be sufficient (Segnestam, 1999).

After selecting and measuring indicators, it is still necessary to interpret them. The absolute level of the indicator can serve as a diagnostic tool and be compared with future trends. In some cases control groups can be used to measure conditions in areas not affected by the project or the activity. In others, modelling techniques should be used to predict what would have happened without the project.

There is also interest in reduced and balanced sets of indicators that provide signals on key dimensions of sustainable development to policy-makers and the general public. Sets of indicators reflecting key trends and policy variables are useful to respond to common policy goals and to demands for simplified indicators lists. Core sets are useful for comparisons and can be adapted for different purposes, ranging from tracking performance against plans to budgetary information (Siniscalo, 2000).

2.4 Use and challenges of indicators

Considering that indicators are intended for use at the national level by countries in their decision-making processes, not all of the indicators will be applicable in every situation. It is understood that countries will choose to use from among the potential indicators those which are relevant to national priorities, goals and targets organisations (UN, 1992).

The problems and limitations with indicators are that some are just parameters; methodology still has to be refined to better reflect sustainable development; there are almost no indicators which might relate environment, social, economic and institutional aspects (Hens, 1996). Also, most indicators are quantitative measures. Environmental and social indicators are often not suited to economic evaluation. The value of ecological functions is most of the time underestimated in traditional economic and accounting models. For this reason, indicators of sustainability are not always quantifiable and sometimes are also subjective (WTO, 1996).

Briassoulis (2001) also points out that indicators are still needed for: several critical dimensions (especially social, cultural, institutional and political); the integration of all the dimensions of sustainability; transitions to sustainability; spatial horizontal and vertical relationships and to set targets.

In particular, indicators are needed to describe the social-environment interface, and to address issues of social sustainability. It is also recognised that there is still a gap between the demand for sustainable development indicators, the measurability of underlying data sets and the actual use of such indicators (Diaz-Chavez, 2011). The interactions between social and environmental dimensions are also complex and many of their links need to be studied. Environmental degradation causes negative social impacts (health and economics), further examples can be found in the report of D5.3 of the Global-Bio-Pact project. Equitability access to goods and policy instruments also have impacts on social issues (jobs, poverty). On the other hand, social conditions and behaviours may have environmental consequences. The economic and social relationships have been acknowledged. Nevertheless their links are difficult to establish (OECD, 2000).

Some authors reject the idea of a single holistic measure of environmental quality, and aggregate score, which can be compared between localities. It is important to reduce the vast flow of information that this integration implies to a manageable level that does not disguise the complexity of the processes and their interaction. They support the development and use of a set of indicators to monitor changes in environmental quality at both regional and local level. Participation of community and their responsibility in the processes remains a weak link (Jenkins and Midmore, 1999).

3 Methodology for the development of the indicators set

The methodology followed for the Global-Bio-Pact selection of indicators included a series of activities with partners of the project and with other relevant activities with external stakeholders. Figure 1 shows the general methodology that was followed for the selection of indicators.

