PLANETS

Funded by
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SSbD Training on Scoping & Tier 1

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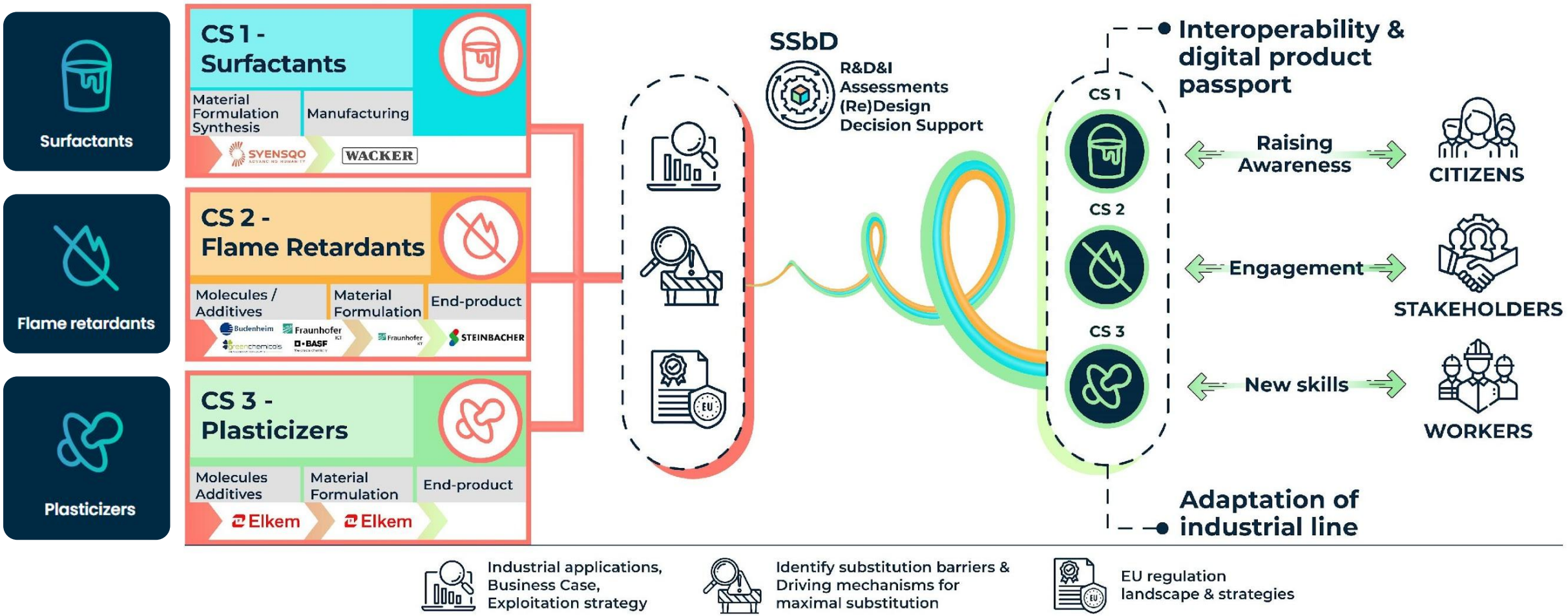
PLANETS' Aim and Objectives

- Develop **safer**, **eco-friendly**, and **socially** conscious alternatives for three key industrial chemicals while ensuring **economic** viability

PLANETS' Cases



EC Recommendation - European Assessment Framework for SSbD chemicals and materials

