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Products**

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**Criteria and indicators developed
for conducting S-LCA social impact
assessment**

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Abstract

The objective of Deliverable 6.3 is to summarise the work performed in Task 6.3 regarding the selection of the most important impact subcategories for the social analysis of these products and the development of a specific methodology to measure them. In order to select the relevant impact subcategories to be included in the analysis, an extensive literature review was conducted (as part of Task 6.1), different workshops were organized (as part of Task 6.2) and questionnaires were distributed to stakeholders. Considering the final list of subcategories, a simple, flexible and practical methodology was developed and adapted to analyse the social performance of bio-products. As reflected in this report, the methodology considers the five categories of stakeholders: workers, consumers, local community, general society and value chain actors and uses quantitative, semi-quantitative and qualitative indicators. Finally, it provides a final score that embodies the overall social performance of the production of a specific bio-product.

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Executive summary

Within the context of environmental issues, such as climate change and resource depletion, the bioeconomy has become an important driver of today. In this framework, it is important to take into account the environmental, social and economic aspects to promote the production of bio-based products. This Deliverable 6.3 assesses criteria and indicators for conducting a social life cycle assessment (s-LCA). There are many methodologies to evaluate social impacts and, compared to social and economic tools, they are in a fledgling stage. In general, life cycle methodologies are considered an interesting tool to evaluate the social dimension of a product and considerable efforts were made to establish the principles and criteria of bio-based products, as well as the indicators to measure them.

A thorough literature review was assessed to gather important social environmental criteria and indicators, with the aim to filter the most relevant subcategories of bio-based products. This review considered important standards and projects for social assessment: GRI Standards, UNEP/SETAC Guidelines, JRC Technical report on S-LCA, PRé Sustainability Handbook and other European projects (i.e. Global-Bio-Pact project, Prosuite, S2Biom project, The BioSTEP project).

The subcategories are composed by social impact categories and stakeholder categories. The S-LCA classified the stakeholders into five main groups i) worker/employs, ii) local community, iii) society, iv) consumers and v) value chain actors. Therefore, a stakeholder analysis was performed to find attracted and relevant parties according to these aforementioned groups presented. It is important to keep in mind that stakeholders participate in different stages of the life cycle of a product. For example, the local community is involved in all stages of the life cycle, from the cultivation of raw materials to end-of-life, while consumers only in the use phase.

The production chain of bio-based products is not that straightforward, as it is a complex supply chain, involving multiple stakeholders around the world. Thus, finding social impact categories that encompasses all the processes is very difficult and a boundary must be determined. This study determined as rule that at least 75% of the final product mass and all contributions over 5% are covered.

As part of tasks 6.2 and deliverable D6.2, workshops with stakeholders identified 15 important impact subcategories for social assessment. Meanwhile this present study, as being part of task 6.3, designed a questionnaire to understand deeply the importance of these 15 subcategories ranking their importance from 1 (low importance) to 5 (high importance) vis-à-vis their suitability to measure the social aspect of bio-based products. The performance rules have also been identified with the aim of proposing conformity to bio-products.

The key considerations of this report can be summarized in Table 1.



Table 1. Overview of main findings

Topic	Main considerations
General information of respondents of the questionnaire (20 respondents)	53% males and 47% females; 16% under 30 years old, 74% between 30-49, and 11% between 50-69; 5% from farmer associations, 5% consumer associations, 5% local NGOs, 80% research institutes and 5% bio-based products producers; 45% had less than 5 years of experience, 18% between 5 and 9 years, 27 between 10 and 20 and 9% over 20 years
System boundary	This study determined as rule that at least 75% of the final product mass and all contributions over 5% are covered
Relation between stakeholders and impact categories	Each stakeholder has different impact categories: 1) Workers: child labour; forced labour; fair salary; equal opportunities/discrimination; and health and safety of workers. 2) Consumers: health and safety of end users; feedback mechanisms; transparency and benefits of the product. 3) Local community: health and safety of local community; local employment; and land use rights. 4) General society: food security and economic development. 5) Value chain actors: fair competition in the market
Impact measure	The questionnaire ranked the subcategories in terms of their importance from 1 (low importance) to 5 (high importance). The scale compares the performance with a reference value established according to standard or compliance with a national or international law. The score goes from -2 (unacceptable performance), -1 (intermediate negative performance), 0 (aligned with international standards), +1 (intermediate positive performance) and +2 (Ideal performance)
Score of subcategories	12 of the 15 impact subcategories (mentioned above) attained high score: 4. Moreover, the other 3 (fair competition in the market, benefits of the product and feedback mechanism) obtained a score between 3 and 4. It was then decided to keep the 15 impact subcategories in the S-LCA methodology selected (see Table 4)
Rules of performance	A minimum number of impact subcategories should be covered, that is, at least 12 out of 15 impact subcategories. The very important subcategories should get a score over 0. For the important subcategories, they should be over -1. The product complies with the standard when all these rules are met. The final score would be the average value of the scores attained, from 0 (only aligned with existing standards) to 2 (the company is making a great effort to go beyond the basic requirements).
Case studies performance	One of the objectives of this deliverable is to determine a method to assess the social dimension of bio-products, with special attention to three case studies within the project:



	<ol style="list-style-type: none">1) Poly Butylene Succinate (PBS)2) Biaxially oriented Polylactic acid (BoPLA)3) Ecovio mulch film
Upstream information of the case studies	Three carbohydrate-rich feedstocks are selected to produce the case studies: maize grain, maize stover and sugar beet pulp. The relevant producing countries are: 1) US, China, Brazil and Italy for maize and stover production and 2) United Kingdom, Germany, France and Russia, regarding sugar beet pulp.

Take away messages

It is essential to consider social aspects in the sustainability analysis of bio-based products. However, S-LCA is a complex methodology that is in a fledgling stage of development. Many researchers have proposed different frameworks for S-LCA and all of them require comprehensive data. Moreover, social indicators may be very subjective and vary in their interpretation among the literature. This subjectivity could bias the results, as in this report that uses weighting factors to provide the relative importance of each impact category. This problematic may also limit the comparison of social indicators between studies. Therefore, it is very important to be transparent when performing a social LCA.

It is important to note that social indicators will vary from case study to case study. Especially in the case of bio-based products, food security and land rights are important aspects that need to be assessed. Bio-based products could potentially increase land grabbing, as happened with biofuels in the Global South, jeopardizing small farmers and the local community. However, in the complex supply chain of bio-products, the producers of bio-products generally have no control over the production of raw materials. Producers of first-generation feedstocks, such as maize grain, should pay special attention to food security and the living conditions of the employees, farmers and local community.

The purpose of this report is to use the selected social indicators for the case studies. Nevertheless, due to the absence of real figures from companies, data had to be collected from technical, statistical and scientific reports, such as statistics report from the Food and Agriculture Organisation of the United Nations (FAO) and International Labour Organization (ILO).

Results on food prices and land use are relatively easy to interpret and communicate. However, for other indicators, such as transparency and fair salary, the interpretation of the results can be very subjective and vary between regions (especially between the countries of the global south and the north). The child labour indicator should be carefully considered with a good plan to reverse the situation positively, since they represent in many countries a share of family survival and income. Therefore, for a more detailed evaluation, it is interesting to consider the value of each indicator according to each region and to give a weighting value, because the comparison of the results could underestimate or overestimate the values.



1. Background

Bio-based products represent a great opportunity to decouple economic growth from fossil fuels-derived emissions. They are also capable of reconciling long-term sustainable growth with environmental protection; however, special attention must be paid in this regard, as sustainable bioproducts must allow for prudent and responsible use of renewable resources from agriculture and forestry, avoiding competition with food and feed. The main objective of the STAR-ProBio project is to facilitate the transition from a fossil fuel-based economy to a bio-based one by promoting a more harmonised regulatory framework for sustainability that facilitates the market-pull of bio-based products. To this end, the project aims to provide a framework for the systematic assessment of the sustainability of bio-based products. The standardised approach proposed will allow bio-based products to be assessed against their fossil-based alternatives in order to quantify the benefits of moving towards a bio-based society.

The aim of Work Package 6 (WP6) is to establish the basis for the social assessment of these products. More in detail, it aims to identify the most relevant value items for this analysis and to develop a methodology for the assessment of social and socio-economic impacts (both positive and negative). This methodology should include essential social aspects, such as small-scale holders, job creation, skills upgrading and health and safety issues. Therefore, the outcome of WP6 will be a “fit for purpose” S-LCA methodology for the assessment of social and socio-economic aspects of the production of bio-based products.

The objective of Deliverable 6.3 is to summarise the work done in Task 6.3 regarding the selection of the most important impact subcategories for the social analysis of these products and the development of a specific methodology to measure them. In order to select the relevant impact subcategories to be included in the analysis, an extensive literature review was carried out (as part of Task 6.1), different workshops were organized (as part of Task 6.2) and questionnaires were distributed to stakeholders. Considering the final list of subcategories, a simple, flexible and practical methodology was developed and adapted to analyse the social performance of bio-products. It considers the five categories of stakeholders: workers, consumers, local community, general society and value chain actors and uses quantitative, semi-quantitative and qualitative indicators. Finally, it provides a final score that embodies the overall social performance of the production of a specific bio-product.



2. Introduction

In the early stages of development of the bioeconomy, the first sustainability assessments available in the literature on bio-based products were mainly focussed on the environmental pillar (Iriarte and Fritsche, 2015). This may be motivated by the high degree of development and international acceptance of environmental methodologies. However, due to the general consensus that sustainability should include environmental, economic and social aspects, the further expansion of bio-based products makes the inclusion of social and socio-economic criteria a key issue. Not only as far as bio-based products are concerned, but in general social sustainability has been much less investigated than environmental and economic sustainability. The underlying reasons relate mainly to the fact that the assessment and measurement of social sustainability are inherently more difficult compared to the other pillars, as many social criteria are often subjective (Lehtonen, 2011). The methodologies available for analysing social impacts are still in their early stages of development, and no consensus has been reached on how to carry them out. However, it is important to address this challenge, as the transition to a bio-based economy is expected to bring social and socio-economic benefits, which need to be adequately quantified.

With specific reference to organisations' sustainability reports, the Global Reporting Initiative (GRI) has made a major contribution with the development of new global standards for the preparation of sustainability reports (GRI, 2016). In the area of social sustainability, it includes guidelines on the performance of companies on specific social issues covering a wide range of topics, such as employment, labour/management connection, occupational health and safety, training and education, diversity and equal opportunity, non-discrimination, freedom of association and collective bargaining, and child labour.

However, in terms of assessment methods, the international community considers life-cycle methodologies to be one of the most appropriate tools for assessing the sustainability of bio-based products from a quantitative point of view. The reasons are that they are able to quantify the impacts throughout all stages of the life cycle, following a cradle-to-grave approach. While Environmental Life Cycle Assessment (E-LCA) and Life Cycle Costing (LCC) are well-established and widely used for assessing the environmental and economic dimension of products and services, Social Life Cycle Assessment (S-LCA) is still in its early stages of development (Sureau et al., 2018). In recent years, several authors have been focused on the selection of the most relevant social issues for measuring the social impacts of products (Fontes et al., 2018); however, many other methodological aspects have not yet been established or have not reached full consensus.



3. Foundations to build the S-LCA scheme

The S-LCA developed in the project should be based on internationally recognised standards and reports on the topic. Therefore, an intense review was performed to select the relevant impact categories and indicators to assess the social sustainability of bio-based products. Moreover, the final selection of impact subcategories and indicators to measure these impacts should be built according to the validated value items carried out in Task 6.2, as well as in relevant published guidelines and international projects based on this topic. To this aim, this section presents a summary of the main standards and projects considered.

3.1 GRI Standards

The Global Reporting Initiative (GRI) is an independent international organization that helps companies, governments and other organizations understand and communicate their performance in terms of sustainability. For that purpose, they developed a set of Standards to properly report on the company's economic, environmental and social impacts (GRI, 2016). They defined the information principles necessary to achieve high quality information. As for social issues, these should include stakeholder inclusiveness, sustainability context, materiality and completeness. The organisation should identify the stakeholders involved in its activities and conduct a stakeholder engagement process to understand their reasonable expectations and interests, as well as to take their views into account. In terms of the sustainability context, the organisation must also provide information on how it intends to contribute to the improvement of the economic, environmental and social conditions of the areas in which it has influence. Materiality and integrity refer to the inclusion of relevant issues (those that the organization has prioritized for inclusion in the sustainability report) and their boundaries to assess the economic, environmental and social impacts of the organisation and to enable stakeholders to understand the organisation's performance on these issues. GRI provides a set of topics with different disclosures and guidelines on the type of information that should be provided to report the specific performance of the company in that area. In terms of social topics, GRI Standards include:

- Employment
- Labour management relations
- Occupational health and safety
- Training and education
- Diversity and equal opportunity
- Non-discrimination
- Freedom of association and collective bargaining
- Child labour
- Forced or compulsory labour
- Security practices
- Rights of indigenous peoples
- Human rights assessment
- Local communities
- Supplier social assessment
- Public policy
- Customer health and safety



- Marketing and labelling
- Customer privacy

3.2 UNEP/SETAC Guidelines

The United Nations Environmental Program (UNEP) and the Society of Environmental Toxicology and Chemistry (SETAC) published the report entitled "Guidelines for Social Life Cycle Assessment of Products" (Andrews et al., 2009). The objective of the report was to provide a common and harmonised framework for the assessment of the social aspects of a product from a life-cycle perspective, which would complete the sustainability life-cycle methodologies together with E-LCA and LCC. The guidelines suggested in this report were followed to establish the general framework of the methodology developed, especially as regards goal and scope definition, with the specification of key methodological aspects such as system boundaries, functional unit, modelling approach, etc., as described in section 5 of this report.

3.3 JRC Technical report on S-LCA

On the specific topic of bio-based products, the Technical Committee CEN/TC 411 has developed the European Standard EN 16751:2015 which addresses the issue of sustainability criteria of bio-based products (European Committee for Standardisation, 2015). In terms of social criteria, four main themes were selected: (i) labour rights (including labour rights, working and living conditions), land use rights and land-use change, water use rights (including water-scarce areas) and local development. The recommendations and indications of this standard were considered very important in the selection of social impact subcategories.