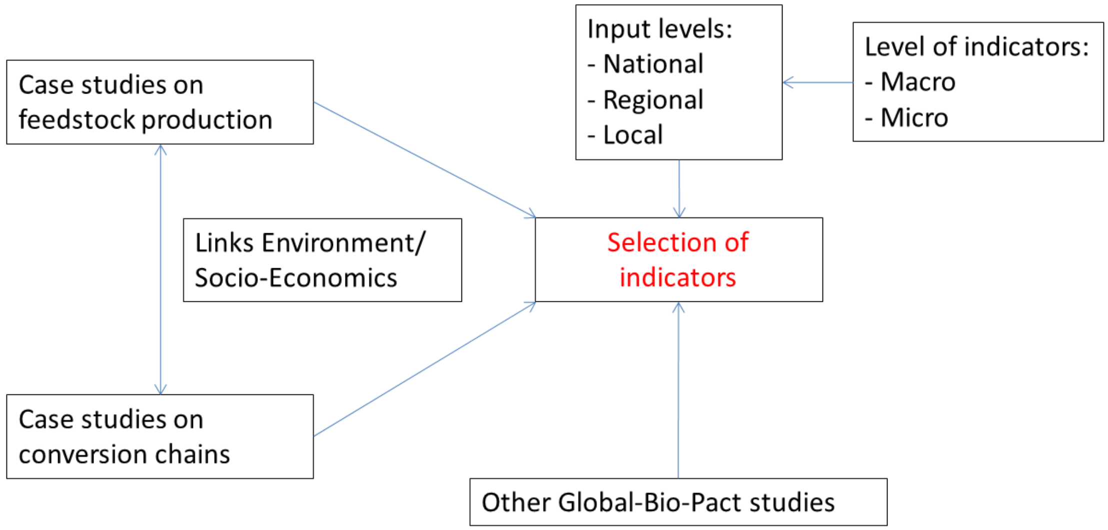

Figure 1: General methodology in the Global-Bio-Pact followed for the selection of indicators.

The general steps followed included:

- Benchmarking of standards for environmental and social indicators
- Identification of impacts mentioned in selected Global-Bio-Pact case studies
- Identification of socio-economic impacts in supply chains
- Links between environmental and social impacts
- Macro and micro indicators in the case studies

Benchmarking with other certification, standards and verification systems through two reports included as Global-Bio-Pact reports on "Assessment of existing socioeconomic principles, criteria and indicators for biomass production and conversion" and "General Environmental Impacts, principles, criteria and indicators of biomass production and conversion"[4]. The benchmarking was conducted in order to review environmental and socio-economic indicators in available sustainability standards related to biofuel production in the agricultural and the forestry sector. Other initiatives such as the Global Bioenergy Partnership (GBEP) were also reviewed.

The standards have been written as normative documents for auditing compliance of plantations and forests, and therefore the Principles, Criteria and Indicators are designed to be able to judge compliance. These are not monitoring frameworks for impacts of the operations, though the standards do require that monitoring is undertaken. In order to measure the impact of the operations, and how implementation of the sustainability standard may have specifically impacted environmental parameters, a different type of indicator is needed.

When considering the development of impact indicators as part of the Global-Bio-Pact project, there are two timescales to consider.

[4] http://www.globalbiopact.eu/index.php?option=com_content&view=article&id=74&Itemid=68

The first timescale is a comparison of before and after the plantation has been established (or harvesting, in the case of forestry). This allowed to compare the overall impact of the operations. The standards examined generally address the 'before' as a requirement to do an environmental impact assessment. However, it may not always be possible to undertake an EIA or similar baseline assessment for operations that have been long-established. In practice, it may be possible to use adjacent area for comparison, but this approach has not been addressed by the existing standards.

The second timescale at which impacts should be considered is through ongoing monitoring of the operations and their impacts. Ongoing monitoring is generally a requirement in the standards examined, however with the exception of the BSI/Bonsucro. The parameters which should be measured are not set out in detail. Where parameters are provided, these are not consistent between the standards.

Use of the sustainability standards examined can be a good proxy for measuring the impact, particularly as they do require monitoring and mitigation activities. However, this approach would not provide consistent parameters which could be compared between operations, including those not implementing a sustainability standard. Out of the standards assessed, only Bonsucro and the GBEP framework systematically provide measurement parameters.

These standards and systems are a useful starting point for developing impact indicators as they identify the important criteria and indicators for a variety of agriculture and forestry operations, and can be used as a framework for developing specific impact measurements for each of land use change, biodiversity, soil, water and air. It is important to note that, social issues are also seen in a different context between North and South. For instance, child labour concerns are not seen in the same context as long as children help out (not under exploitation circumstances) in family tasks in the farms and do not leave their studies.

3.1 Selection of principles, criteria and indicators

During the Global-Bio-Pact project a series of activities were conducted in order to achieve the principles, criteria and indicators that are incorporated in this set of indicators (Figure 2). These activities included:

- Set of a sustainability framework
- Benchmarking of current standards and systems related to bioenergy
- Pre-selection of criteria and indicators
- Workshop with partners of Global-Bio-Pact in London in February15-17, 2012 (Figure 3)
- Final selection of indicators
- Field test in Brazil and Argentina
- Sustainability Conference in Buenos Aires Argentina 2012

