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Deliverable 7.1	LCA, LCC and Social LCA goal and scope definition
Associated WP	WP7
Associated Task(s)	Task 7.1 Environmental Life Cycle assessment (LCA) and eco-design Task 7.2 Life Cycle Cost and cost-feasibility Task 7.3 Social LCA assessments
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List of Abbreviations

LCA	Life Cycle Assessment
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact/Interpretation Assessment
SLCA	Social Life Cycle Assessment
LCC	Life Cycle Cost
ILCD	International Reference Life Cycle Data System

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Executive summary

Sustainability is most often defined as meeting the needs of the present without compromising the ability of future generations to meet theirs. Broadly speaking, a company implements sustainable practices by reducing its consumption of limited resources, or finding alternative resources with lower environmental consequences. Sustainability has three main pillars: economic, environmental, and social. These three pillars are informally referred to as people, planet, and profits.

This document will define the system boundaries and functional units related to Tasks 7.1, 7.2 and 7.3. The environmental assessment within the project will be carried out by applying the internationally and recognized methodology LCA. The main objective of task 7.1 is to analyze and advice the development of biobased packaging and compare the environmental performance with current materials available in the market from an environmental point of view. Additionally, LCC is performed in Task 7.2 as an analytical methodology for calculating the total cost of a product during its design, fabrication, use and recycling. LCC will provide the cost profiles of the systems analyzed and contribute to the selection and design of materials.

The LCA and LCC will provide detailed knowledge which can be used to convince clients of the benefits of the novel group of bio-based materials and evaluate the social impact (Task 7.3). This will enable a larger group of (industrial and R&D&I) stakeholders to integrate this knowledge and to increase their own innovation capacity/benefit by taking well-funded decisions on the benefits of using the new biobased materials.

Data collection for LCA and LCC will start in the next period in connection with project technological advances. Online survey for SLCA are currently in progress and collected data will be discussed in the next deliverable version.

1. Introduction to environmental, cost and social assessment

Life Cycle Assessment (LCA) is used as a methodology to evaluate the environmental impact of the circular use of bio-based packaging in PRESERVE project. International standards assist in the specification, definition, methods and protocols associated with LCA studies. ISO 14040 describes the principles and framework for life cycle assessment and ISO 14044 provides specific requirements and guidelines for conducting an LCA.

Life Cycle Assessment encompasses all processes, environmental releases and resources consumption. It begins with the extraction of raw materials, manufacturing, use and final deposition of the product. In consequence, LCA can help the decision makers to characterize the environmental trade-offs associated with product or process alternatives, and select those that are less aggressive on the environment.

Besides that, Life Cycle Costing (LCC) is used as an analytical methodology to measure and analyze the capital, operational costs and cost variations resulting from applying the proposed technologies for each of the stages in the materials life cycle and packaging product's supply chain. The LCC will contribute to the development of business plan and will push the introduction of the biobased packaging to the market by quantifying economic viability and cost effectiveness of the new developed materials.

Social life cycle assessment (S-LCA) is a method that can be used to assess the social and sociological aspects of products, their actual and potential positive as well as negative impacts along the life cycle. It includes the extraction and processing of raw materials, manufacturing, distribution, use, reuse, maintenance, recycling and final disposal. S-LCA makes use of generic and site-specific data, can be quantitative, semi-quantitative or qualitative, and complements the environmental LCA and LCC. It can either be applied on its own or in combination with the other techniques.

2. Life Cycle Assessment

The goal of LCA is to compare the full range of environmental effects assignable to products and services in order to improve processes, support policy and provide a sound basis for informed decisions. The term life cycle refers to the notion that a fair, holistic assessment requires the assessment of raw-material production, manufacture, distribution, use and end-of-life including all intervening transportation steps necessary or caused by the product's existence.

LCA can assist in:

- discovering the chances to improve the environmental performance of products at various points in their life cycle;
- informing decision-makers in industry, government or non-government organizations (e.g. for the purpose of decision making, planning, priority setting, product or process design or redesign);
- choosing relevant indicators of environmental performance;

- marketing (e.g. implementing an ecolabelling scheme, making an environmental claim, or producing an environmental product declaration);

There are four phases in an LCA study in accordance with the ISO 14040:2021 and ISO 14044:2021 standards (See Figure 1), which are also explained in more detail in the following subchapters:

1. Goal and scope definition – Include the scope and the system boundary of the study.
2. Life Cycle Inventory analysis (LCI) – It is an inventory of input/output data of the system under consideration. It involves collection of the data necessary to meet the goals of the defined study.
3. Life Cycle Impact Assessment (LCIA) – The purpose of LCIA is to provide additional information to help assess a product system's LCI results so as to better understand their environmental impacts.
4. Interpretation – Life cycle interpretation is the final phase of the LCA procedure, in which the results of an LCI or LCIA, or both, are aggregated and discussed as a basis for conclusions, recommendations and decision-making in accordance with the goal and scope definition