3.4 PRé Sustainability Handbook

The Handbook for Product Social Impact Assessment (Fontes, 2016; Goedkoop, Indrane, & Beer, 2018) also sheds light on the issue of social assessment. The last two versions of this handbook propose a set of social topics classified by stakeholder category and specific methodologies to account for these impacts. In more detail, version 3.0 provides a quantitative and scale-based approach to accounting for these impacts; however, version 4.0 considers a simplified approach by considering only scale-based analysis, i.e. the assessment of social impacts on a reference scale (+2, +1, 0 -1, -2). This methodology was the one selected to build the social assessment framework. Accordingly, the scale-based approach was modified and specifically adapted to analyse bio-based products and measure the social impact subcategories selected.

3.5 Other European projects

Finally, other research projects have been reviewed to analyse the type of social and socio-economic criteria considered in the assessment of the social sustainability of bio-based products.

The Global-Bio-Pact project (Global Assessment of Biomass and Bioproduct Impacts on Socio-economics and Sustainability) (Dam et al., 2010) categorised the socio-economic impacts of biomass production according to the type of feedstock (soy, palm oil, jatropha, sugarcane and second generation biomass).

The Prosuite (Prospective Sustainability Assessment of Technologies) project (Gassbeek and Meijer, 2013) proposed a new methodology for assessing the sustainability impact of new technologies based on a five-pillar framework: human health, social well-being, natural environment, exhaustible resources and prosperity.



The S2Biom project (Delivery of sustainable supply of non-food biomass to support a “resource-efficient” Bioeconomy in Europe) (Iriarte and Fritsche, 2015) also selected a set of sustainability criteria in this matter. Regarding social aspects, these included participation and transparency, land tenure, employment and labour rights, health risks and food, fuelwood and other products.

The BioSTEP project (Promoting stakeholder engagement and public awareness for a participative governance of the European bioeconomy) (Hasenheit et al., 2016) included general and specific social issues to assess bio-based products, such as food security, land access, employment, household income, workdays lost due to injury, quality of life and health.

4. Social Life Cycle Assessment (S-LCA)

S-LCA is defined by Andrews et al. (2009) as “a social impact (and potential impact) assessment technique that aims to assess the social and socio-economic aspects of products and their potential positive and negative impacts along their life cycle encompassing extraction and processing of raw materials; manufacturing; distribution; use; re-use; maintenance; recycling; and final disposal”. It also defines social impacts as “consequences of positive or negative pressures on social endpoints (i.e. well-being of stakeholders)”. These consequences arise from “social relations (interactions) weaved in the context of an activity (production, consumption or disposal) and/or engendered by it and/or by preventive or reinforcing actions taken by stakeholders”.

These impacts are reported in terms of impact categories and subcategories, which are defined as socially relevant themes or attributes analysed in the study. These subcategories are classified per impact category and stakeholder category. The methodology defines five categories of stakeholders, which are the groups potentially affected by the life cycle of the product:

- i) Workers/employees
- ii) Local community
- iii) Society
- iv) Consumers
- v) Value chain actors.

The methodology to perform an S-LCA follows the same stages as for E-LCA (Figure 1), according to the ISO 14044 framework (ISO 14040, 2006; ISO 14044, 2006). These steps are the following:

- i) Goal and scope definition
- ii) Life cycle inventory
- iii) Life cycle impact assessment and
- iv) Interpretation

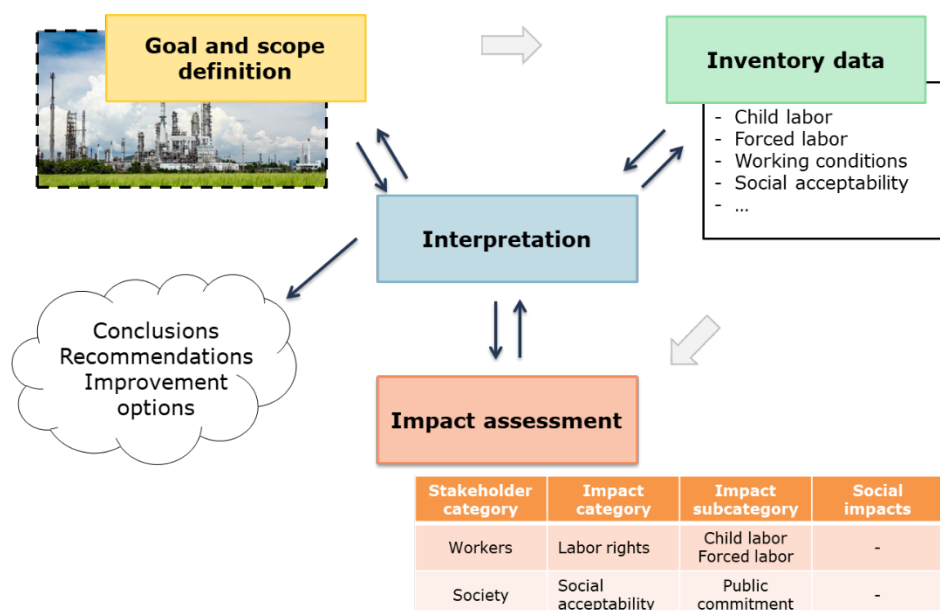


Figure 1. Different phases of the Social Life Cycle Methodology



In addition, other methodological aspects are similar to the E-LCA; however, others are considered in a different perspective or are different. The main differences of an S-LCA in comparison with an E-LCA are:

Goal and scope definition

The goal states the intended application, the reasons for carrying out the study and the target audience; while the scope includes the system, the functions, the functional unit, the system boundaries, etc.

Therefore, as in E-LCA, the function of the product must be described and a functional unit (FU) must be defined. Impacts are generally expressed per FU; however, in S-LCA it is a common practice to use semi-quantitative and qualitative indicators and data. Therefore, this information cannot be always referred directly to a FU.

With regard to the selection of impact subcategories, the guidelines propose a broad set of subcategories classified both by stakeholder category and by impact category. According to the report, a justification is needed in S-LCA when a subcategory is not included in the study.

Life Cycle Inventory

Inventory analysis involves data collection and calculation procedures to quantify relevant inputs and outputs of a product system. To perform a S-LCA, data on activity variables of the organisation is required. This activity variable is a measure of the activity or scale of the process that can be related to the output of the process (for example, the number of working hours to estimate the participation of each processing unit in the product system). In addition, subjective data are sometimes encouraged in the S-LCA, as there is a possibility that in trying to turn this information into objective data, greater uncertainty is introduced into the analysis. The collection of this information also differs from E-LCA, as stakeholder information may be the most relevant.

Life Cycle Impact

The impact assessment phase aims at evaluating the significance of potential social impacts using the data from the LCI results. The characterisation models are different. The use of the Performance Reference Point methodology requires the collection of additional information such as thresholds that helps to interpret the information gathered. Besides, S-LCA accounts for both positive and negative impacts of the product, to encourage performance beyond compliance.

Interpretation

At this stage, the findings from the inventory analysis and the impact assessment are considered together. It provides consistent results with the defined goal. It also should deliver conclusions, explain limitations and provide recommendations. Information regarding the engagement of stakeholders is needed in order to properly interpret the results obtained.



5. Goal and scope definition

Goal definition is the starting point of a S-LCA study, where a clear statement of the purpose of the study is made. This is an important stage since all the relevant methodological decisions are made according to the goal pursued; therefore, it guides all the detailed aspects of the scope definition, which determines the framework for the following stages. The definition of the goal states the intended application, the reasons for carrying out the study, the target audience and the decision-context (ISO 14040, 2006). The scope determines the depth of the study and it includes the statement of different important methodological aspects. According to Andrews et al. (2009), this step requires:

- i. To specify the objective of the study and to define some methodological aspects such as function of the product, FU, etc.
- ii. To determine system boundaries and the unit processes that will be analysed in detail in the study.
- iii. To select the impact categories and subcategories to reflect the impacts produced by the production system during the impact assessment step.
- iv. To determine the data required to perform the study, including activity variables, to plan data collection and data quality requirements.

5.1 Goal definition

The goal of the social assessment is to analyse the social conditions and socio-economic performance of bio-based products throughout their life cycle for all stakeholders involved. The main aim is to learn about and contribute to build a consolidated methodology that helps to determine and quantify the positive and negative social impacts. Another objective is to propose options for reducing the potential negative impacts in order to promote the general improvement of the social sustainability of the bio-based product as well as to encourage participation and dialogue among stakeholders and decision makers.

The reasons for carrying out this type of study are to support decision-makers on the actions taken to favour the introduction of bio-based products into the market. The target audience includes all interested parties and stakeholders that can participate in the introduction of bio-based products into the market, including the scientific community, public authorities, citizens and other local stakeholders. In terms of the decision-context, it is expected that the study will serve as a decision-support tool for governmental recommendations on bio-based products.

5.2 Life-cycle stages and stakeholders categories

The life cycle of a bio-based product is a complex system composed by several stages and it cannot be objectively defined just as one single life-cycle. For S-LCA studies, a simplified approach must be defined, which could include, for example, feedstock cultivation, bio-based platform chemical production, production of the final bio-based product, use stage and end-of-life. According to the stages that are being considered within the system boundaries, different studies can be distinguished:

- i. Cradle to grave, where all life-cycle stages are considered, from raw materials extraction to final disposal of wastes.
- ii. Cradle to gate, when the final stages are excluded from the system boundaries, for example use and end-of-life.
- iii. Gate to gate, when both some early and final stages are excluded from the study.

Figure 2 shows the common life cycle stages of a generic bio-product. As shown in Figure 2, a cradle to gate approach is suggested in this S-LCA scheme, considering the cultivation of the feedstock, the production of bio-based chemicals, the production of the final product, and the use stage. Moreover, when necessary, the exclusion of the production of the final product may be required due to the requirements of data. A bio-product is produced from other products apart from the bio-based one, which is object of the study; therefore, it is possible that the collection of inventory data for these other products highly complicate the study, without providing insights for the sustainability of bio-based share of the product. Therefore, in this case, the FU and system boundaries should be revised and adapted as needed. In other cases, it may be necessary to exclude the consumption stage. It can be done for comparison purposes since it would be the similar for a bio-based product and a fossil-based product, since they provide the same function. Moreover, the lack of data needed is also an issue as well as in transportation processes. Regarding the end-of-life stage, it is the subject of Task 6.4 of WP6; therefore, its study was not included in this Deliverable.

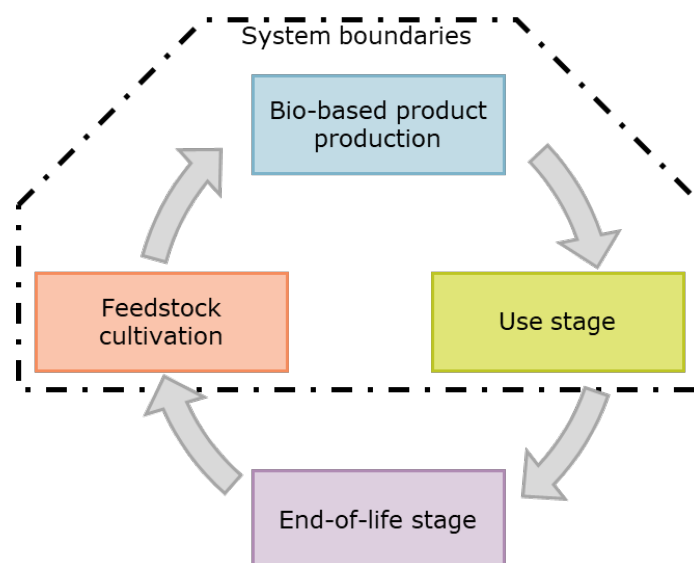


Figure 2. Life cycle stages considered in the cradle-to-gate study

Another important aspect of this step is to identify the main stakeholders that would be the receptors of the social impacts produced and to classify them into the 5 categories defined. For example, in this type of systems, the category of workers is represented by farmer associations and trade unions; consumers by consumer associations; local community by local NGOs and representatives of local government; general society by researchers; and value chain actors by processors and producers of bio-based materials. Table 2 shows the relations between life cycle stages of bio-based products and the five stakeholders categories. As can be observed, in each life cycle stage different stakeholders are involved. While local community and society would be presented in all life cycle stages, consumers only would be related with the use phase, while workers appear in feedstock cultivation, bio-based platform chemical and final product production and end-of-life (Goedkoop et al., 2018). Therefore, it is fundamental to consider that the potential social impacts related for workers, for example, needs to be analysed in more than one life cycle stage to have a reliable assessment. According to the system boundaries established before, it would be only included in the study of social impacts on stakeholders only the two first life cycle stages would be included.

Table 2. Relation between life cycle stages and stakeholder categories

Life cycle stages				
Feedstock cultivation		Bio-based product production	Use stage	End-of-life
Stakeholder categories	Farmers (e.g. farmers associations)	Factory workers (e.g. trade unions)	Users of bio-based products (e.g. consumers associations)	Workers in composting plants, recycling plants, landfills, etc. (e.g. trade unions)
		Value chain actors (e.g. processors and producers of bio-based products)		
	Local community of the production site (e.g. local public procurers, local NGOs, local government)			
	General society (e.g. research institutes, certification bodies)			

5.3 Attributional and consequential S-LCA

The decision-context is one key criterion for determining the most appropriate method for modelling the analysed process or product, which can be attributional or consequential (European Commission, 2010). The attributional model includes all the relevant processes that contribute to the supply-chain of the system. It uses actual data of the system, supposing that it is embedded into a static technosphere. Therefore, it depicts the potential environmental impacts that can be directly attributed to the product under study over its life cycle. The consequential one is used when a decision is going to be made; it integrates the theoretical supply-chain as it would change as a consequence of this change, considering the changes that affect the market. The objective is to identify the consequences that a decision has on other processes. So, this model does not reflect the actual supply-chain, but a hypothetic alternative supply-chain modelled considering market-mechanisms and potentially including political interactions and consumer behaviour changes.

Until now, S-LCA studies have mainly been conducted using attributional modelling, which is the simplest approach; since the development of the methodology will continue, consequential S-LCA is likely to be carried out in the future.