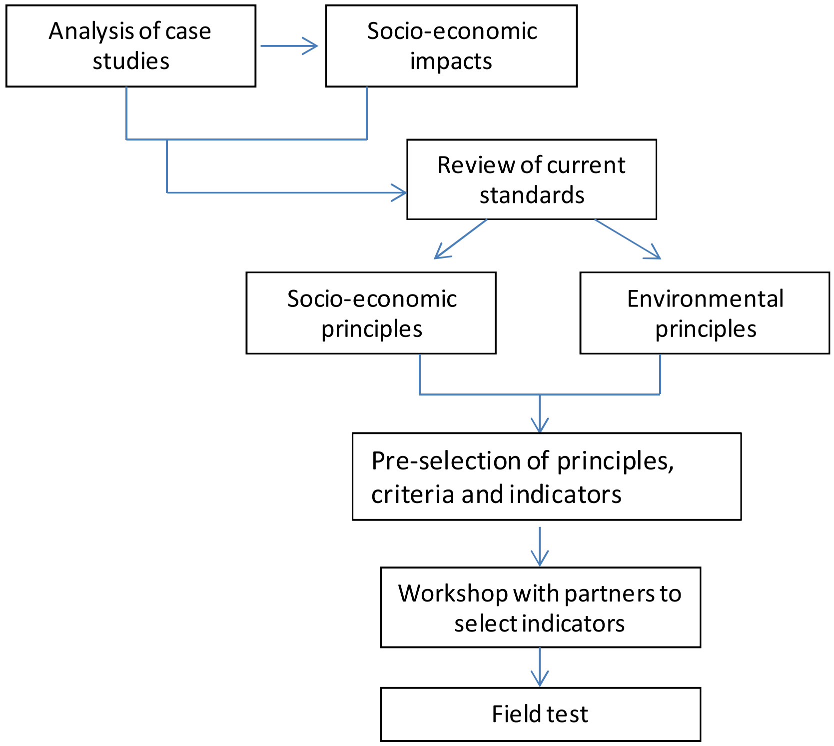

Figure 2 Steps followed for the selection of the criteria and indicators

Figure 3 Global-Bio-Pact workshop at Imperial College London, London 2012

3.2 Boundaries and usefulness

The criteria and indicators were selected within the Global-Bio-Pact project with the intention to provide a clear and balanced set.

It is not intended that this set will provide definitive criteria and indicators as the set does not attempt to be a certification or verification system in any form. Nevertheless, according to the methodology followed and the benchmarking review, it is expected that the set of indicators will be used by different stakeholders when considering:

- to initiate or assess a bioenergy proposal or project
- to assess the sustainability of a feasibility report for a bioenergy proposal or project
- to monitor impacts at the local and regional level
- to be used in addition to a standard

Finally, the set of indicators may differ under different frameworks, projects, experts, countries or any other stakeholders opinion.

3.3 Testing of Indicators

As with any set of indicators it is necessary to consider different factors for their relevance (see Table 2). Four characteristics were selected to assess the effectiveness of the indicators. These included:

- Measurability – how easy is to measure the impact
- Easiness to gather the data – how easy and cost-effective is to gather the data for the indicator
- Usefulness for assessing socio-economic impacts – if they really represent the assessment of the impact
- Temporality – what is the timeframe for the usefulness of the indicator including the data

The indicators were field-tested in two companies in Argentina and Brazil. The field tests were implemented in June/September 2012 in cooperation with the local Global-Bio-Pact partners Proforest, INTA and UNICAMP. Results of this field tests are described in a report on "*Audit report on testing the Global-Bio-Pact set of socio-economic sustainability criteria*" which is availabele at the Global-Bio-Pact website.

3.4 Selected Indicators

The indicators were selected considering they can measure an impact over a period of time. For this reason a baseline was suggested for the field test work.

The indicators were classified in background information, socio-economic indicators and environmental indicators:

- Basic Information: data that provides background information from the selected case study (Table 4)
- Socio-economic indicators: these include the impacts caused by bioenergy crops production and the different stages of the supply chain to produce biofuels (Table 5)

- Environmental indicators: in the project's context they refer to the environmental impacts that affect the socio-economic characteristics of the communities (Table 6)

Table 3 presents the main topics and impacts selected. The guideline explanation of the impact is included in the indicators list.