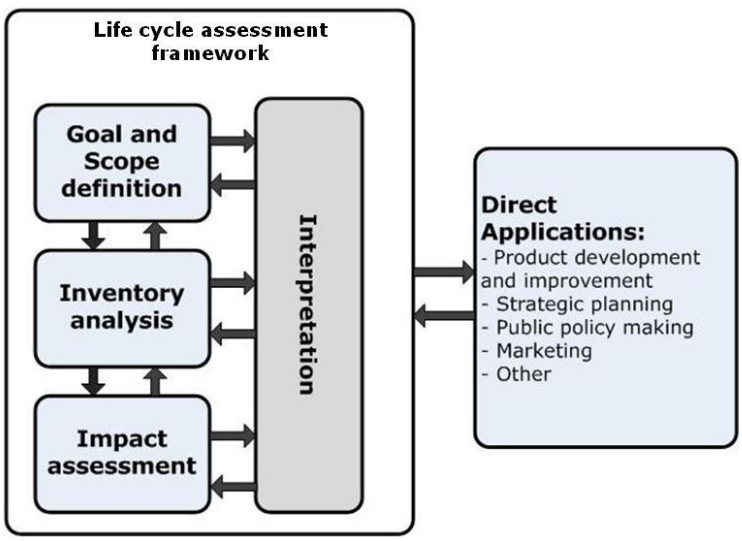


Figure 1 LCA steps according to the ISO 14040: 2021

ISO 14040:2006 covers two types of studies: LCA and LCI. LCI studies are similar to LCA studies but the LCIA phase is excluded. LCI studies should not be confused with the LCI phase of an LCA study.

LCA models the life cycle of a product as its product system, which performs one or more defined functions. The important property of a product system is characterized by its function. Figure 2 shows an example of a product system. Product systems are divided into the process units as seen in Figure 3. Unit processes are linked to one another by flows of intermediate products, to other product systems by product flows, and to the environment by elementary flows. Dividing a product system into its unit processes assists to identify the inputs and outputs of the product system.

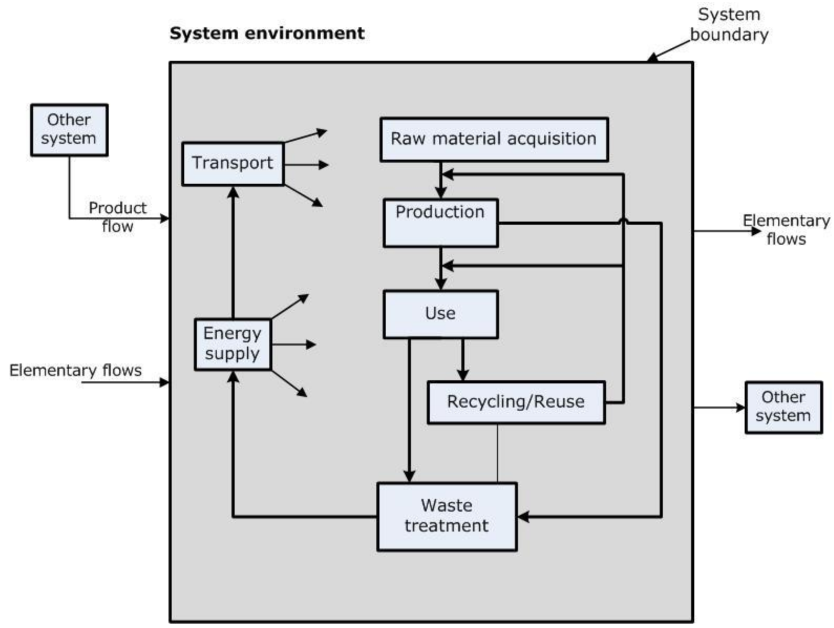


Figure 2 Example of the product system

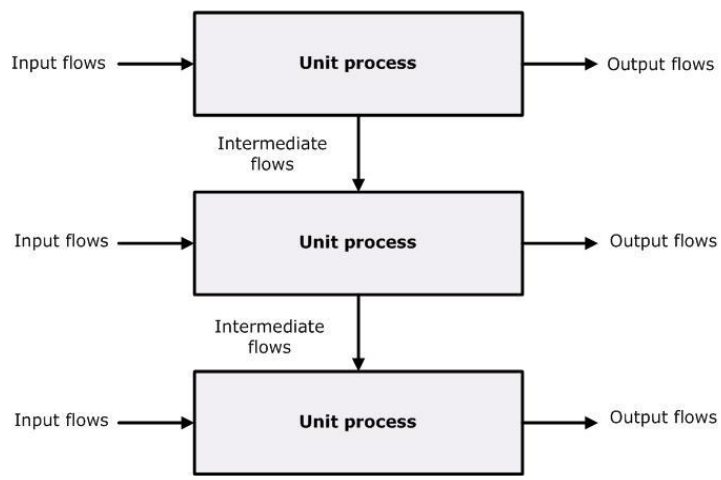


Figure 3 Example of a set of unit processes

2.1 Step 1: The Goal and Scope Definition

In this phase, the products or services to be assessed are identified, a functional unit is chosen, and the required level of detail is defined. The type of analysis, impact categories to be evaluated, and set of data that needs to be collected are determined. System boundary and functional unit definitions are important elements of this component. Several aspects should be defined during the goal definition. These are:

- the intended application

- the reason for carrying out the study
- the intended audience
- Whether results are intended to be used in comparative assertions intended to be disclosed to the public.