5.4 Function and functional unit

It is also necessary to specify the function and the FU in a S-LCA. In fact, the selection of the function of the system is one of the main methodological issues in LCA studies, as it relates to the definition of the FU and the system boundaries. A system may have a number of possible functions and the one selected depends on the goal and scope of the study. The function is the utility, the role that the product plays for its consumers. The FU defines the quantification of the identified functions of the system, providing a reference to which social data are related. The correct definition of the main function of the system, as well as the derived FU, are especially relevant issues when the aim of the LCA study is to make a comparison between two systems that provide the same function.

For studies accounting for the whole life-cycle of a product, especially when the aim of the study is to compare two products, practitioners should identify the purpose of the use of the product, considering the relevant market segment and the main product alternatives. However, for studies from a cradle-to-gate perspective, the market function of the product will not be a suitable option; and a based-item function may be more appropriate, for example: “the production and use of the target product”, since it simply allows the relation with the social information that will be gathered.

5.5 System boundaries

The system boundaries define which unit processes belong to the analysed system and which are excluded from the study (ISO 14040, 2006). These processes are recognised because they are required for providing the function to the system as defined by the FU. The system boundaries refer to the identification of all unit processes that are involved in the system that is being assessed. The life cycle stages included in the study have a direct implication in this identification, since it indicates the stages where these unit processes should be determined. However, more experience needs to be gained on the topic to know if the definition of system boundaries in environmental and social LCA should be the same or different. The general flowchart for a bio-based product specifying the main processes that should be included in the S-LCA is shown in Figure 3.

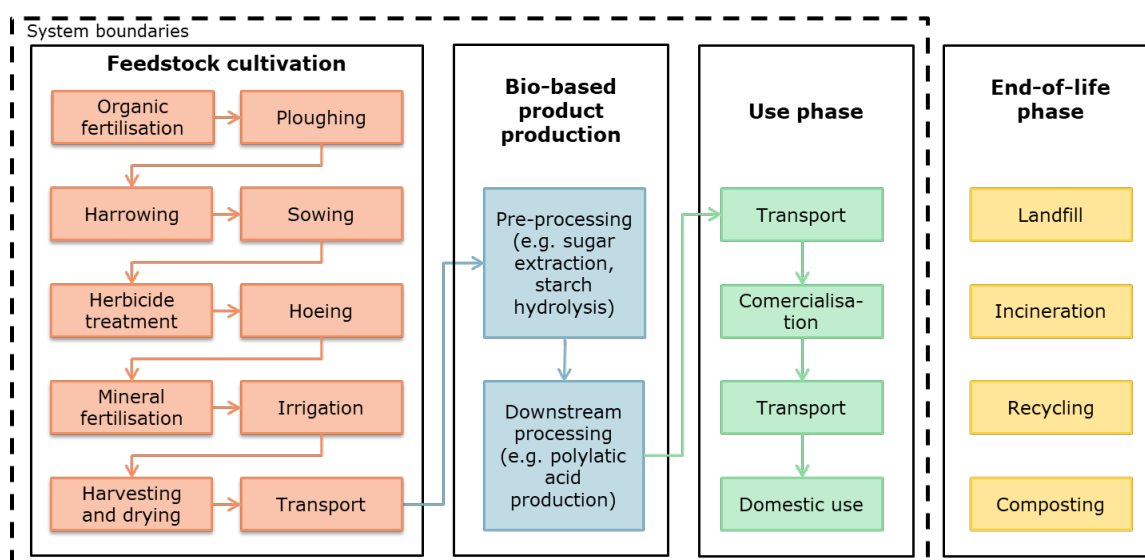


Figure 3. Flowchart of the processes involved in the life cycle of bio-based products

However, the production chain of bio-based products is not that simple or linear. As shown in Figure 4, these products are embedded in a global market and they have very complex supply chains with multiple suppliers normally covering feedstock production and industries in many countries around the world. It is clear that to collect data from all production steps is impossible due to the amount of dispersed production processes involved; however, considering only the main factor of the product would result in an unrepresentative study. Therefore, it is fundamental to establish some rules for the coverage of data that should be collected to perform a reliable S-LCA study. In order to gather representative data, but keeping the amount of work feasible, it is proposed to collect data which cover at least the 75% of the mass of the final product as well as all contributions over 5%.

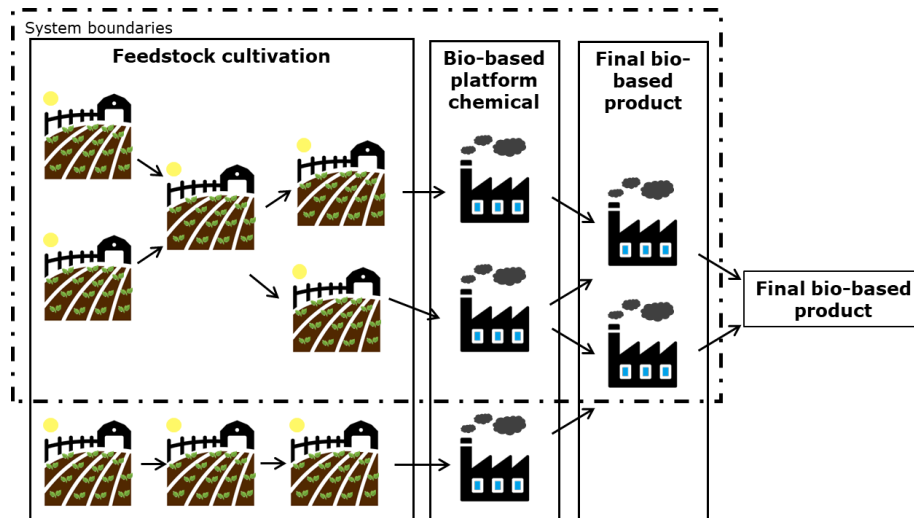


Figure 4. System boundaries and coverage of data (adapted from Goedkoop et al., (2018))

5.6 Selection of social indicators

As shown in Figure 5, each stakeholder category has different impact categories directly related. For example, to evaluate the impacts produced in the stakeholder category of workers, the following impact categories can be analysed: labour rights and decent work, working conditions, human rights, health and safety, training and education, social benefits, job satisfaction... Moreover, each impact category is again split into different impact subcategories. For example, labour rights and decent work is measured through freedom of association and collective bargaining, child labour, forced labour, etc. Finally, each impact subcategory is quantified in the practical application of the S-LCA by quantifying the performance of different performance indicators.

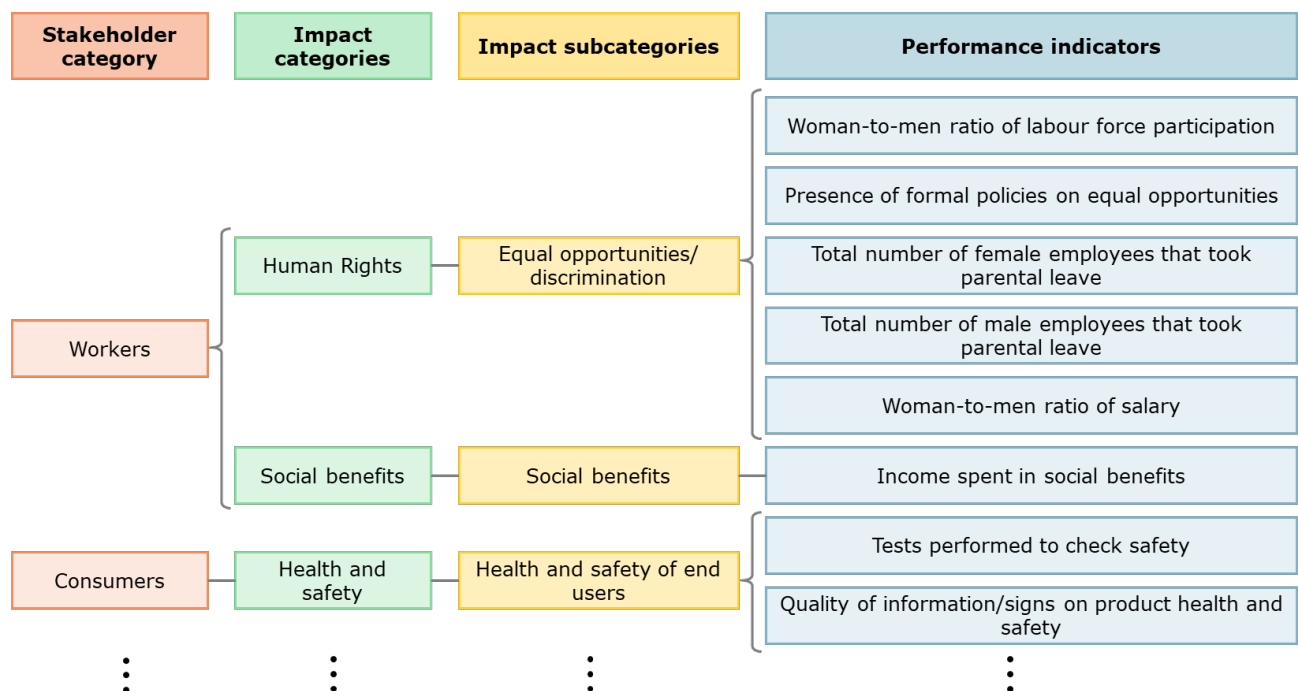


Figure 5. Relation between stakeholder categories, impact categories, subcategories and performance indicators (adapted from Goedkoop et al., (2018))



This complex structure makes S-LCA a complex methodology; moreover, the UNEP/SETAC guidelines recommend a set of categories, subcategories and indicators, which are not always the same that other relevant reports (such as the GRI standards, the Social Handbook, etc.). As suggested in the UNEP/SETAC guidelines, social impacts should be quantified in terms of different impact subcategories. Therefore, a lot of effort has been put in the selection of the relevant impact subcategories for the specific assessment of bio-based products. However, the selection of social topics to be included in the S-LCA is recognised by the scientific available literature as one of the most critical steps. Moreover, there are several subcategories which have been considered important by different researchers for evaluating the social performance of products.

In Task 6.1, an extensive review of the literature was conducted to identify all available social aspects considered in the guidelines, handbooks and related studies. Subsequently, a second review of the literature was carried out to reduce the list obtained, maintaining the most used subcategories. To do so, the literature review was based on the most relevant and recent peer review papers on the topic of social life cycle assessment of bio-based products as well as on Corporate Social Responsibility reports. In detail, this literature review allowed to reduce the list from 19 impact categories, 28 subcategories and 85 indicators up to 15 impact categories, 23 impact subcategories and 49 indicators, which were those presented to the stakeholders that participated in the workshops.

Later, as part of Task 6.2, the list of social issues was presented to stakeholders in different workshops to validate their importance. Stakeholders from all categories were invited to four different workshops held in Spain, Italy and Germany. They were asked to rank social issues and related indicators according to their importance in assessing the social performance of bio-based products as very relevant, relevant, slightly relevant and not relevant. Finally, the 15 impact subcategories listed in Table 3 were selected on the basis of the results obtained.

More information about the literature review performed can be found in Deliverable 6.1 of the project. Furthermore, results of the workshops and the selection of the impact subcategories can be found in Deliverable 6.2.

Table 3. Impact subcategories selected by stakeholder category

Stakeholder category					
	Workers	Consumers	Local community	General society	Value chain actors
Impact subcategories	Child labour	Health and safety of end users	Health and safety of local community	Food security	Fair competition in the market
	Forced labour	Feedback mechanisms	Local employment	Economic development	
	Fair salary	Transparency	Land use rights		
	Equal opportunities/discrimination	Benefits of the product			
	Health and safety of workers				

Later on, a questionnaire was designed to confirm the importance of the impact subcategories obtained. It was divided in three main sections. The first one was an introduction to present the project and to explain the objectives of the questionnaire. The second one comprised general questions to gather information about the respondents such as gender, age, profile/position and years of working experience. The last one was the part about the specific questions, where a short definition was provided for each of the 15 subcategories, and stakeholders were asked to rank their importance from 1 (low importance) to 5 (high importance) regarding their suitability to assess the social sustainability of bio-based products. The questionnaire can be found in the Annex Section of this Deliverable. The questionnaire was distributed in Spain and Italy (around 100 questionnaires were sent); however, only 20 responses were obtained.

Regarding the general information about the respondents, 53% were males and 47% females; 16% were under 30 years old, 74% between 30-49, and 11% between 50-69; 5% came from farmer associations, 5% were consumer associations, 5% were local NGOs, 80% were research institutes and 5% were bio-based products producers; 45% had less than 5 years of experience, 18% between 5 and 9, 27 between 10 and 20 and 9% over 20. The average scores obtained for the different subcategories are presented in Table 4 in descending order of importance.

Table 4. Results obtained from the questionnaires regarding the importance of subcategories

Specific questions	Score
Child labour	4.65
Equal opportunities/ discrimination	4.55
Health and safety of end users	4.53
Local employment	4.30
Forced labour	4.25
Food security	4.25
Health and safety of local community	4.20
Economic development	4.20
Fair salary	4.15
Health and safety of workers	4.15
Transparency	4.15
Land use rights	4.10
Fair competition in the market	3.80
Benefits of the product	3.60
Feedback mechanism	3.30

As shown in Table 4, 12 of the 15 impact subcategories achieved a score over 4, meaning that they were considered very important. Moreover, the other 3 obtained a score between 3 and 4; therefore, they could be considered as important as well. According to the results obtained, it was decided to keep the 15 impact subcategories in the S-LCA methodology selected.

5.7 Selection of assessment methodology

As mentioned before, to analyse the impacts of bio-based products it was decided to follow and adapt the scale-based methodology proposed in Goedkoop et al. (2018). As represented in Figure 5, per each stakeholder category different subcategories were selected. In Goedkoop et al. (2018), each subcategory has associated a set of performance indicators to measure it. Information about the performance of the company regarding these indicators, normally from 4 to 6, should be collected. The methodology also provides a reference scale for each subcategory to obtain the final score according to the indicators mentioned. As presented in Figure 6, the measurement scale goes from +2, meaning ideal performance to -2, meaning non-acceptable performance. More information about how this methodology works in practice can be found in Section 6 and 7 of this Deliverable.