Table 3: Impacts and examples of indicators

Impact	Examples of indicators
Basic information	
Framework conditions	Location, average yield
Socio-Economic	
Contribution to local economy	Value added, employment
Working conditions and rights	Employment benefits
Health and safety	Work related accidents
Gender	Benefits
Land rights	Land rights and conflicts
Food security	Land converted from staple crops
Environmental	
Air	Open burning
Soil	Soil erosion
Water	Availability of water
Biodiversity	Conservation measures
Ecosystem Services	Access to ecosystem services

4 Set of the Global-Bio-Pact Impact Indicators

The impacts and indicators were selected through the process demonstrated in Figures 1 and 2. The set of indicators consists of basic Information (Table 4), socio-economic indicators (Table 5), and environmental indicators (Table 6).

Each indicator is linked to a measurement, monitoring process or unit depending of its nature. For instance, the "Average yield of the feedstock" is measured in t/ha/yr. The set includes furthermore guidance on how to measure or monitor the indicator. Furthermore it is indicated from where the data could be accessed:

- Processing company or plantation (P)
- Government (G)
- Community (C)

- Non-Governmental Organisation (N)
- Worker (W)

Table 4: Global-Bio-Pact set of impact indicators: 1 Basic information

No	Indicator	Measurement/ Monitoring Process/ Unit	Guidance	Data access
1.1	Name and location	Name and geographical location of the operation	Location map	P
1.2	Land area under cultivation	The total area of land cultivated by the operation (ha)	Breakdown of land under different feedstocks and under different tenure (own land, rented land, smallholders, outgrowers)	P
1.3	Expansion of land area	Additional land area under production (ha/year)	Additional land under feedstock production within the last 5 years. Previous land use of the land area.	P, G
1.4	Average yield	Average yield of the feedstock (t/ha/yr)	Annual average yields of the feedstock within the last 5 years	P
1.5	Annual production	Annual production of feedstock and subsequent products (t)	Annual production of the feedstock and the subsequent products and byproducts within the last 5 years	P
1.6	Certification	Is the operation certified? If so, which certification(s)?	Type of certificate	P, N
1.7	Sectorial associations	Is the operation involved in sectorial associations, if so which association(s)?	Registered membership of associations	P, N

Table 5: Global-Bio-Pact set of impact indicators: 2 Socio-economic indicators

No	Indicator	Measurement/ Monitoring Process/ Unit	Guidance	Data access
		Contribution to local economy		
2.1	Production cost	Breakdown of yearly production costs of the facility (incl. labour, raw material, energy, services, etc.) (EUR/t of feedstock)	Annual production costs within a 5-year period	P
2.2	Value added	Value added by the operation. Annual value of sales less the price of goods, raw materials (including energy) and services purchased. (EUR/t of feedstock)	Annual value added within a 5-year period	P
2.3	Taxes/royalties paid to the government	Breakdown of payments made to the government/year (EUR)	Payments made to the government per year within 5 years	P, G
2.4	Contributios made by the operation to allied industries in the local	Percentage of total production cost paid to contractors, suppliers per annum	Percentage of total production cost paid annually to contractors and suppliers of raw materials (excluding suppliers of feedstock) within a 5-year period	P