A system can have several possible functions, e.g. face creams may have several functions such as moisturizing, protecting from the sun, and medium to deliver essential elements to the skin etc. The ones selected for a study depends on the goal and scope of the LCA.

The functional unit defines the quantification of the identified functions (performance characteristics) of the product. The primary purpose of a functional unit is to provide a reference to which the inputs and outputs are related. This reference is necessary to ensure comparability of LCA results. Comparability of LCA results is particularly important when different systems are being assessed, to ensure that such comparisons are made on a common basis. It is important to determine the reference flow in each product system, in order to fulfil the intended function, i.e. the number of products needed to fulfil the function.

The ISO14040:2021 defines the system boundary as a "set of criteria specifying which unit processes are part of a product system". The system boundary identifies the unit processes to be included in the system. The product system should be modelled in such a manner that inputs and outputs at its boundary are elementary flows.

The choice of elements of the physical system to be modelled depends on the goal and scope definition of the study, its intended application and audience, the assumptions made, data and cost constraints, and cut-off criteria. The models used should be described and the assumptions underlying those choices should be identified. The cut-off criteria used within a study should be clearly understood and described.

The criteria used in setting the system boundary are important for the degree of confidence in the results of a study and the possibility of reaching its goal. Figure 4 illustrates an overview of how different system boundary can be defined.

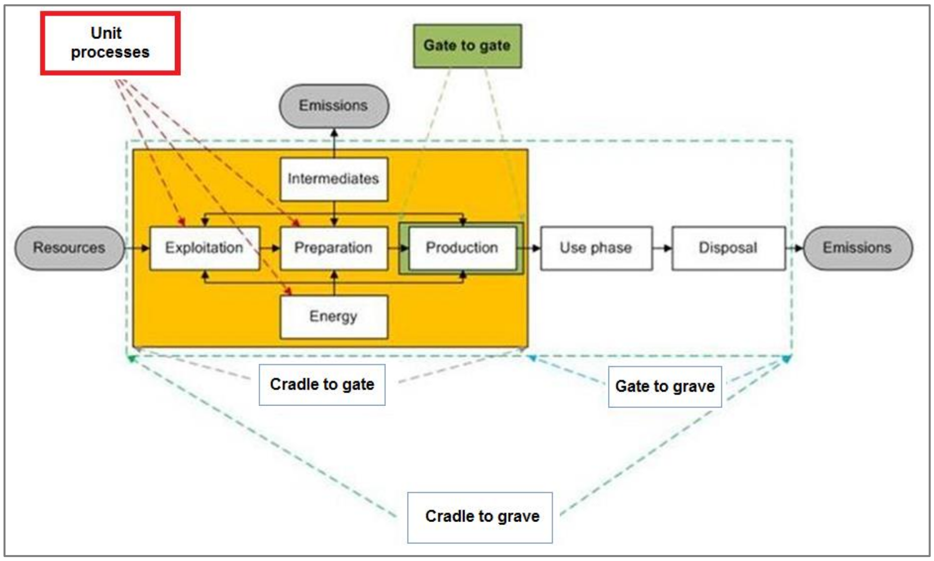


Figure 4 Possible system boundary in the life cycle of a product

The functional unit selected for the demonstrators selected in the project is 1 piece (Figure 5). The system boundaries relate to the project processes in the products life cycle that are included in the LCA (Figure 6).

Figure 5 Project demonstrators.

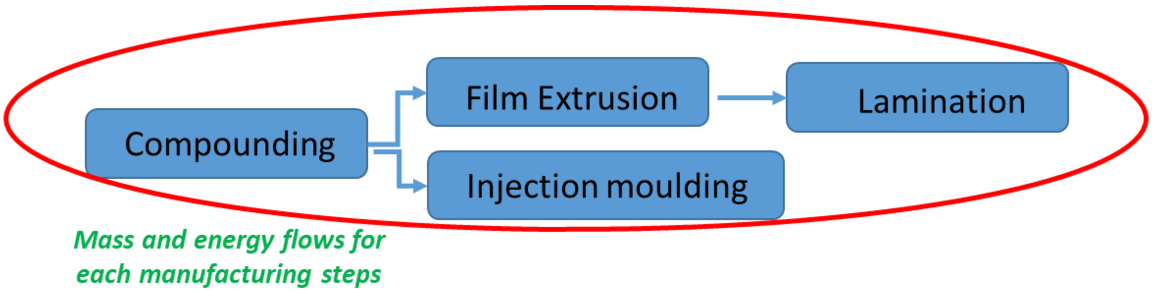


Figure 6 Prototypes manufacturing system boundaries.

2.2 Step 2: Life Cycle Inventory Analysis (LCI)

Inventory analysis involves data collection and calculation procedures to quantify relevant inputs and outputs of a product system. The process of conducting an inventory analysis is iterative. As data are collected and more is learned about the system, new data requirements or limitations may be identified that require a change in the data collection procedures so that the goals of the study will still be met. In some cases, the goal or scope of the study needs to be revised when some issues are identified. Data for each unit processes within the system boundary is needed to be identified according to the following topics:

- Energy inputs, raw material inputs, ancillary inputs other inputs
- Products, co-products and waste
- Emissions to air, discharges to water and soil
- Other environmental aspects

After the data collection, calculation procedures, including validation of data collected, the relating of data to unit processes, and the relating of data to the reference flow of the functional unit, are needed to generate the results of the inventory of the defined system for each unit process and for the defined functional unit of the product system that is to be modelled.