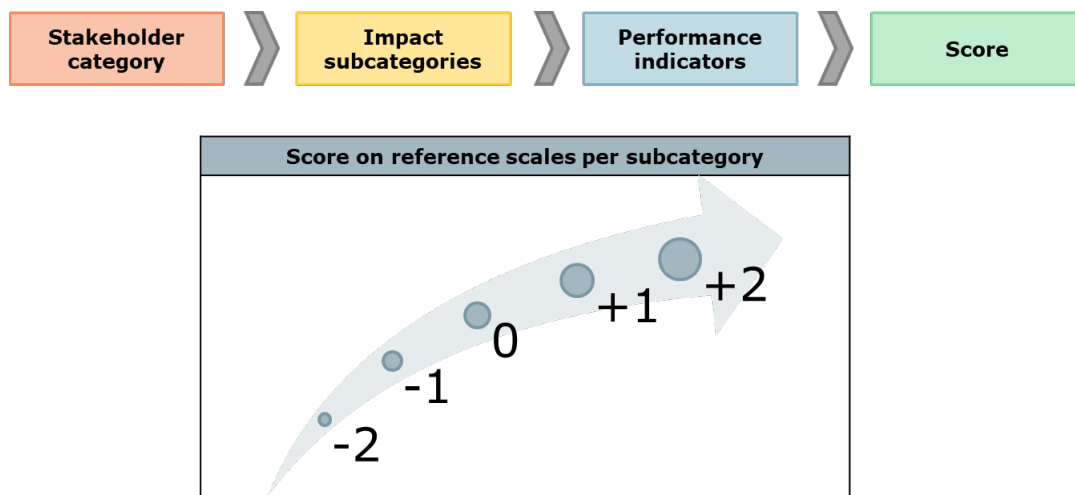


Figure 6. Overview of the impact assessment methodology



6. Inventory data analysis

This stage involves the decision of which data collect on site and for which processes general data will be used. On one hand, site-specific data refers to data collected for a specific process, which is directly gathered in a specific company using, for example, questionnaires. Since behaviours are so important in social impacts assessment, it is important to know the site-specific information. On the other hand, generic data means data that have not been collected on site. This type of information may not be representative of the impacts of the particular product that is being analysing; however, it is important to consider that sometimes it is the only option. Moreover, the evaluation may include generic assessment for life cycle stages that are not under the organisation's influence. Specific assessment may be included when entering the sphere of influence of the organisation producing the product assessed. However, it should be noted that spheres of influence and importance do not necessarily coincide.

There is a difference between primary data and site-specific data. Primary data is gathered during the study in question, rather than published data prior to the study. Data may be gathered from a sample of unit processes, in order to estimate the average parameters for a group of unit processes. Primary data estimated from a sample of processes in the group is not site-specific.

This stage involves deciding which data are collected on site and for which processes the general data will be used. In this case, the entire S-LCA study would be conducted with site-specific data collected directly from a specific company or facility through a questionnaire. This decision was based on the importance of actual primary data and actions on assessing social impacts and on the fact that generic data may not be representative of the impacts of the particular product being analysed. In addition, databases are being developed for S-LCA, such as PSILCA or the Points of Social Interest Database. The questionnaire designed to collect inventory data was constructed in an Excel file, where each spreadsheet corresponds to a category of stakeholders. In the case of workers, two spreadsheets were implemented, one for farmers (in the life cycle stage of feedstock production) and one for factory workers (in the life cycle stage of bio-based product production). However, these two sheets include the same subcategories of impacts and type of data in relation to performance indicators. In these two sections, general data regarding the production of feedstock and the bio-based product, respectively, is included, such as the country of production, the reporting period, the number of persons working directly in agricultural or forestry production or in the factory, the name and yield of the main products and the related co-products.

The rest of the questionnaire was developed according to the scale approach developed in Goedkoop et al. (2018), in relation to the impact subcategories that coincide with those used in the Handbook: child labour, forced labour, fair salary (named as Remuneration in the Handbook), equal opportunities/discrimination (named as Discrimination in the Handbook), health and safety of workers, health and safety of end users (named as Safety in the Handbook), health and safety of local community and land rights. In the case of local employment, the performance indicator of the previous version (Fontes, 2016) was partially combined with the new one (Employment and skills development). As already mentioned, data should be site-specific and can be collected from internal databases on health and safety, environment, operations, human resources, etc.



However, for the other impact subcategories (feedback mechanisms, transparency, benefits of the product, food security, economic development and fair market competition), the respective performance indicators were developed following the same methodology as in the Handbook. To do so, a review of all indicators used in the literature was undertaken, including GRI Standards, UNEP/SETAC guidelines, EN 1675:2014, European Projects (Prosuite, BIOSTEP, S2BIOM and Global-Bio-Pact) and relevant literature (Aparcana and Salhofer, 2013; Dale et al., 2013; Ekener-Petersen et al., 2014; Haaster et al., 2017; Manik et al., 2013; Siebert and Bezama, 2018). This group of indicators was used as basis for the development of the performance indicators for the other subcategories. Table 5 shows two examples of these performance indicators developed for transparency and economic development. The information shown in the table would be the information that each company should provide to analyse its performance for each impact subcategory, along with the necessary evidence. Most responses follow a yes/no approach, but for other impact subcategories quantitative information, such as percentages, may be required.

Table 5. Examples of performance indicators developed following the approach of Goedkoop et al. (2018)

Benefits of the product		Description/evidence
The product is generally recognised as having a positive impact on the consumer's well-being		
Yes/No		
A company specific study exists to analyse the positive and negative feelings of the consumers when using the product		
Yes/No		
Percentage of the product that is produced from natural resources		
Percentage		
Economic development		Description/evidence
The company or facility has a policy prioritising buying goods and services from local suppliers		
Yes/no		
The company or facility actively contributes to skill development in connection to its future need for staffing and the staffing of its subcontractors and smallholders		
Yes/no		
The percentage of employees to total economically active population has grown in the last 5 years		
Yes/no		
The market share of the company has grown in the last 5 years		
Yes/no		

The performance indicators of the 15 impact subcategories selected are collected in the Annex Section of this Deliverable.

7. Impact assessment

7.1 Assessment methodology

To properly link the results obtained in the inventory phase with the reference scales of the methodology (Table 5), data should be interpreted, and the scores attributed to the different performance options. The scale compares the performance with a reference, value established according to standard or compliance with a national or international law.

Table 6. Reference scale from Goedkoop et al. (2018)

Reference scale	
+2	Ideal performance
+1	Intermediate positive performance
0	Aligned with international standards
-1	Intermediate negative performance
-2	Unacceptable performance

As in the life cycle stage, the reference scales were taken for the impact subcategories already included in the handbook, while for the different impact subcategories they were developed. As before, Table 6 shows the reference scale of the previous examples presented in Table 5.



Table 7. Reference scales developed following the approach of Goedkoop et al. (2018)

Benefits of the product	
+2	The product is generally recognised as having a positive impact on the consumer's well-being
	A company specific study exists to analyse the positive and negative feelings of the consumers when using the product
	Percentage of the product that is produced from natural resources >70%
+1	The product is generally recognised as having a positive impact on the consumer's well-being
	A company specific study exists to analyse the positive and negative feelings of the consumers when using the product
	Percentage of the product that is produced from natural resources >50%
0	The product is generally recognised as having a positive impact on the consumer's well-being
	Percentage of the product that is produced from natural resources >50%
-1	The product is generally recognised as having a positive impact on the consumer's well-being
	Percentage of the product that is produced from natural resources ≤50%
-2	Percentage of the product that is produced from natural resources ≤40%
Economic development	
+2	The company or facility has a policy prioritising buying goods and services from local suppliers
	The company or facility actively contributes to skill development in connection to its future need for staffing and the staffing of its subcontractors and smallholders
	The percentage of employees to total economically active population has grown in the last 5 years
	The market share of the company has grown in the last 5 years
+1	The company or facility has a policy prioritising buying goods and services from local suppliers
	The company or facility actively contributes to skill development in connection to its future need for staffing and the staffing of its subcontractors and smallholders
	The percentage of employees to total economically active population has grown in the last 5 years
0	The company or facility has a policy prioritising buying goods and services from local suppliers
	The company or facility actively contributes to skill development in connection to its future need for staffing and the staffing of its subcontractors and smallholders
-1	The company or facility actively contributes to skill development in connection to its future need for staffing and the staffing of its subcontractors and smallholders
-2	The company or facility does not actively contribute to skill development in connection to its future need for staffing and the staffing of its subcontractors and smallholders

The result of the evaluation is a score for each impact subcategory (except for those related to workers, which would have two scores). An illustrative example of how the results of the social assessment would be presented is shown in Figure 7 (it is important to note that the results are not real).

In order to get the final score of the product, summarising its social performance, some rules should be established. Firstly, it should be indicated the minimum number of impact subcategories covered. It is proposed that at least information from 12 of the 15 impact subcategories is provided. This would convert the methodology in a flexible tool able to be adapted to the different requirements of each bio-product. Regarding the subcategories considered very important, according to the results of the questionnaire performed (see Table 4 of this Deliverable), they should get a score over 0. For the important subcategories, they should be over -1, meaning that, despite they are not performing well, the company is taking actions to improve the performance of this subcategory. When all these rules are met, the product complies with the standard. The final score would be the average value of the scores obtained, which would go from 0 (only aligned with existing standards) to 2 (meaning that the company is making a great effort to go beyond the basic requirements). This approach considers the same weight for all impact subcategories considered “very important”; the development of weighting factors to provide the relative importance of each impact subcategory is very difficult since important subjective considerations and uncertainty would be introduced into the methodology.

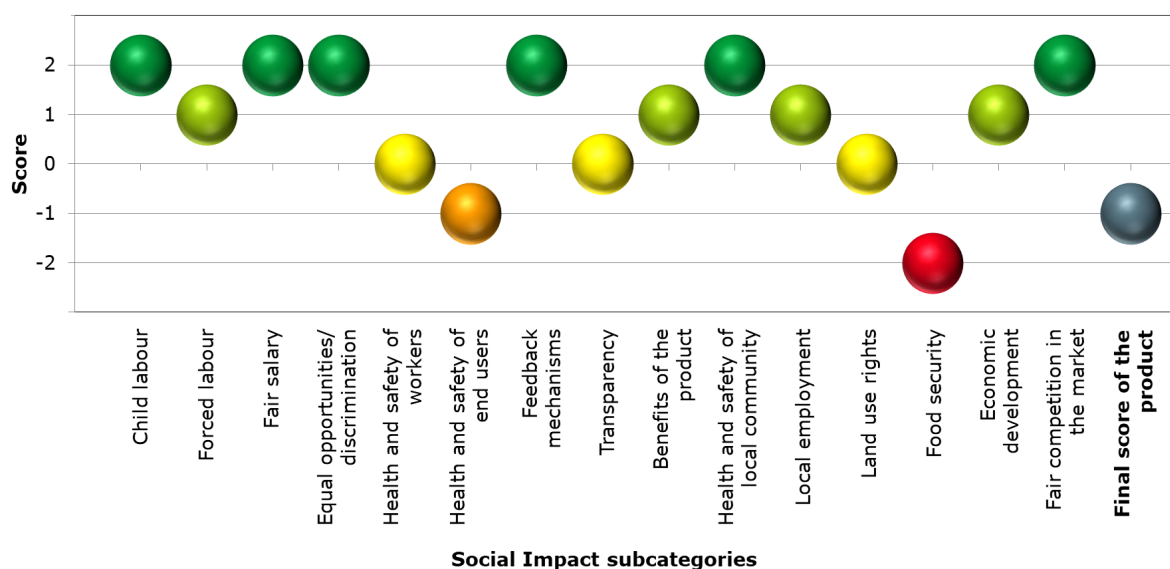


Figure 7. Representation of the social impacts obtained

7.2 Other considerations

An important aspect of this work was the adaptation of the methodology developed to the specific aspects of bio-based products. The evaluation of these products has particularities that must be addressed in the S-LCA. Among the impact subcategories selected in this study, food security and land rights are the most related to the specific requirements of bio-based product assessment. As for land rights, it is important to bear in mind that smallholders do not lose their land rights, as land grabbing is an outstanding social impact of such products. In this regard, the consideration of small farmers in general in the social assessment is considered an important issue. On the other hand, businesses using crops that can be used as food or feed should pay attention to this point, perhaps by implementing measures to improve and ensure local food security. An important indicator to follow this subcategory of impact may be the percentage of hectares that have changed in the variety of crops and arable land in the region since the feedstock demand for bio-products. Other important aspects to consider in bio-products may be the living conditions of the farmers' families and the integration of subcontractors into the stakeholders considered in the study.

8. Case studies' performance

The main objective of Deliverable 6.3 is to define a methodology for analysing the selected impact subcategories to assess the social sustainability of bio-based products, paying special attention to the case studies defined within the project:

Poly Butylene Succinate (PBS). Polybutylene succinate (PBS), which in the past was mainly made from fossil resources, is now considered a biodegradable material that can also be composted. It is a crystalline polyester that can be synthesized from the combination of succinic acid and 1,4-butanediol and another monomer, such as dicarboxylic acid. In terms of upstream processes, the main carbon source is glucose, which is a common material input in industrial fermentation processes. Glucose for fermentation is often used as glucose syrup, which contains approximately 90% glucose. Glucose can be produced from a variety of raw materials, the most common being maize, wheat and potato starch. In this study, both succinic acid and 1,4-butanediol are materials of 100% biological origin.

There are many applications for PBS, such as in the packaging sector (e.g. food packaging), agriculture (e.g. agricultural mulch film), fibres (e.g. fishing nets) and construction/automotive (e.g. wood composites)(Succinity GMBH, n.d.). So far, PBS production is still in its early stage and has an estimated global production capacity of 1 million tonnes per year (see deliverable D3.1). Its fossil counterparts that share analogous properties is polystyrene (PS) resin. PS is generally non-biodegradable and few PS producers practice recycling. Throughout the world, this fossil polymer is mainly disposed of in landfills at the end of its life cycle. PS is used worldwide in the packaging, construction and electronics sectors. The functional unit chosen in this study is 1 kg of 100% bio-based PBS resin.