No	Indicator	Measurement/ Monitoring Process/ Unit	Guidance	Data access
	economy			
2.5	Involvement of smallholders or small suppliers	Percentage of feedstock that originates from associated smallholders and outgrowers	Percentage of feedstock that originates from associated smallholders outgrowers within a 5-year period. Number of associated smallholders or outgrowers.	P, C, W
2.6	Amount paid to smallholders and suppliers of feedstock	Annual amount paid to smallholders and suppliers of feedstock (EUR)	Annual value paid to associated smallholders and outgrowers per unit of product within a 5 year period.	P, C, W
2.7	Employment	Total number of employees and person days of employment per year	Total number of people employed each year and total number of person days per year within a 5 year period. Breakdown should be given for categories of employment for operation (management/office/processor/field labour, male/female, contract/no contract)	P, W
2.8	Ratio between local and migrant workers	Ratio of employment from local area / outside local area per category of employment (management/office/processor/ field labour)	Local area is defined as state or province (however, assessor can further adapt this to local context). Absolute annual number of workers per employment category (including temporary/ permanent) within a 5-year period	P, G
2.9	Percentage of permanent workers	Percentage of workers that have a fixed contract employment per category of employment	Annual percentage permanent vs. temporary workers within a 5-year period	P, G
2.10	Provision of worker training	Number of workers that have received training (for skills development, education etc.) each year, number of working days spent in training provided by the operation each year, type of training	Annual numbers should be given for a 5-year period	P, W
2.11	Community investment	Amount invested in community investment projects (e.g. CSR) (% of annual revenue) and qualitative description of investments including any projects specific for women	Annual values should be given for a 5-year period. This should be calculated as percentage of annual revenue.	P, C
		Working conditions and rights		
2.12	Employee income	Average income of employees by category of employment (EUR)	Annual average income per employment category for a five-year period	P, W
2.13	Employment benefits	Employment benefits (e.g. housing, health care, holidays) provided by operation (desctiption of benefits per	Breakdown of average benefits given per employment category. Distinction should be made between the benefits that are	P, W

No	Indicator	Measurement/ Monitoring Process/ Unit	Guidance	Data access
		employee per year)	mandated by law and those that are not.	
2.14	Income spent in basic needs	Percentage of worker disposable income (by category of employment) spent on fulfilling basic needs (food, accomodation and transport)	To be estimated based on average salary per employment category, amount spent in food per day, accomodation per month and transport per day	W, C
2.15	Hours of work	Average daily hours of work per employee per employment category (h)	Average daily working hours per category of employment. This should be verified from employment records and worker interviews with questions addressing number of working hours/day.	P, W
2.16	Freedom of association	Existence of labour unions	Existence of labour unions and whether workers have the right to join them. This should be verified by interviewing the management and the workers: Do workers belong to a union or other type of working association?	P, W, C
Health and safety				
2.17	Work related accidents and diseases	Number of work related accidents per person days of employment per year, number of work related diseases/ person days of employment per year	Records of any work-related accidents or diseases.	P, W
2.18	Personal protective equipment	Percentage of workers that use appropriate personal protective equipment	To be calculated as a percentage of sample in a site visit	P
2.19	OSH training	Percentage of employees that have received OSH (Occupational Safety & Health) training	Training records and worker interviews	P, W
Gender				
2.20	Benefits created for women	Employment benefits that are specific for women	List any employment benefits that are specific for women (i.e. maternity leave, others)	P, W
Land rights and conflicts				
2.21	Legal title of land right	Operation has a legal title/ concession for the land that is not challenged.	Document of legal title	P, G
2.22	Communal/ public land	Area of land cultivated by the operation that is customary, public or commmunity land (ha)	Report on public or commmunity land within the project which would affect people living from subsistence agricultures, nomades, etc. Cross-check this information with the land categories listed under 'basic information'	P, C (N)

No	Indicator	Measurement/ Monitoring Process/ Unit	Guidance	Data access
2.23	Land conflicts	Area of land currently under dispute, land conflict. (ha) Has the operation had any land use conflicts, if so, what caused them, how were they resolved?	Land area currently under dispute. Qualitative description of any current or previous land use conflicts. If they were resolved, how this happened.	P, C, G (N)
Food security				
2.24	Land that is converted from staple crops	Land that has been converted from staple crops (ha)	Hectares of land land that has been converted from staple crops to the feedstock production (assessor should define staple crops for the country) within the last five years	P, (G, N)
2.25	Edible feedstock diverted from food chain to bioenergy	Amount of edible raw material diverted into bioenergy production (t)	Annual amount of edible feedstock that was used in bioenergy production (5-year period)	P
2.26	Availability of food	Perceived change in availability of food after the beginning of bioenergy operations	Check (survey) at community level about perceived change	C, W
2.27	Time spent in subsistence agriculture	Change in time spent in subsistence agriculture in the household	Check (survey) at community level about perceived change	C, W