The calculation of energy flows should take into account the different fuels and electricity sources used, the efficiency of conversion and distribution of energy flow as well as the inputs and outputs associated with the generation and use of that energy flow.

Few industrial processes yield a single output or are based on a linearity of raw material inputs and outputs. In fact, most industrial processes yield more than one product, and they recycle intermediate or discarded products as raw materials. Consideration should be given to the need for allocation procedures when dealing with systems involving multiple products and recycling systems.

Templates for project data collection for each demonstrator have been prepared in collaboration with project partners according to: project manufacturing steps, involved organization, mass balance and energy consumption. Inventory table example is reported in Figure 7.

D1: To-go pocket for liquid product (FERRERO)

Sample picture

	Current Structure	PRESERVE Structure	PRESERVE Production Steps	Company	Mass (Kg)	Waste (Kg)	Energy Consumed (kWh)
Tray/ Cup	PE/EVOH/PS/PS	main component: self-reinforced PLA	Extrusion	CTB			
		barrier film: protein based	Protein Coating (Printing)	Südpack			
		adhesive: hotmelt	Lamination	Südpack			
		sealing/second layer: self-reinforced PLA with optional fatty acid grafting	Lamination	Südpack			
High barrier lidding film	PET/Alu/PE	main component: PLA (biaxially-oriented)	Extrusion (PLA)	Südpack			
		first layer coating: protein-based	Protein Coating (Printing)	Südpack			
		barrier film: metallised	Metallisation	IVV?			
		adhesive: bio-based	Lamination	Südpack			
		second layer: protein-based	Protein Coating (Printing)	Südpack			
		sealing/second layer: PLA	Lamination	Südpack			
Medium barrier lidding film	-	main component: biaxially-oriented PLA	Extrusion (PLA)	Südpack			
		barrier film: protein-based	Protein Coating (Printing)	Südpack			
		adhesive: bio-based	Lamination	Südpack			
		second layer: protein-based	Protein Coating (Printing)	Südpack			
		sealing/second layer: PLA with optional fatty acid grafting	Lamination	Südpack			

	Current Structure	PRESERVE Structure
Tray/ Cup	PE/EVOH/PS/PS	main component: self-reinforced PLA
		barrier film: protein based
		adhesive: hotmelt
		sealing/second layer: self-reinforced PLA with optional fatty acid grafting

PRESERVE Production Steps	Company	Mass (Kg)	Waste (Kg)	Energy Consumed (kWh)
Extrusion	CTB			
Protein Coating (Printing)	Südpack			
Lamination	Südpack			
Lamination	Südpack			

Figure 7 – Example of inventory table for Ferrero project demonstrator.

2.3 Step 3: Life Cycle Impact Assessment (LCIA)

The impact assessment phase of LCA is aimed at evaluating the significance of potential environmental impacts using the LCI results. In general, this process involves linking inventory data with specific environmental impact categories and category indicators, thereby seeking to understand these impacts. The LCIA phase also provides information for the life cycle interpretation phase.

The impact assessment may include the repeated process of reviewing the goal and scope of the LCA study to determine if the objectives of the study have been met, or to modify the goal and scope if the assessment indicates that they cannot be achieved. Elements of LCIA are illustrated in Figure 8.