Biaxially oriented Polylactic acid (BoPLA). BoPLA is derived from the chemical monomer lactic acid and is produced for packaging films. BoPLA is assumed to be produced from glucose, thus from carbohydrate-rich raw materials, e.g. corn starch. BoPLA is a relatively new material and its market share is currently unknown. It is a promising polyester to replace Biaxially oriented polypropylene (BoPP). BoPP is made from fossil fuels and is the most commonly used plastic for packaging vegetables and fruits. BoPLA is an interesting material for food packaging, as it has the ability to be a barrier to taste. The functional unit is 1 unit of 350 mm × 250 mm, a thickness of 0.025 mm and a weight of 5.58 g. The BoPP fossil packaging has the same specification, resulting in a weight of 4.67 g.

Ecovio mulch film. Ecovio® F mulch film is an 80% biodegradable product from BASF, which is a blend of PLA and Eco-flex® F Blend. PLA is 100% bio-based, while Eco-flex® F Blend is produced from bio-based 1,4 butanediol and fossil based adipic acid and terephthalic acid. Its fossil counterpart is the linear low-density polyethylene (LLDPE) mulch film, which faces the challenge of soil contamination due to inefficient forms of removal and collection in the field in its end-use cycle. PLA mulch film is in its early stage of development, being a market niche. The functional unit is 1 ha of agricultural field and one crop rotation period. In terms of mass, it results in 152 kg of Ecovio® F mulch film per hectare. On the other hand, fossil mulch film requires about 185 kg of materials for 1 ha of agricultural field.



Table 8. Information regarding the case studies

Case study	Bio-based platform chemical	Final bio-based product	Application	Benchmark system
1 Polybutylene succinate (PBS)	Polybutylene succinate (PBS): Succinic acid (SA) 1,4-Butanediol (BDO)	PBS resin	Agriculture, packaging, fibres, construction and automotive sectors	Polystyrene (PS) Fossil SA Fossil BDO
2 Biaxially oriented Polylactic acid (BoPLA)	Polylactic acid (PLA): Lactic Acid (LA)	PLA-based food packaging film	Food sector	Biaxially oriented polypropylene (BoPP) film
3 Ecovio mulch film	Polylactic acid (PLA) mulch: Lactic acid (LA) 1,4-Butanediol (BDO)	Bio-based biodegradable mulch film	Agricultural sector	Linear low-density polyethylene (LLDPE) film converter

These bio-based products used for the case studies would be produced from two main feedstock: maize grain, maize stover and sugar beet pulp. The relevant countries regarding these feedstocks have been identified. For maize production, United States of America, China and Brazil were identified as the main producers. Moreover, Italy has been considered a relevant country since for the case studies of Polybutylene succinate (PBS), an important percentage of the feedstock used in Novamont come from maize cultivated in Italy and France. Regarding sugar beet pulp, the relevant producing countries are United Kingdom, Germany, France and Russia. The following sections describe the social indicators selected for the case studies. However, in the absence of primary data from the companies, data from technical, statistical and scientific reports will be collected.

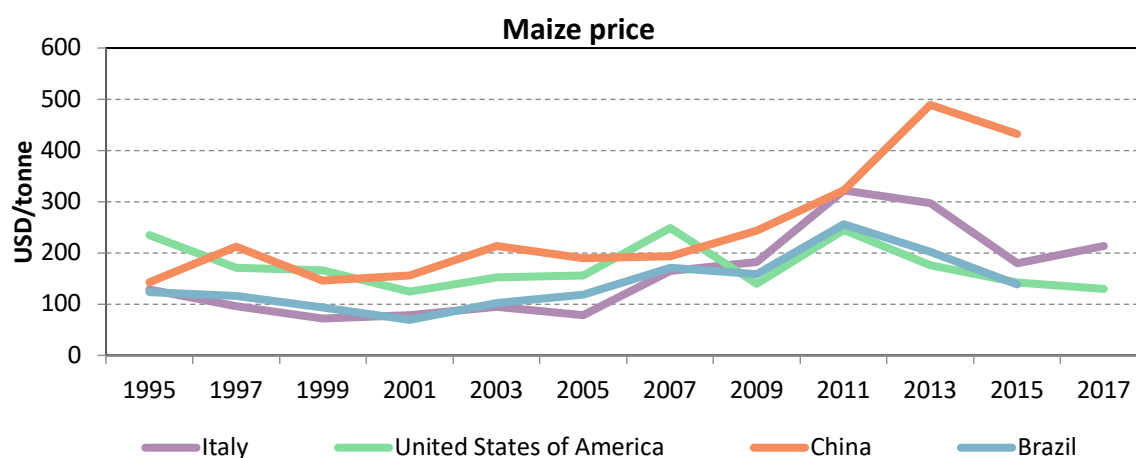
8.1 Feedstock prices

It is generally recognised that the price of the feedstock used in bio-based products have an important impact in the production processes, affecting the social performance of the product. In Figure 8, the evolution of prices regarding maize and sugar beet can be found for each of the countries considered relevant for these feedstocks.

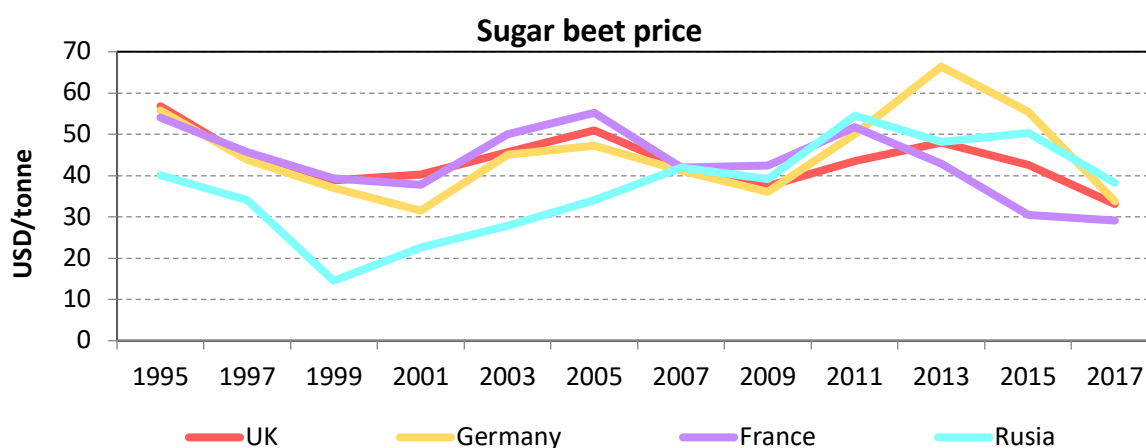


Figure 8. Evolution of feedstock price per country, regarding a) maize and b) sugar beet. Data from FAO, (2019)

a)



b)



8.2 Child labour

According to UNICEF¹, the indicator of child labour is defined as: "Percentage of children aged 5 to 14 years involved in child labour activities at the time of research". With the exception of Brazil, the UNICEF global statistics for 2017 do not show cases of child labour in the countries evaluated in this study (Italy, USA, China, UK, Germany, France and Russia). The results of the research in Brazil showed that 7% of the cases had child labour. It is important to keep in mind that child labour is a controversial issue in many developing countries and does not have the same meaning and acceptance as in the so-called developed countries.

8.3 Forced labour

¹ https://www.unicef.org/infobycountry/stats_popup9.html

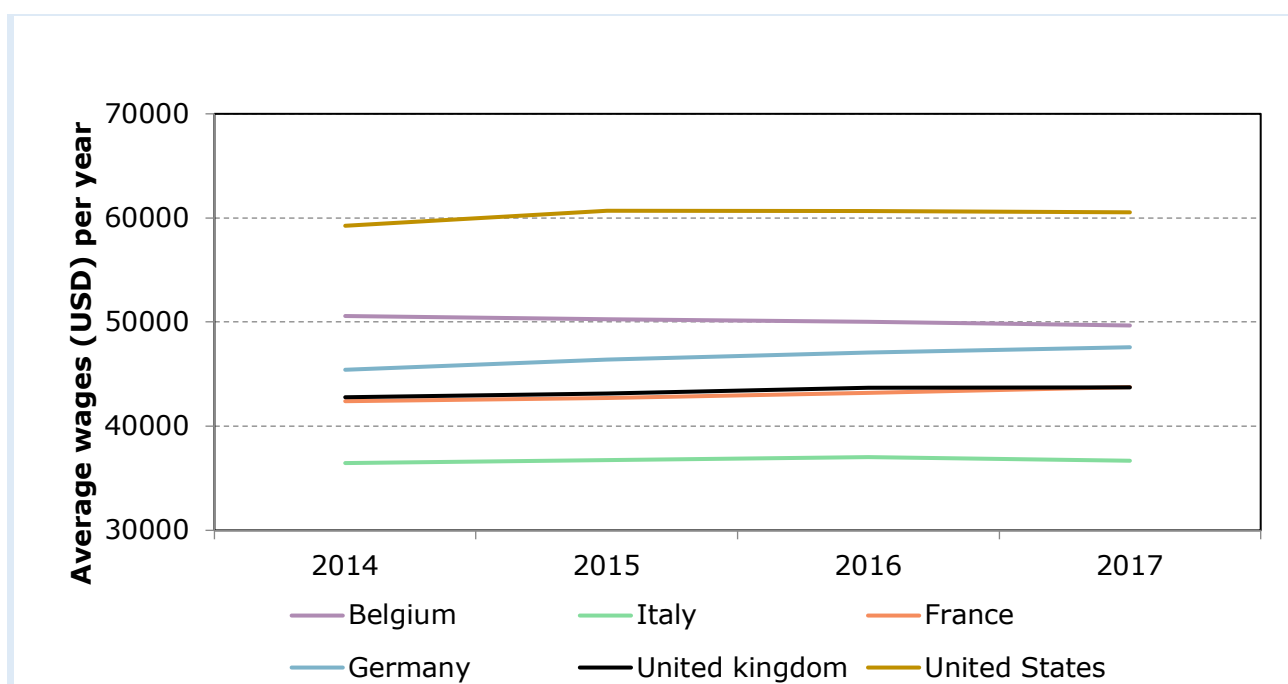


Forced labour, according to the International Labour Organization (ILO) represents "*situations in which persons are coerced to work through the use of violence or intimidation, or by more subtle means such as accumulated debt, retention of identity papers or threats of denunciation to immigration authorities*"². ILO stated that there are some 21 million victims of forced labour in the world. This represents three human beings in the forced labour situation among 1000 people. Women represent 55%, while men represent 45%. Adults (74%) are more prone to forced labour than children (26%). Approximately 90% of all forced workers are in the private sector. Most of the forced laborers in the private sector are located in agricultural fields, construction sites, housework and industries, accounting for about 68%. The remaining 22% and 10% come from sexual exploitation and forced labour by the state (for example, rebel army), respectively. The regions with the highest number of cases of forced labour are Africa and the Commonwealth of Independent States (with about 4 cases per 1000 inhabitants) and Europe has the lowest incidents (about 1.5 cases per 1000 inhabitants) (ILO, 2012).

8.4 Fair salary

The comparison of fair wages can be assessed in terms of average wages. Figure 9 shows the average salaries of some of the countries considered in this report from 2014 to 2017.

Figure 9. Average wages per year (USDA). Data from (OECD, 2019)



8.5 Equal opportunities/ discrimination

Ongoing work is being conducted to obtain data from technical, statistical and scientific reports.

8.6 Health and safety of workers

² https://www.ilo.org/global/topics/forced-labour/news/WCMS_237569/lang--en/index.html



The indicator of health and safety of workers can be measured in terms of occupational injuries (e.g. time lost, fatal, non-fatal). According to the ILO, around 2.3 million people are victims of workplace injuries every year. The main causes of occupational accidents occur in sites that deal with hazardous substances, in the construction sectors and in the case of people working in old and young age. It is estimated that there are more than 600,000 deaths per year due to the handling of hazardous materials³. Table 9 shows a summary of the occupational injuries reported by the ILO. However, the latest global health and safety statistics were published in 2003. The actual situation of working conditions may reflect another reality.

Table 9. Summary of occupational injuries in the year 2003. Data from (ILO, 2003)

Region	Fatal accident	Accident at work (at least 4 days absence)	Diseases at work	Mortality at work	Deaths by hazardous substances
African regions	55,489	52,168,676	360,360	415,848	120,658
Canada, Cuba and US	8,723	8,200,993	96,185	104,908	32,205
Rest of America continent	30,449	28,627,393	104,654	135,103	35,041
South eastern Asia	93,436	87,845,499	517,873	611,309	173,398
Rest of Asia	123,011	115,651,552	395,638	518,649	132,471
Western Europe	5,298	4,981,125	139,519	144,817	46,715
Eastern Europe	16,266	15,293,286	179,010	195,276	59,937
Oceania, Brunei and Singapore	2,370	2,228,468	45,745	48,115	15,317
France	782	735,214	19,279	20,061	9,014
Belgium	84	78,974	2,893	2,977	1,353
Italy	991	931,709	16,987	17,978	7,943
Germany	901	847,094	28,568	29,469	13,358
United Kingdom	224	210,598	20,778	21,002	9,716

8.7 Health and safety of end-users

Ongoing work is being conducted to obtain data from technical, statistical and scientific reports.



³https://www.ilo.org/moscow/areas-of-work/occupational-safety-and-health/WCMS_249278/lang--en/index.htm



8.8 Feedback mechanisms

Ongoing work is being conducted to obtain data from technical, statistical and scientific reports.

8.9 Transparency

The Organisation for Economic Co-operation and Development (OECD), define transparency as *"an environment in which the objectives of policy, its legal, institutional, and economic framework, policy decisions and their rationale, data and information related to monetary and financial policies, and the terms of agencies' accountability, are provided to the public in a comprehensible, accessible, and timely manner"*⁴. According to Transparency International⁵, the *"corruption perception index"* in 2017 shows that Europe is one of the best regions with less corruption, while sub-Saharan Africa has the worst performance. New Zealand and Denmark are one of the most transparent countries.

8.10 Benefits of the product

Ongoing work is being conducted to obtain data from technical, statistical and scientific reports.