Table 6: Global-Bio-Pact set of impact indicators: 3 Environmental indicators

No	Indicator	Measurement/ Monitoring Process/ Unit	Guidance	Data access
Air				
3.1	Open burning on company level	Days open burning used in operations/year	Annual days open burning used in operations, 5-year period	P
3.2	Open burning area	Percentage of surface under open burning regime	% surface under open burning regime	P
3.3	Use of Best Available Technologies for reducing emissions	List of best available technologies in place	Review technologies used at company	P
Soil				
3.4	Implemented Practices	Percentage of surface under no or reduced tillage	Check practices on the fields	P
3.5		Fertiliser applied (type)(kg/ha/yr)	List types of fertilizer and the annual amounts applied per hectare (5-year period)	P
3.6		Herbicides and pesticides applied (type)(kg/ha/yr)	List types of fertilizer and the annual amounts applied per hectare (5-year period)	P
3.7	Soil Erosion	Feedstock cultivation area in flood prone region (ha)	Maps and data from company	P

3.8		Feedstock cultivation area in wind prone region (ha)	Maps and data from company	P
3.9		Feedstock cultivation area in slopes above 25° surface gradient	Maps and data from company	P
3.10		Implemented measures to control soil erosion	List measures implemented	P
3.11	Soil analysis	Frequency of carrying out soil analysis in the operation	How often is soil analysis carried out in the operation?	P
Water				
3.12	Water consumption (irrigation)	Net non-recycled water consumed through irrigation per unit mass of product (l/ton of feedstock)	Check water balances at the company level	P
3.13	Water Management Plan	Implementing a water management plan	Is there a water management plan, is it implemented?	P
3.14	Availability of water	Perceived change in availability of water by local communities (amount consumed)	Questions addressed to local community representatives, NGO or local authority	C, N, G
3.15	Quality of water	Perceived change in quality of water by local communities	Questions addressed to local community representatives, NGO or local authority	C, N, G
Biodiversity				
3.16	Reduction of biodiversity	Non-agricultural land or pasture that has been converted towards feedstock operation within a 5- year period (ha), type of previous vegetation of converted land	This can be check with the operation and cross checked with local or national authorities or environmental NGOs	P (G, N)
3.17	Impacts on fisheries/other aquatic fauna	Local perceptions on impacts on fisheries/other aquatic fauna	Questions addressed to local community representatives, NGO or local authority	C, N, G
3.18	Impacts on local fauna/flora perceived by community	Local perceptions on impacts on local fauna and flora	Questions addressed to local community, NGO or local authority	C, N, G
3.19	Conservation Measures	% of surface set-aside for conservation purposes	e.g. protected habitat, buffer zones, ecological corridors, riparian vegetation, etc.	P
Ecosystem services				
3.20	Access to ecosystem services	Reduction in local communities' access to hunting, fishing	Qualitative questions to local community representatives, and NGO(s)	C, N
3.21		Reduction in local communities' access to non-timber forest products	Qualitative questions to local community representatives, and NGO(s)	C, N
3.22		Reduction in local communities' access to cultural ecosystem services such as sacred and recreational sites	Qualitative questions to local community representatives, and NGO(s)	C, N

5 Conclusion

Any sustainability standard must include the three key components: economic, social and environmental aspects. Although, a political and institutional new pillar has to be included as many of the issues implied in sustainability are regarded of political nature (e.g. targets), see Diaz-Chavez, 2003).

Most of the research on standards work on a monitoring and compliance basis but few have indicators which can actually be monitored under quantitative or clear qualitative parameters. The set of indicators of the Global-Bio-Pact project objective was to be able to indicate the state of the impact and to be able to monitor it over time. It is expected that this indicators cna be useful for different users from project developers, government and standards.

The review of existing sustainability standards in the report on "Assessment of existing socioeconomic principles, criteria and indicators for biomass production and conversion" demonstrated that there is still a need to include other socio-economic indicators that can contribute to avoid some negative impacts of biofuel production.

The set of indicators proposed by the Global-Bio-Pact project in this report is balanced and includes the main topics of impacts selected by a clear process with the aid of expert partners of the project. Furthermore, the topics reflect the main identified socio-economic and environmental areas which can be measured in order to monitor and if possible to eliminate negative impacts and to promote the benefits if a sustainable production is in place.

We strongly consider that the use of these indicators will help the different users in promoting the sustainable production of biofuel production.

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