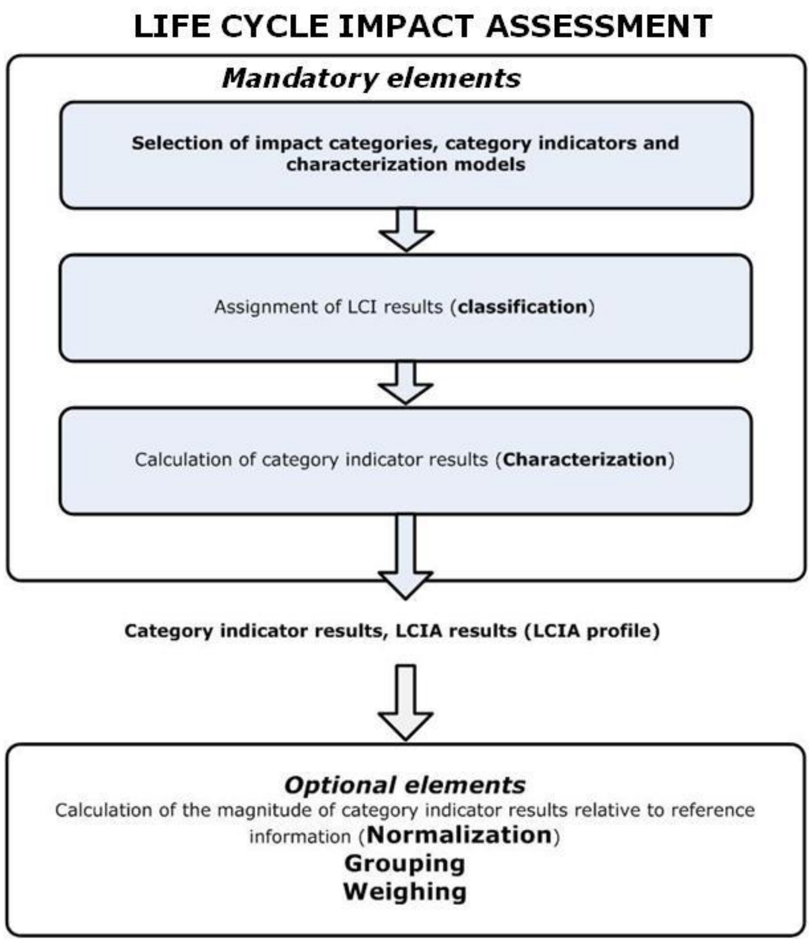


Figure 8 Elements of the LCIA phase

The LCIA addresses only the environmental issues that are specified in the goal and scope. Therefore, LCIA is not a complete assessment of all environmental issues of the product system under consideration. LCIA cannot always demonstrate significant differences between impact categories and the related indicator results of alternative product systems.

The lack of spatial and temporal dimensions in the LCI results introduces uncertainty in the LCIA results. The uncertainty varies with the spatial and temporal characteristics of each impact category.

2.4 Step 4: Life Cycle Interpretation

The interpretation should reflect the fact that the LCIA results are based on a relative approach, that they indicate potential environmental effects, and that they do not predict actual impacts on category endpoints, the exceeding of thresholds or safety margins or risks.

The interpretation phase may also include the repeated process of reviewing and revising the scope of the LCA, as well as revising the nature and quality of the data collected in a way which is consistent with the defined goal.

Reporting is an integral part of an LCA. A good report should address the different phases of the study under consideration. The report must contain data, methods and assumptions applied in the study, results, conclusions and the limitations as well. The way the report is presented must be in a proper form and suitable to their intended audience.

LCIA methodology and types of impacts

The International Reference Life Cycle Data System (ILCD) Handbook, which was developed by the Institute for Environment and Sustainability in the European Commission (EC) Joint Research Centre (JRC), is a specific guidance document for developing a life cycle assessment study. The ILCD Handbook is based on the existing international standards on LCA, ISO 14040/44, that provide the indispensable framework for LCA.

The ISO standards brought some clarity on basic principles in LCIA, but a comprehensive set of requirements for LCIA methods is currently lacking. Therefore, these clarifications can be done based on ILCD Handbook. To be fully compliant with the ILCD handbook, a LCA study needs to include the following 14 different impact categories:

- Climate change
- Ozone depletion
- Human toxicity, cancer effects
- Human toxicity, non-cancer effects
- Particulate matter/Respiratory inorganic
- Ionizing radiation, human health
- Photochemical ozone formation
- Acidification
- Eutrophication, terrestrial
- Eutrophication, aquatic
- Ecotoxicity (freshwater)
- Land use
- Resource depletion, water
- Resource depletion, mineral, fossil and renewable

The ISO 14044 standard defines Life Cycle Impact Assessment (LCIA) as the interpretation phase of life cycle assessment. Thus, the purpose of the impact assessment phase is to interpret the life cycle emissions and resource consumption inventory in terms of indicators for the Areas of Protection

(AoPs). According to ILCD Handbook from four steps of LCIA, the steps of "classification" and "characterization" are mandatory whereas "normalization" and "weighting" are optional steps.

Below Figure 9 shows the relationship between the midpoint impact categories and the AoPs which are addressed in this Guidance Document.