8.11 Health and safety of local community

Ongoing work is being conducted to obtain data from technical, statistical and scientific reports.

8.12 Local employment

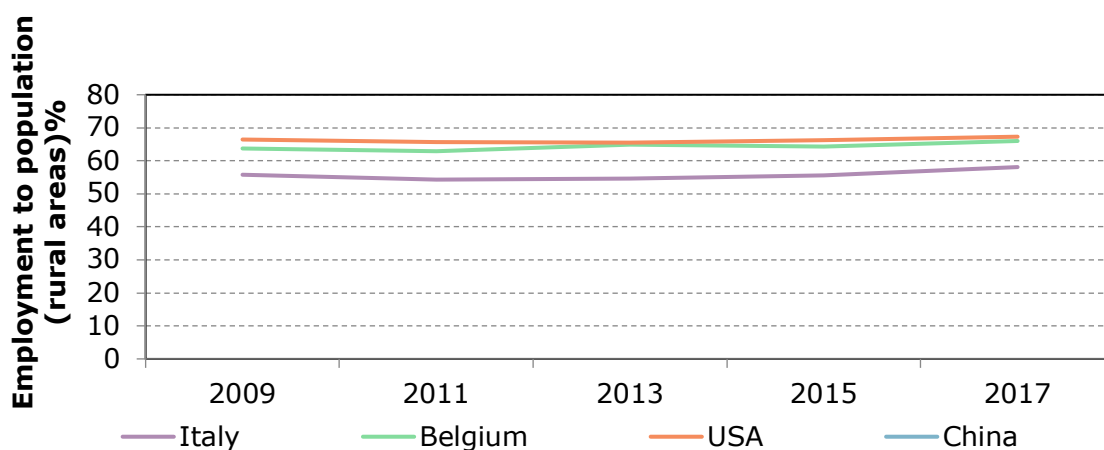
Local employment data can be gathered in FAOSTAT (FAO, 2019b), as regards employment in the rural areas and more specifically in the agricultural fields. The indicator "employment to population, in rural areas (Figure 10a) is assessed by the numbers of employees in rural areas as percentage related to the total population. It is important to consider that the distinction between rural and urban is not uniform across countries. The indicator "employment in agriculture" (Figure 10b) corresponds the relative significance of agriculture for employment. Employment may comprise paid employment or self-employment. Finally, the indicator "share of employee in agriculture" (Figure 10c) corresponds to the segment of employees in the agricultural sector between the total workforces.

Figure 10. Employment indicators. Data from (FAO, 2019b)

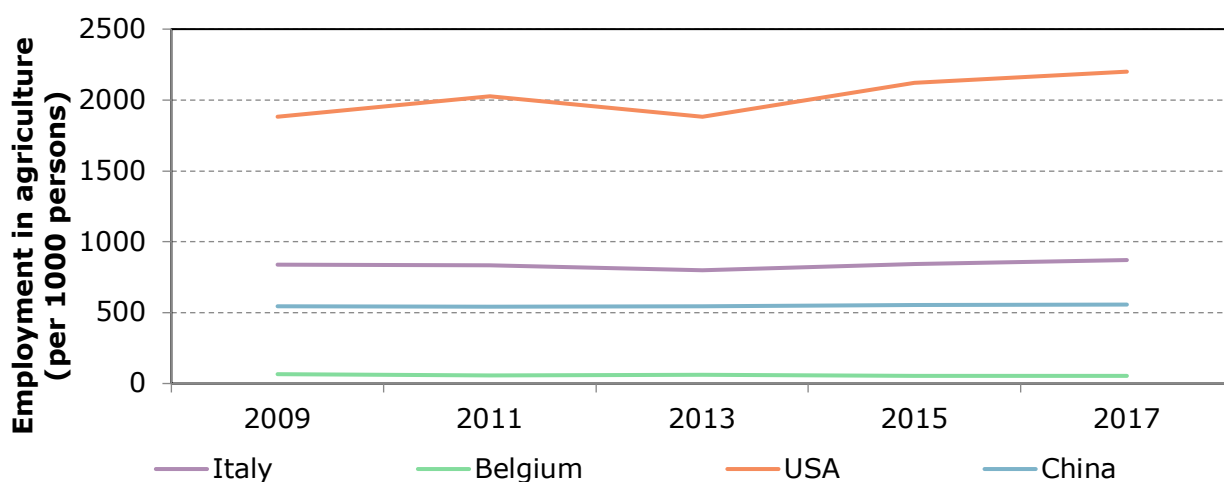
a)

⁴ <https://stats.oecd.org/glossary/detail.asp?ID=4474>

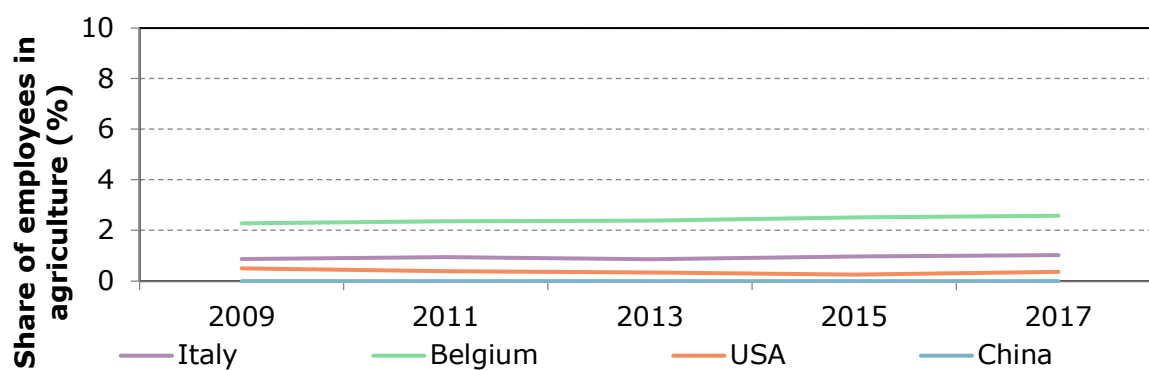
⁵ https://www.transparency.org/news/feature/corruption_perceptions_index_2017



b)



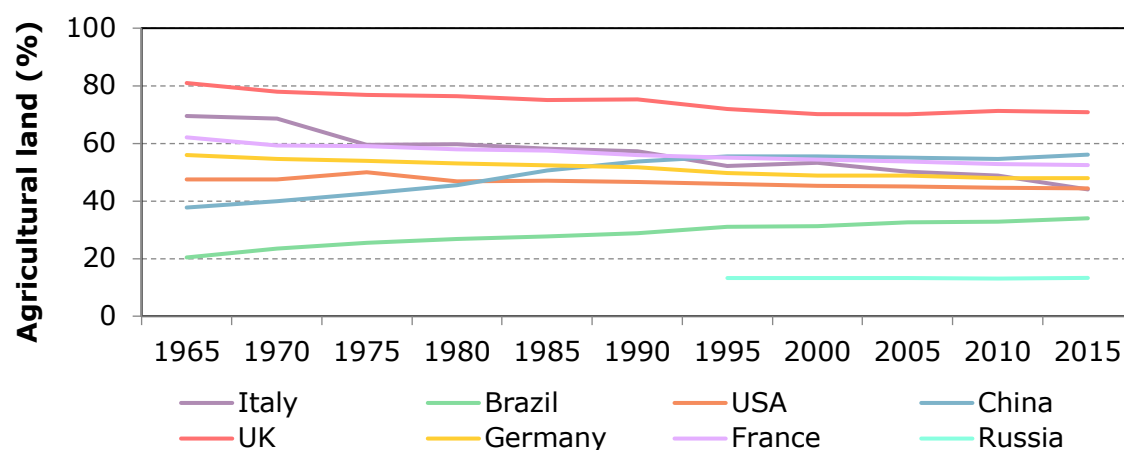
c)



8.13 Land use rights

In FAOSTAT⁶, information is also available regarding agriculture, which includes arable land (land under temporary crops, temporary meadows or pasture and land temporary fallow), permanent crops (land cultivated with crops that occupy the land for long periods) and permanent pastures (land used for herbaceous forage). This indicator is expressed as a percentage of the total land area. The results for the different countries can be found in Figure 10.

Figure 11. Agricultural land in each country under study. Data from (FAO, 2019c)



8.14 Food security

Regarding food security, FAO analysed a list of interesting indicators by performing household surveys (FAO, 2019d). Among the long list of indicators used to measure food security, it could be highlighted:

- i) Food consumption in monetary value
- ii) Dietary energy consumption
- iii) Share of food consumption in total income
- iv) Share of dietary energy consumption from protein
- v) Share of dietary energy consumption from fat
- vi) Share of dietary energy consumption from total carbohydrates
- vii) Share of purchased food in total food consumption
- viii) Share of won produced food in total food consumption

⁶ <http://www.fao.org/faostat>

However, this study was performed for a selected range of countries, such as Bangladesh, Bolivia, Cambodia, Guatemala, Haiti, Hungary, Kenya, Philippines... in different years and the countries selected as relevant for the case studies of the STAR-ProBio are not included.

Nevertheless, information regarding other indicators used for analysing food security can be found for these countries, including: i) average dietary energy supply adequacy measured as a percentage of energy requirements (Figure 11) and ii) average protein supply measured in g per capita and per day (Figure 12).

Figure 12. Evolution of average energy supply adequacy. Data from (FAO, 2019e)

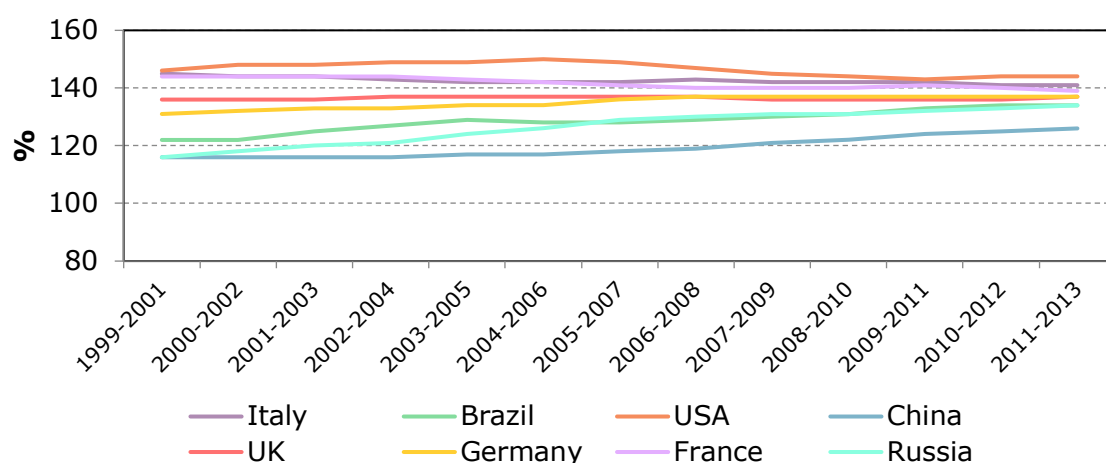
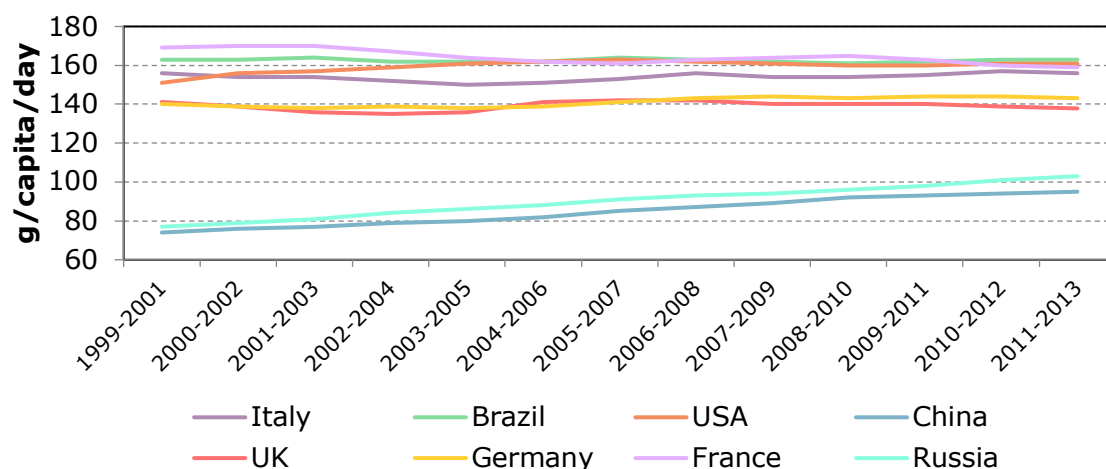


Figure 13. Evolution of average energy supply adequacy. Data from (FAO, 2019e)



8.15 Economic development

Ongoing work is being conducted to obtain data from technical, statistical and scientific reports.

8.16 Fair competition in the market

Ongoing work is being conducted to obtain data from technical, statistical and scientific reports.



9. Conclusions

It is essential to include social aspects in the sustainability assessment of the incoming bioeconomy. Today, however, social assessment remains a complicated issue. The objective of this document is to present the development of an appropriate methodology for the social evaluation of bio-based products. The ultimate goal is to implement the methodology as one of the pillars of a certification scheme designed to analyse the performance of the products being implemented in the current developing bioeconomy.

First, the relevant social aspects were selected to analyse the social performance of bio-based products. Secondly, the methodology developed by Goedkoop et al. (2018) to measure the selected impact subcategories was revised. This methodology was selected because it was considered to keep the amount of work at a feasible level, especially considering the intrinsic difficulty of quantifying social aspects. The above methodology was therefore adapted through the development of specific performance indicators (corresponding to the life cycle inventory phase) and reference scales (corresponding to the impact assessment phase). The results of the social assessment would be a score ranging from -2 to +2. Therefore, encourage the company to continue to improve its performance over time until it reaches the ideal performance of +2.

Once the basis of the methodology for analysing the social aspects of bio-based products has been established, the next step would be to make the "proof-of-concept". The aim would be to collect all the information from the performance indicators of some examples of bio-based products in order to analyse possible difficulties in the practical application of the proposed methodology.