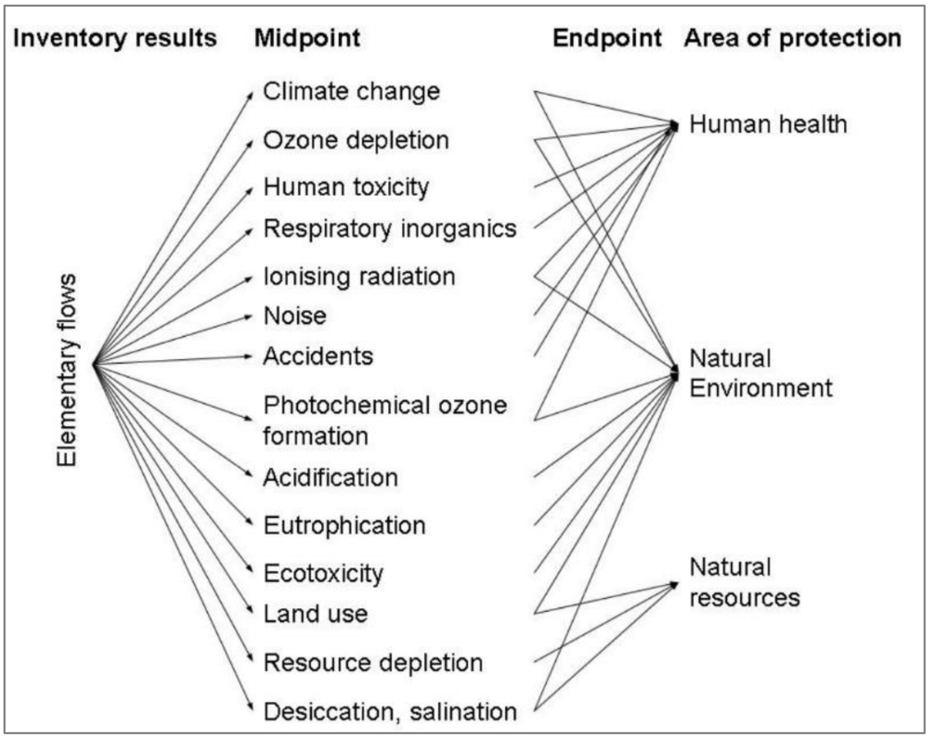


Figure 9 Framework of impact categories

Impact categories at the midpoint level are defined at the place where a common mechanism for a variety of substances within that specific impact category exists. For example, Global Warming impacts involve a series of steps, starting with the release of greenhouse gases, and ending with impacts on humans and ecosystems. Greenhouse gases have an effect on the radiative forcing, therefore radiative forcing is a suitable midpoint indicator for the impact category Global Warming. Most of the other impact categories, such as Human Toxicity and Ecotoxicity Effects are more heterogeneous. In these impact categories there, is no real midpoint. The midpoint applied is in fact as close as practicable to the area of protection. The main areas of protection defined in the ILCD handbook are the following:

For Human Health, the aim is to provide indicators, in terms of both mortality and morbidity, for the effects caused by various types of stressors. Aggregate Human Health indicators are of particular relevance.

For Natural Environment, the aim is thus to quantify the negative effects on the function and structure of natural ecosystems as a consequence of exposure to chemicals or physical interventions. In ecotoxicology, this task has typically been addressed by focusing on the occurrence of different species in the ecosystem, i.e. the biodiversity. Biodiversity can be defined at different levels: ecological diversity (ecosystems), population diversity (species) and genetic diversity (genes). When modeling damage to natural ecosystems, biodiversity is thus not the only possible endpoint. Consequently, function-related parameters like biomass production or mineralization might better represent the functional performance of the ecosystem.

The characterization models used in LCIA for the category indicators for Natural Resources, have an anthropocentric approach as they focus on the use value for humans: Natural resources comprise both abiotic resources, such as fossil fuels, minerals, metal ores, land, water, and renewables.

3. Life Cycle Cost and cost-feasibility

Life Cycle Costing (LCC) is an analytical methodology for calculating the total cost of a product during its design, fabrication, use and end-of-life phases. LCC will provide the cost profiles of the systems analyzed and contribute to the selection and design of materials. In addition, it will also facilitate the choice of the technological route for the production of the materials.

The LCC will contribute to the development of a business plan and will push the introduction of the biobased packaging in PRESERVE project to the market by quantifying economic viability and cost effectiveness of the new developed materials.

The results of this analysis will make it possible to compare the proposed new materials and products with alternative ones from an economical point of view, and to determine the overall reduction of costs that could be achieved using this model in the packaging products value chains.

CAPEX and OPEX analysis will be also performed to evaluate in which conditions and for processing which materials the proposed production lines are economically feasible to reach to the market:

1) Capital expenditures (CapEx) are funds used by a company to acquire, upgrade, and maintain physical assets such as property, plants, buildings, technology, or equipment. CapEx is often used to undertake new projects or investments by a company. Making capital expenditures on fixed assets can include repairing a roof, purchasing a piece of equipment, or building a new factory. This type of financial outlay is made by companies to increase the scope of their operations or add some economic benefit to the operation.

2) Operating Expenses (OpEx) represent the indirect costs incurred by a business to continue running its day-to-day operations. While not directly tied to the revenue generated from the products/services, operating expenses are an essential part of a company’s core operations.

Templates to collect capital expenditure and operating expenses from industrial project partners are reported in Table 1 and Table 2.

Table 1 - Capital Expenditure example template (values are US$).

	Forecast Period				
FINANCIAL STATEMENTS	**2017**	**2018**	**2019**	**2020**	**2021**
Income Statement					
Reveneue	**158.311**	**165.435**	**172.052**	**178.074**	**183.416**
Cost of Goods Sold (COGS)	58.575	61.211	61.939	64.107	64.196
Gross Profit	**99.736**	**104.224**	**110.113**	**113.967**	**119.220**
Expenses					
Salaries and Benefits	26.913	28.124	29.249	30.273	31.181
Rent and Overhead	10.000	10.000	10.000	10.000	10.000
Depreciation & Amortization	15.008	15.005	15.003	15.002	15.001
Interest	1.500	1.500	500	500	500
Total Expenses	**53.421**	**54.629**	**54.752**	**55.775**	**56.682**
Earnings Before Tax	**46.314**	**49.595**	**55.361**	**58.192**	**62.538**
Balance Sheet					
Assets					
Cash	272.530	307.632	327.097	368.487	413.243
Accounts Receivable	7.807	8.158	8.485	8.782	9.045
Inventory	11.715	12.242	12.388	12.821	12.839
Property & Equipment	37.513	37.508	37.505	37.503	37.502
Total Assets	**329.565**	**365.541**	**385.474**	**427.593**	**472.629**

Table 2 - Operating Expense example template.

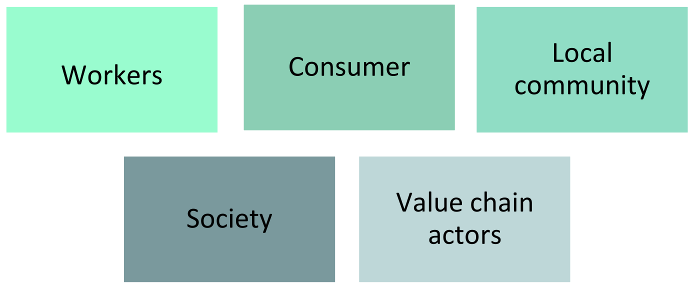
Operating Income Example	
Sales Reveune	**$25.000.000**
Cost of Goods Sold	$9.000.000
Expenses	
Direct Labor Costs	$2.000.000
Admin and Salaries	$4.000.000
Depreciation & Amortization	$1.000.000
Operating Income	**$9.000.000**

3. Social Life Cycle Assessment

Social and socio-economic benefits of implementing new packaging products will be addressed in Task 7.3. Social LCA (S-LCA) will be applied by the following steps:

1) Definition of goal and scope of the assessment
2) Inventory of drivers which may lead to an impact
3) Impact assessment

4) Interpretation of results



The environmental and social urgencies of the climate demand innovative solutions for satisfying the population demand of goods and services.

The overall objectives of the work are:

- To map the potential areas of concerns from a social perspective with respect to the use of an innovative packaging for food and cosmetics;
- To provide insights on the expectation of different social categories affected by a variable degree of impact (with respect to the use of plastic "traditional" packaging);
- To gather the potential social benefits deriving by the introduction of new packaging in the food and cosmetic industries;
- To map the level of risk attributed to the use/production of plastic packaging.

Main areas of investigations:

- Health and safety;
- Jobs creations;
- Working conditions;
- Well-being;
- Awareness and communication.

Preliminary information for social implication of project results will be collected by online survey according to the following questions:

WORKERS QUESTIONNAIRE

1. To which industry do you belong?
   - Food
   - Cosmetics
   - Textile
   - Distribution
   - Logistics
   - Pharmaceutical
   - Plastic producer
   - Packaging design
   - Packaging production

- Other

2. Which is your age range?
   - 18-26
   - 26-35
   - 35-50
   - 50-60
   - > 60
3. Please, indicate your average monthly wage (in Euro): ___________
4. Please, indicate the number of hours in a normal working week:
   - < 30
   - 30-35
   - 35-40
   - > 40
5. Did you receive training in the field of security and safety in the workplace? If yes, how many hours were compulsory?
6. Rate from 1 to 10 the degree of safety of your work in a normal working day
7. Please, indicate existing preventive measures and protocols with regards to accidents and injuries that you are aware of
8. Please, indicate existing preventive measures and protocols with regards to chemical exposure that you are aware of
9. To which extent do you believe that an innovative packaging solution based upon renewable materials (bioplastics) would be applicable in your production? Rate 1-10
10. To which extend do you think it would be feasible to change the materials of your productive sector? Rate 1-10
11. Which are the main obstacles do you identify? (Rate 1-10 for each option, where 1 is the minimum and 10 is the maximum)
    - Excessive cost of the innovative material
    - Difficulties in the production process with the use of the innovative material
    - Technical barriers
    - EU and national regulations
    - Low marketing attractiveness
    - Little benefit in the short-term
    - Mind-set
    - Others

CONSUMERS QUESTIONNAIRE

1. Sex:
   - Male
   - Female
2. Which is your range age?
   - 16-20
   - 20-30
   - 30-40

- 40-50
- 50-60
- >60

3. What is your main activity?
    - Student
    - University student
    - Manufacturing worker
    - Freelance
    - Entrepreneur
    - Manager
    - Office employee
    - Unemployed
    - Retired
    - Other
4. What is your level of education?
    - First level diploma
    - High school diploma
    - Bachelor degree
    - Master degree
    - Ph.D
    - Other
5. Rate from 1 to 10 your interest towards sustainable materials and environmental issues
6. Rate from 1 to 10 your attention towards the material labels present in packaging products
7. How would you rate your attention to the choice of a product depending on the packaging it is contained in? 1-10
8. How do you feel about the use of plastic packaging in everyday life?
    - No opinion
    - Not interested
    - Worried about the consequence on the environment
    - Very concerned, looking for possible alternative solutions
9. To which extent would you buy a cosmetic or a food product packed in a sustainable packaging material based on bioplastics, even if the cost of the final product would be higher than the traditional one? 1-10
10. To which extent are you concerned with the respect of the health and safety requirements by the new packaging material for food products? 1-10
11. To which extent are you concerned with the respect of the health and safety requirements by the new packaging material for cosmetics products? 1-10
12. Are you interested in the social benefits deriving by the use of innovative sustainable materials for packaging?
    - Not interested
    - Yes, I am interested, however the cost remains the main factor I consider
    - Yes, I am interested and I would accept a higher final price of the product using sustainable packaging

13. Would you be interested in knowing more about the material composition of plastic packaging, the recycling process and the environment consequence of plastic use?
   - Not interested
   - Yes, I am interested
   - Yes, I am interested and available to attend thematic workshops
   - Yes, I am interested in participating to thematic workshops and local events