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Notes on references and style:

In large reports, in which individual chapters are written more or less autonomously by one or more authors, the reference list should be placed as the last section in each chapter.

Reference style to be used: "European Union Interinstitutional Style Guide", which is the common style guide that is used by the different branches of the European Union. It is available in most bibliographic management tools and compatible with <http://citationstyles.org/> See also <http://www.citationmachine.net/european-union-interinstitutional-style-guide/cite-a-other> for simple automated citation formatting.

The European Union Interinstitutional Style Guide⁷ also provides detailed guidance on Punctuation, Singular or plural, Tenses of minutes, Spelling, Upper and lower case, Numbers, dates and time, Gender-neutral language, Italics and on Abbreviations and symbols: <http://publications.europa.eu/code/pdf/en-PIV-rev2105.pdf>

Due to the diverse nature of the consortium, we cannot use bibliographic software. References should be manually added in-line as a footnote (see example on this page). Further guidance on citations will be provided in a separate document.

⁷ European Union Interinstitutional Style Guide. European Union. 2011





Information Sheet STAR-ProBio

STAR-ProBio supports the European Commission in the full implementation of European policy initiatives, including the Lead Market Initiative in bio-based products, the industrial policy and the European Bio-economy Strategy.

STAR-ProBio does so by developing sustainability assessment tools for bio-based products, and by developing credible cases for bio-based products with the highest actual market penetration and highest potential for the future markets.

STAR-ProBio integrates scientific and engineering approaches with social sciences and humanities-based approaches to formulate guidelines for a common framework promoting the development of regulations and standards supporting the adoption of business innovation models in the bio-based products sector.

The aim of STAR-ProBio is to cover gaps in the existing framework for sustainability assessment of bio-based products and improve consumer acceptance for bio-based products by identifying the critical sustainability issues in their value chains.

STAR-ProBio constitutes a multidisciplinary project that will:

- meet environmental, social and economic challenges, paving the way for a much-needed sustainability transition towards a bio-based economy;
- promote a more efficient and harmonized policy regulation framework;
- boost the market-pull of bio-based products within the context on a sustainable 21st Century.

The overall objective of the project is to promote a more efficient and harmonized policy regulation framework for the market-pull of bio-based products. This will be achieved by developing a fit-for-purpose sustainability scheme, including standards, labels and certifications.

An integral part of STAR-ProBio is the adoption of life-cycle methodologies to measure Environmental, techno-economic and social impacts, and comprehensively assess the roll-out of bio-based products. The analysis of selected case studies on construction materials, bio-based polymers, and fine chemicals, will ensure that the approach is not too broad and theoretic, allowing the benchmarking against non-bio-based products.

The specific objectives of STAR-ProBio are to:

- Develop a fit-for-purpose sustainability scheme;
- Identify gaps regarding sustainability indicators, requirements and criteria;
- Develop a sound and harmonised approach for environmental LCA, Social-LCA and techno-economic LCC assessment of bio-based products;
- Enhance the reliability of sustainability certifications and standards;
- Assess the effectiveness of the proposed sustainability scheme for selected case studies;
- Develop an approach to identify and mitigate the risk of negative ILUC effects;
- Encourage market pull for bio-based products through the assessment of consumers' preferences and acceptance;
- Spread awareness about sustainable production of bio-based products among farmer associations, industries, EU bodies, entrepreneurs and stakeholders from the civil society.





The STAR-ProBio consortium is integrated by:

- UNITELMA Sapienza University of Rome, Italy (Consortium leader)
- University of York, United Kingdom
- Technische Universität Berlin, Germany
- Agricultural University of Athens, Greece
- DBFZ, Germany
- SQ Consult B.V., The Netherlands
- University of Bologna, Italy
- Uniwersytet Warmiński Mazurski w Olsztynie, Poland
- ChemProf, Poland
- Quantis SARL, Switzerland
- Novamont SPA, Italy
- Naturvårdsverket, Sweden
- Universidad de Santiago de Compostela, Spain
- European Environmental Citizens Organisation for Standardisation, Belgium
- agroVet GmbH, Austria

STAR-ProBio receives funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no. 727740, Work Programme BB-01-2016: Sustainability schemes for the bio-based economy.

Additional information can be found here: www.star-probio.eu





11. Annex

11.1 Questionnaire about impact subcategories' relevance

Questionnaire to support the selection of impact subcategories in the social assessment of bio-based products

Bio-based products represent a great opportunity to reconcile sustainable long-term growth with environmental protection, a priority of the European Growth Strategy, through the prudent and responsible use of renewable resources for agriculture and industry. Managing those resources and their derived products in a sustainable manner implies major challenges.

Specially focusing on social aspects, related impacts are analysed for the five categories of stakeholders: i) workers, ii) consumers, iii) local community, iv) society, v) value chain actors. For each stakeholder subcategory different social topics or impact subcategories can be analysed. The objective of this questionnaire is to assist the selection of these social topics, which will be used in the assessment of the social impacts of bio-based products and possible implementation of a sustainability certification scheme.

The questionnaire is structured according to three sequential stages. The respondent is kindly asked to:

1. Respond to the initial general questions;
2. Respond to specific questions related with their preference among impact subcategories.





1. General questions

a. Gender

Male	
Female	

Age

< 30	
30 – 49	
50 – 69	
> 70	

b. Profile/position

Farmer association	
Trade union related to workers	
Consumer association	
Local public procurers	
Local NGOs	
Representatives of local government	
Research institutes	
Certification bodies	
Processors of bio-based products	
Producers of bio-based products	
Other, specify	

c. Years of working experience





< 5	
5-9	
10-20	
>20	





2. Specific questions

- a. For the stakeholder category of "**workers**", which social topics are more appropriate to analyse the potential social impacts of **bio-based products**? Give the importance from 1 to 5, where 1 is the lowest importance and 5 the highest.

Impact category	Impact subcategory	Definition	1	2	3	4	5
Labour rights and decent work	Child labour	It measures if the organization might or is employing children and the existence and quality of the prevention and mitigating measures taken by the organization					
	Forced labour	It measures if there is any work or service that is exacted from any person under the menace of any penalty					
	Fair salary	It measures whether the wage provided is meeting legal requirements					
Human rights	Equal opportunities/discrimination	It measures if the organization includes any preference made in hiring, remuneration, training, promotion, or retirement on the basis of race, colour, sex, religion, political opinion, national extraction or social origin.					
Health and safety	Health and safety of workers	It measures the rate of incidents and the status of prevention measures					

- b. For the stakeholder category of "**consumers**", which social topics are more appropriate to analyse the potential social impacts of **bio-based products**? Give the importance from 1 to 5, where 1 is the lowest importance and 5 the highest.

Impact category	Impact subcategory	Definition	1	2	3	4	5
Health and safety	Health and safety of end users	It measures if the consumers' rights to be protected against products and services that may be hazardous to health or life are fulfilled.					
Social acceptability	Feedback mechanism	the existence and effectiveness of paths by which consumers communicate with organizations, such as surveys, return policies, quality assurances, guarantees, warranties, etc.					
	Transparency	It measures if the organization communicates on all issues regarding its product and social responsibility in a transparent way.					
	Benefits of the product	It measures the benefits associated with the use of a product, including positive impacts in the consumer, percentage of natural resources used, etc.					

- c. For the stakeholder category of "**local community**", which social topics are more appropriate to analyse the potential social impacts of **bio-based products**? Give the importance from 1 to 5, where 1 is the lowest importance and 5 the highest.





Impact category	Impact subcategory	Definition	1	2	3	4	5
Health and safety	Health and safety of local community	It measures if the organization impacts in community safety and health, for example through equipment accidents or structural failures.					
Contribution to economy	Local employment	It measures the role of an organization in directly or indirectly affecting local hiring, including locally-based suppliers.					
	Economic development	It measures to what extent the organization/product or service contributes to the economic development of the country; for example, by generating revenue, creating jobs, providing education and training, making investments, or forward research.					

- d. For the stakeholder category of “**general society**”, which social topics are more appropriate to analyse the potential social impacts of **bio-based products**? Give the importance from 1 to 5, where 1 is the lowest importance and 5 the highest.

Impact category	Impact subcategory	Definition	1	2	3	4	5
Social acceptability	Land use issues	It measures whether land grabbing or any difficulties on access and tender to land (due to changes in land prices, land property rights, etc.) are taking place.					
Food security	Food security	It measures the impact on food availability region, food access, food distribution, impacts on food and feed prices...					

- e. For the stakeholder category of “**value chain actors**”, which social topics are more appropriate to analyse the potential social impacts of **bio-based products**? Give the importance from 1 to 5, where 1 is the lowest importance and 5 the highest.

Impact category	Impact subcategory	Definition	1	2	3	4	5
Fair competition in the market	Fair competition in the market	It measures if the organization’s competitive activities are conducted in a fair way and in compliance with legislations preventing anti-competitive behaviour, anti-trust, or monopoly practices.					





11.2 Questionnaire to gather and measure social impacts

1.1.1 Performance indicators

Workers

Product				Description/evidence
What is the country where the product is produced?				
• Country				
What is the reporting period ? (e.g. 1 year (2018), 5 years (2013-2018))				
• Reporting period				
How many people work direct in the production system?				
What is the main product obtained? What is the yield produced?				
• Main product name			kg product/ha·year	
Is there any other co-product obtained from the field? What is the yield produced?				
• Co-product 1 name			kg co-product/ha·year	
• Co-product 2 name			kg co-product/ha·year	
• Co-product 3 name			kg co-product/ha·year	

Child labour				Description/evidence
The company or facility has policies against employing children				
Yes/no				
The company has a system in place to implement the policy prohibiting child labour				
Yes/no				
If incidents of child labour have been discovered, the company has developed a corrective action plan with a clear timeline for completion				
Yes/no				
The company or facility has a PDCA (plan-do-check-act) process in place to raise awareness of issues associated with child labour				
Yes/no				
Company commitments and progress on the PDCA (plan-do-check-act) are reported publicly				
Yes/no				





Forced labour		Description/evidence
The company or facility has a policy which prohibits retention of all or part of a worker's salary, benefits, property or original documents.		
Yes/no		
The company or facility has a system in place to implement the policy prohibiting retention of all or part of a workers' salary, benefits, property or original documents.		
Yes/no		
Evidence that there is no force labour (e.g. providing transparency on procedures or the absence of credible claims that there is forced labour).		
Yes/no		
If incidents of forced labour have been discovered, the company or facility has developed a corrective action plan with a clear timeline for completion.		
Yes/no		
The company or facility has a PDCA (plan-do-check-act) process in place to raise awareness of issues associated with forced labour.		
The company or facility publicly reports its commitments, performance, progress and effectiveness of the PDCA programme (plan-do-check-act).		

Fair salary		Description/evidence
Percentage of workers whose wages meet at least legal or industry minimum standards and their provision fully complies with all applicable laws		
Percentage		
Incidents of delayed payments have been reported		
Yes/no		
Percentage of workers paid a living wage (e.g. the percentage of the salary spent in basic needs such as accommodation and food do not exceed 40%)		
Percentage		
Percentage of workers who receive additional social benefits on top of what is provided by the government (e.g. retirement, health insurance, disability)		
Percentage		





Equal opportunities/discrimination		Description/evidence
The company or facility has a non-discrimination policy		
Yes/no		
The company or facility has a system in place to enforce the non-discrimination policy		
Yes/no		
If incidents of discrimination have been discovered, the company or facility has established a corrective action plan with a clear timeline for completion		
Yes/no		
The company or facility has a PDCA process in place to pro-actively promote non-discrimination		
Yes/no		
the company or facility reports publicly on their commitments, performance, progress and effectiveness of the programmes		
Yes/no		
The top management of the company or facility have publicly recognised non-discrimination as a key priority		
Yes/no		





Health and safety of workers		Description/evidence
The company or facility complies with health and safety standards or local laws		
Yes/no		
Workers have access to all the required personal protective equipment		
Yes/no		
The occupational health and safety of workers is monitored		
Yes/no		
In case of a non-compliance with health and safety standards or local laws, the company or facility has developed a corrective action plan with clear timeline for completion		
Yes/no		
The company has a PDCA (plan-do-check-act) model in place to pro-actively protect workers' health and safety, beyond compliance with local laws.		
Yes/no		
Company's commitments and progress on occupational health and safety are disclosed publicly (to external stakeholders).		
Yes/no		
The top management of the company has publicly declared/recognised health and safety of workers as key priority and the company aims to be the best in class		
Yes/no		





Consumers

Health and safety of end users		Description/evidence
There is solid science-based evidence that normal use of the product is safer for active or passive users than alternative solutions and that the product or service eliminates a risk in common products and services used for the same purpose.		
Yes/No		
There company has a dossier or other evidence that shows how the product or service has been designed to create maximum safety for active and passive users.		
Yes/No		
The product conforms to all national requirements regarding product safety.		
Yes/No		
The normal use of the product or services can cause higher risks compared to alternative solutions.		
Yes/No		
Any use of the product can be regarded as unsafe.		
Yes/No		
The company has user-facing programmes in place to raise awareness and educate users on safety risks associated with the product.		
Yes/No		

Feedback mechanisms		Description/evidence
Presence of a mechanism for customers to provide feedback		
Yes/No		
Presence of management measures to improve feedback mechanisms exist		
Yes/No		
There are other practices related to customer satisfaction, including surveys measuring customer satisfaction		
Yes/No		
The company takes action according to the results of these practices		
Yes/No		





Transparency		Description/evidence
There has been compliance with regulations regarding transparency		
Yes/No		
There have been no consumer complaints regarding transparency		
Yes/No		
A sustainability report has been published about the economic, environmental and social impacts of its activities		
Yes/No		
The sustainability report has driven the company to set goals and to provide changes more effectively		
Yes/No		

Benefits of the product		Description/evidence
The product is generally recognised as having a positive impact on the consumer's well-being		
Yes/No		
A company specific study exists to analyse the positive and negative feelings of the consumers when using the product		
Yes/No		
Percentage of the product that is produced from natural resources		
Percentage		