SOCIETY QUESTIONNAIRE

1. Sex:
   - Male
   - Female

2. Which is your age range?
   - 16-20
   - 20-30
   - 30-40
   - 40-50
   - 50-60
   - >60

3. What is your main activity?
   - Student
   - University student
   - Manufacturing worker
   - Freelance
   - Entrepreneur
   - Manager
   - Office employee
   - Unemployed
   - Retired
   - Other

4. What is your level of education?
   - First level diploma
   - High school diploma
   - Bachelor degree
   - Master degree
   - Ph.D
   - Others

5. Rate from 1 to 10 your interest towards sustainable materials and environmental issues

6. Rate from 1 to 10 your attention towards the material labels present in packaging products

7. How would you rate your attention to the choice of a product depending on the packaging it is contained in? 1-10

8. How do you feel about the use of plastic packaging in everyday life?

- No opinion
- Not interested
- Worried about the consequence on the environment
- Very concerned, looking for possible alternative solutions

9. Are you aware of alternative solutions (like packaging based upon bioplastics or innovative material)? If yes, how did you find out?

10. To which extent are you concerned with the respect of the health and safety requirements by the new packaging material for food products? 1-10

11. To which extent are you concerned with the respect of the health and safety requirements by the new packaging material for cosmetics products? 1-10

12. Are you interested in the social benefits deriving by the use of innovative sustainable materials for packaging?
- Not interested
- Yes, I am interested, however the cost remains the main factor I consider
- Yes, I am interested and I would accept a higher final price of the product using sustainable packaging

13. Would you be interested in knowing more about the material composition of plastic packaging, the recycling process and the environment consequence of plastic use?
- Not interested
- Yes, I am interested
- Yes, I am interested and available to attend thematic workshops
- Yes, I am interested in participating to thematic workshops and local events

LOCAL COMMUNITY QUESTIONNAIRE

1. Sex:
- Male
- Female

2. Which is your age range?
- 16-20
- 20-30
- 30-40
- 40-50
- 50-60
- >60

3. What is your main activity?
- Student
- University student
- Manufacturing worker
- Freelance
- Entrepreneur
- Manager
- Office employee

- Unemployed
- Retired
- Other

4. What is your level of education?
   - First level diploma
   - High school diploma
   - Bachelor degree
   - Master degree
   - Ph.D.
   - Others

5. To which association do you belong?
6. Is your organisation engaged/active in environmental, sustainability and recycling thematic? If yes, which are the main activities?
7. Rate from 1 to 10 your attention towards the material labels present in packaging products
8. How would you rate your attention to the choice of a product depending on the packaging it is contained in? 1-10
9. How do you feel about the use of plastic packaging in everyday life?
   - No opinion
   - Not interested
   - Worried about the consequence on the environment
   - Very concerned, looking for possible alternative solutions

10. Would you be interested in knowing more about the material composition of plastic packaging, the recycling process and the environment consequence of plastic use?
    - Not interested
    - Yes, I am interested
    - Yes, I am interested and available to attend thematic workshops
    - Yes, I am interested in participating to thematic workshops and local events

VALUE CHAIN ACTORS QUESTIONNAIRE

1. To which area of the value chain do you belong?
   - Biopolymer supplier
   - Packaging material companies
   - Packaging, products design
   - Packaging converters
   - Technological Centre
   - Technological cluster
   - Association & Network
   - Waste management company
   - Distribution and logistics

  - Chemical industry
  - Food and drink industry
  - Pharmaceutical industry
  - Cosmetic industry
  - Academia
  - Other
2. To which extent do you believe that an innovative packaging solution based upon renewable materials (bioplastics) would be applicable in your area? Rate 1-10
3. Is your organisation engaged/active in environmental, sustainability and recycling thematic? If yes, which are the main activities?
4. Is the organisation/company where you belong engaged in research and innovation activities regarding alternative solutions to plastic packaging (like use of bioplastics or innovative material)?
5. To which extend do you think it would be feasible to change the materials used in your productive sector? Rate 1-10
6. Which are the main obstacles do you identify? (Rate1-10 for each option, where 1 is the minimum and 10 is the maximum)
   - Excessive cost of the innovative material
   - Difficulties in the production process with the use of the innovative material
   - Technical barriers
   - EU and national regulations
   - Low marketing attractiveness
   - Little benefit in the short-term
   - Health and security concern
   - Mind-set
   - Other

4. Conclusions and future steps

D7.1 include the description of all the methodologies used for environmental, economic and social assessment identifying the functional unit and system boundaries related to the project demonstrators. Template for LCA and LCC data collection have been prepared in collaboration with the project partners. Inventory data will be collected in the next period to evaluate the environmental and cost-feasibility of the bio-based packaging developed in PRESERVE project. It is envisaged that the results of this study will demonstrate the impacts of implementing PRESERVE materials into new packaging products, compared with their counterparts on the market, at the demonstrators' level. The S-LCA methodology proposed will embed a detailed inventory method tailored on real data, collected directly from the field of application thanks to customized surveys that allow modelling the life cycle of the proposed technologies.

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