Local community

Health and safety of local community		Description/evidence
No incidents of actual damage, adverse impacts or risks to community health and safety have been discovered.		
Yes/no		
If incidents of actual damage, adverse impacts or risks to community health and safety have been discovered, a corrective action plan with a timeline for completion have been developed by the company or facility.		
Yes/no		
The company or facility has a policy on local community health and safety to meet the requirements set by local laws or international standards		
Yes/no		
The company or facility has a system or mechanism in place to enforce the policy on local community health and safety		
Yes/no		
The company or facility has a PDCA programme in place to address health and safety of local communities beyond the requirements set in the local laws. The programme includes (but it is not limited to): i) A strategy to prevent and mitigate adverse impacts on local communities, ii) regular monitoring and analysis of the data, iii) proactive action to improve community health and safety, for instance by education and awareness raising, better technology, pollution control, etc.		
Yes/no		
The company or facility publicly reports and discloses its commitments, performance, progress and effectiveness of the PDCA programmes/initiatives/activities		
Yes/no		

Local employment		Description/evidence
The company or facility has publicly committed to grow local employment or at least keep the workforce stable in the long term		
Yes/no		
Number indefinite or temporary jobs (but higher than 6 months) created during the reporting period		
Number		
Number indefinite or temporary jobs (but higher than 6 months) lost during the reporting period		
Number		





Land rights		Description/evidence
Percentage of small-scale entrepreneurs who have documented legal rights to land		
Yes/No		
Percentage of small-scale entrepreneurs who feel that their land rights are secure		
Yes/No		
Risk of land grabbing and tenure security in the region is monitored		
Yes/No		



**General society**

Food security		Description/evidence
The company or facility has implemented measures to improve and ensure local food security supply		
Yes/No		
The company or facility has a PDCA (plan-do-check-act) to identify and reduce risks on local food security and to identify and prevent changes in food and feed prices		
Yes/No		
Percentage of hectares that have changed in the variety of crops and arable land in the region since the appearance of feedstock demand for bio-products		
Yes/No		

Economic development		Description/evidence
The company or facility has a policy prioritising buying goods and services from local suppliers		
Yes/no		
The company or facility actively contributes to skill development in connection to its future need for staffing and the staffing of its subcontractors and smallholders		
Yes/no		
The percentage of employees to total economically active population has grown in the last 5 years		
Yes/no		
The market share of the company has grown in the last 5 years		
Yes/no		



**Value chain actors**

Fair competition in the market		Description/comments
No legal actions pending or completed during the reporting period regarding anti-competitive behaviour and violations of anti-trust and monopoly legislation in which the reporting organization has been identified as a participant		
Yes/No		
No membership in alliances that behave in an anti-competitive way		
Yes/No		
Documented statement or procedures (policy, strategy, etc.) to prevent engaging in or being complicit in anti-competitive behaviour		
Yes/No		
Employee awareness of the importance of compliance with competition legislation and fair competition		
Yes/No		





1.1.2 Reference scales

Workers

Child labour	
+2	The company or facility has a PDCA process in place to raise awareness of issues associated with child labour.
	The commitments, performance, progress and effectiveness of programmes are reported publicly.
+1	The company or facility has a PDCA process in place to raise awareness of issues associated with child labour.
0	The company or facility has a system in place to enforce the policy prohibiting child labour and
	There is evidence that there is not child labour.
-1	Incidents of child labour have been discovered within the company or facility and a corrective action plan with a clear timeline for completion has been developed or
	The company or a facility has a policy prohibiting child labour but does not have a system in place to enforce it.
-2	Incidents of child labour have been discovered, but a corrective action plant with a clear timeline for completion has not been developed.

Forced labour	
+2	The company or facility has a PDCA process in place to raise awareness of issues associated with forced labour.
	The commitments, performance, progress and effectiveness of programmes are reported publicly.
+1	The company or facility has a PDCA process in place to raise awareness of issues associated with forced labour.
0	The company or facility has a system in place to implement the policy prohibiting retention of all or part of a worker's salary, benefits, property or original documents and
	There is evidence of no forced labour
-1	Incidents of forced labour have been discovered within the company or facility and a corrective action plan with a clear timeline for completion has been developed or
	The company or facility has a policy which prohibits retention of all or part of a worker's salary, benefits, property or original documents but does not have a system to enforce the policy
-2	Incidents of forced labour have been discovered within the company or facility, but a corrective action plan with a clear timeline for completion has not been developed.





Fair salary	
+2	All workers are paid a living wage and receive additional social benefits.
+1	All workers are paid a living wage.
0	All workers are paid the legal or industry minimum wage.
-1	All workers are paid the legal or industry minimum wage, but incidents of delayed payments have been reported.
-2	Not all workers are paid the legal or industry minimum wage.

Equal opportunities/discrimination	
+2	The company or facility has a PDCA process in place to pro-actively promote non-discrimination.
	The commitments, performance, progress and effectiveness of programmes are reported publicly.
	The top management of the company or facility have publicly recognised non-discrimination as a key priority.
+1	The company or facility has a PDCA process in place to pro-actively promote non-discrimination.
0	The company or facility has a system in place to monitor and enforce the non-discrimination policy.
-1	Incidents of discrimination have been discovered within the company or facility, and a corrective action plan with a clear timeline for completion has been developed or
	The company or facility has a non-discrimination policy but does not have a system in place to enforce the policy.
-2	Incidents of discrimination have been discovered within the company or facility
	A corrective action plan with a clear timeline for completion has not been developed.





Health and safety	
+2	The company has a PDCA process in place to pro-actively protect workers' health and safety (beyond compliance with local laws).
	Company commitments and progress on occupational health and safety are disclosed publicly.
	The top management of the company has publicly declared/recognised health and safety of workers as key priority and the company aims to be the best in class.
+1	The company has a PDCA model in place to pro-actively protect workers' health and safety (beyond compliance with local laws).
0	Sufficient evidence indicates compliance with health and safety standards or local laws or
	The occupational health and safety of workers is monitored, and workers have access to all the required personal protective equipment
-1	Evidence indicates that the company does not comply with health and safety standards and a corrective action plan with a clear timeline for completion has been developed
-2	Evidence indicate that the company or facility does not comply with health and safety standards or local laws but a corrective action plan with a clear timeline for completion has not been developed or
	No data is available





Consumers

Health and safety	
+2	There is solid science-based evidence that normal use of the product is safer for users or passive users than alternative solutions and that the product or service eliminates a risk in common products and services used for the same purpose and
	The company has user-facing programmes in place to raise awareness and educate users on safety risks associated with the product
+1	The company has a dossier or other evidence that shows how the product or service has been designed to create maximum safety for active and passive users.
0	The product conforms to all national requirements regarding product safety
-1	The normal use of the product or service can cause higher risks compared to alternative solutions
-2	Any use of the product can be regarded as unsafe

Feedback mechanisms	
+2	Presence of a mechanism for customers to provide feedback
	Presence of management measures to improve feedback mechanisms exist
	There are other practices related to customer satisfaction, including surveys measuring customer satisfaction
	The company takes action according to the results of these practices
+1	Presence of a mechanism for customers to provide feedback
	Presence of management measures to improve feedback mechanisms exist
	There are other practices related to customer satisfaction, including surveys measuring customer satisfaction
0	Presence of a mechanism for customers to provide feedback
	Presence of management measures to improve feedback mechanisms exist
-1	Presence of a mechanism for customers to provide feedback
-2	No presence of a mechanism for customers to provide feedback





Transparency	
+2	There has been compliance with regulations regarding transparency
	There have been no consumer complaints regarding transparency
	A sustainability report has been published about the economic, environmental and social impacts of its activities
	The sustainability report has driven the company to set goals and to provide changes more effectively
+1	There has been compliance with regulations regarding transparency
	There have been no consumer complaints regarding transparency
	A sustainability report has been published about the economic, environmental and social impacts of its activities
0	There has been compliance with regulations regarding transparency
	There have been no consumer complaints regarding transparency
-1	There has been compliance with regulations regarding transparency
-2	There has not been compliance with regulations regarding transparency





Benefits of the product	
+2	The product is generally recognised as having a positive impact on the consumer's well-being
	A company specific study exists to analyse the positive and negative feelings of the consumers when using the product
	Percentage of the product that is produced from natural resources >70%
+1	The product is generally recognised as having a positive impact on the consumer's well-being
	A company specific study exists to analyse the positive and negative feelings of the consumers when using the product
	Percentage of the product that is produced from natural resources >50%
0	The product is generally recognised as having a positive impact on the consumer's well-being
	Percentage of the product that is produced from natural resources >50%
-1	The product is generally recognised as having a positive impact on the consumer's well-being
	Percentage of the product that is produced from natural resources ≤50%
-2	Percentage of the product that is produced from natural resources ≤40%





Local community

Health and safety	
+2	The company or facility has a PDCA programme in place to address the health and safety of local communities beyond the requirements set in local laws.
	Commitments, performance, improvement and effectiveness of programmes are disclosed publicly.
+1	The company or facility has a PDCA programme in place to address the health and safety of local communities beyond the requirements set in local laws.
0	No incidents of actual damage, adverse impacts or risks to community health and safety have been discovered or
	The company or facility has a system or a mechanism in place to enforce the policy on local community health and safety impacts to meet the requirements set by local laws or international standards
-1	Incidents of actual damage, adverse impacts or risks to community health and safety have been discovered and a corrective action plan with a timeline for completion has been developed or
	The company or facility has a policy to ensure the health and safety of local communities, but does not have a mechanism or system in place to enforce the policy.
-2	Incidents of actual damage, adverse impacts or risks to community health and safety have been discovered, but a corrective action plan with a timeline for completion has not been developed





Local employment	
+2	The company or facility has publicly committed to grow local employment.
	Number of new jobs created > number of jobs lost.
	Number of new jobs created > 2% of total number of jobs in the company of facility
+1	The company or facility has publicly committed to grow local employment.
	Number of new jobs created > number of jobs lost.
	Number of new jobs created ≤ 2% of total number of jobs in the company of facility
0	The company or facility has publicly committed to grow local employment.
	Number of new jobs created = number of jobs lost.
-1	The company or facility has publicly committed to grow local employment.
	Number of new jobs created < number of jobs lost.
-2	Number of new jobs lost < 2% of total number of jobs in the company of facility
	The company or facility has publicly committed to grow local employment.
	Number of new jobs created < number of jobs lost.

Land rights	
+2	Evidence can be given that no land grabbing takes place in the region.
	Most of the small-scale entrepreneurs feel that their land rights are secure.
+1	Land tenure security in the region is regularly monitored and risks of land grabbing are assessed.
0	Most of the small-scale entrepreneurs have documented legal rights to land.
-1	Most of the small-scale entrepreneurs do not have documented legal rights to land or
	Evidence indicates that there is a substance risks of land grabbing. Most the small-scale entrepreneurs think that their land rights are not secure.
-2	Security of land rights is not monitored or known.





General society

Food security	
+2	The company or facility has implemented measures to improve and ensure local food security supply
	The company or facility has a PDCA (plan-do-check-act) to identify and reduce risks on local food security and to identify and prevent changes in food and feed prices
	Percentage of hectares that have changed in the variety of crops and arable land in the region since the appearance of feedstock demand for bio-products $\leq 15\%$
+1	The company or facility has a PDCA (plan-do-check-act) to identify and reduce risks on local food security and to identify and prevent changes in food and feed prices
	Percentage of hectares that have changed in the variety of crops and arable land in the region since the appearance of feedstock demand for bio-products $\leq 15\%$
0	The company or facility has a PDCA (plan-do-check-act) to identify and reduce risks on local food security and to identify and prevent changes in food and feed prices
	Percentage of hectares that have changed in the variety of crops and arable land in the region since the appearance of feedstock demand for bio-products $\leq 25\%$
-1	Percentage of hectares that have changed in the variety of crops and arable land in the region since the appearance of feedstock demand for bio-products $\leq 25\%$
-2	Percentage of hectares that have changed in the variety of crops and arable land in the region since the appearance of feedstock demand for bio-products $> 25\%$





Economic development	
+2	The company or facility has a policy prioritising buying goods and services from local suppliers
	The company or facility actively contributes to skill development in connection to its future need for staffing and the staffing of its subcontractors and smallholders
	The percentage of employees to total economically active population has grown in the last 5 years
	The market share of the company has grown in the last 5 years
+1	The company or facility has a policy prioritising buying goods and services from local suppliers
	The company or facility actively contributes to skill development in connection to its future need for staffing and the staffing of its subcontractors and smallholders
	The percentage of employees to total economically active population has grown in the last 5 years
0	The company or facility has a policy prioritising buying goods and services from local suppliers
	The company or facility actively contributes to skill development in connection to its future need for staffing and the staffing of its subcontractors and smallholders
-1	The company or facility actively contributes to skill development in connection to its future need for staffing and the staffing of its subcontractors and smallholders
-2	The company or facility does not actively contribute to skill development in connection to its future need for staffing and the staffing of its subcontractors and smallholders





Value chain actors

Fair competition in the market	
+2	No legal actions pending or completed during the reporting period regarding anti-competitive behaviour and no violations of anti-trust and monopoly legislation in which the reporting organization has been identified as a participant
	Membership in alliances that behave in an anti-competitive way
	Documented statement or procedures (policy, strategy, etc.) to prevent engaging in or being complicit in anti-competitive behaviour
	Employees are aware of the importance of compliance with competition legislation and fair competition
+1	No legal actions pending or completed during the reporting period regarding anti-competitive behaviour and no violations of anti-trust and monopoly legislation in which the reporting organization has been identified as a participant
	Membership in alliances that behave in an anti-competitive way
	Documented statement or procedures (policy, strategy, etc.) to prevent engaging in or being complicit in anti-competitive behaviour
0	No legal actions pending or completed during the reporting period regarding anti-competitive behaviour and no violations of anti-trust and monopoly legislation in which the reporting organization has been identified as a participant
	Documented statement or procedures (policy, strategy, etc.) to prevent engaging in or being complicit in anti-competitive behaviour
-1	No legal actions pending or completed during the reporting period regarding anti-competitive behaviour and no violations of anti-trust and monopoly legislation in which the reporting organization has been identified as a participant
-2	Legal actions pending or completed during the reporting period regarding anti-competitive behaviour and violations of anti-trust and monopoly legislation in which the reporting organization has been identified as a participant