SSbD Framework

SSbD EC Recommendation

Case studies and Identification of challenges

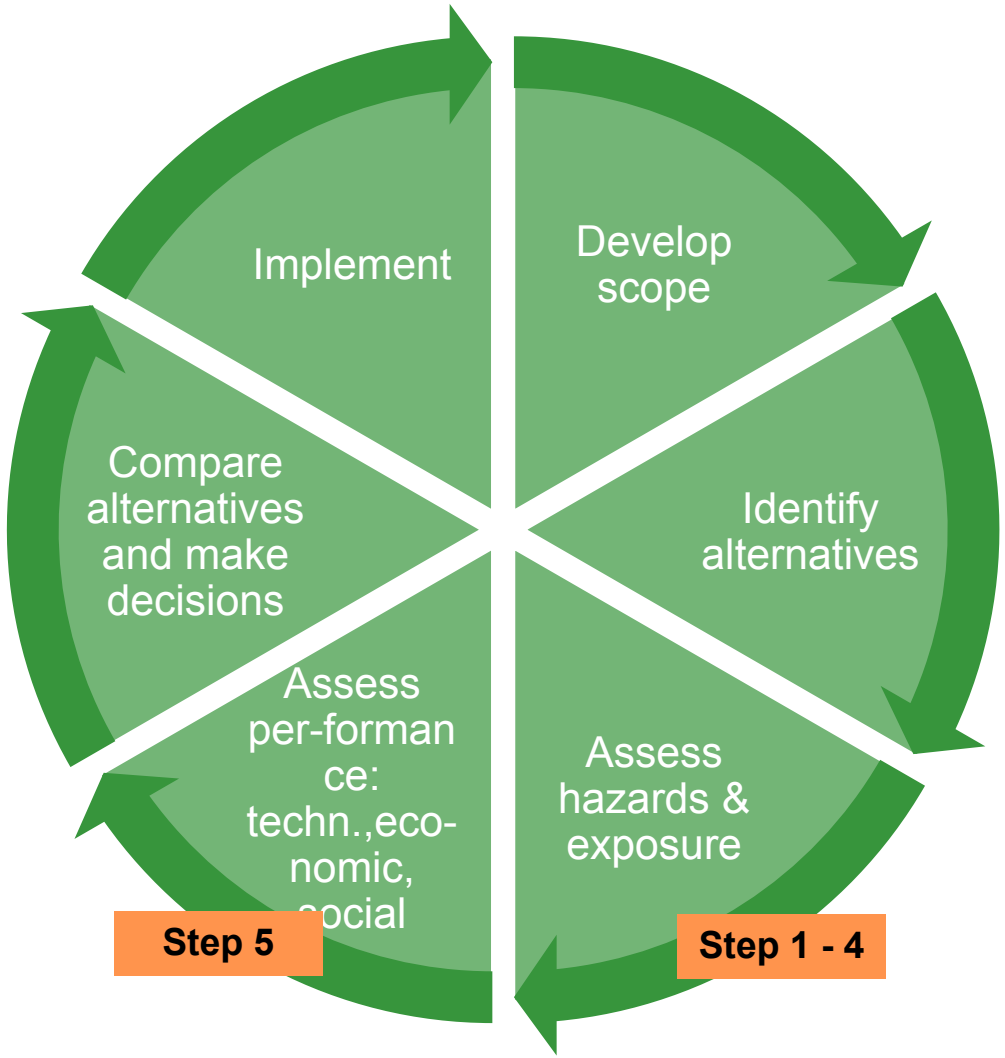
Methodological guidance

Revised framework

July 2022 — Dec 2022 — July 2023 — May 2024 — 2026

5 Stakeholders workshops and 2 SSbD Bootcamps

SSbD - generic workflow



SSbD **Assessment steps**

Step 1: Hazard assessment of chemical/material

Step 2: Human health and safety aspects in the chemical/material production and processing phase

Step 3: Human health and safety aspects in the final application phase

Step 4: Environmental sustainability assessment

Step 5: Social and economic sustainability assessment

Dimensions of safety & sustainability

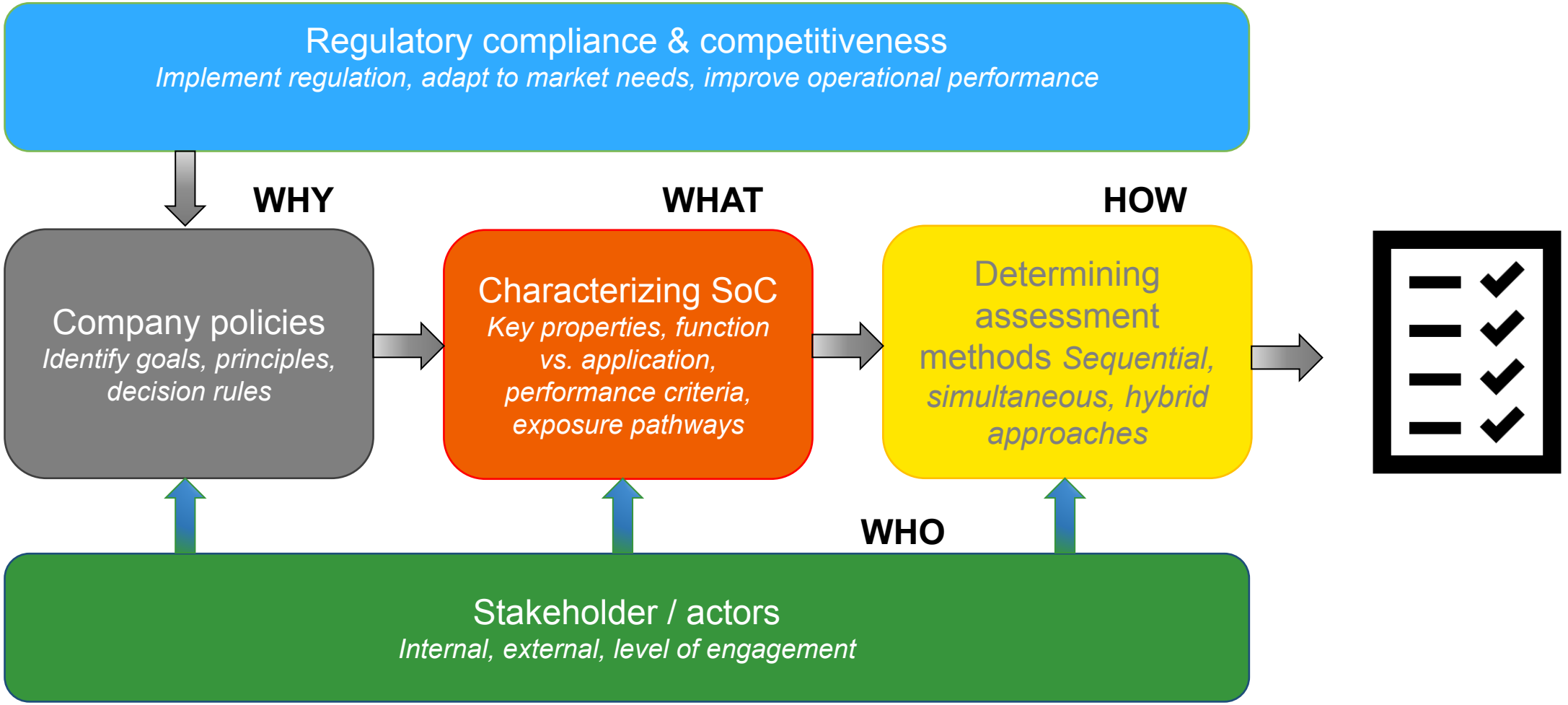
- Safety dimension
- Environmental dimension
- Social and economic dimensions

For SSbD you need a plan
Scoping

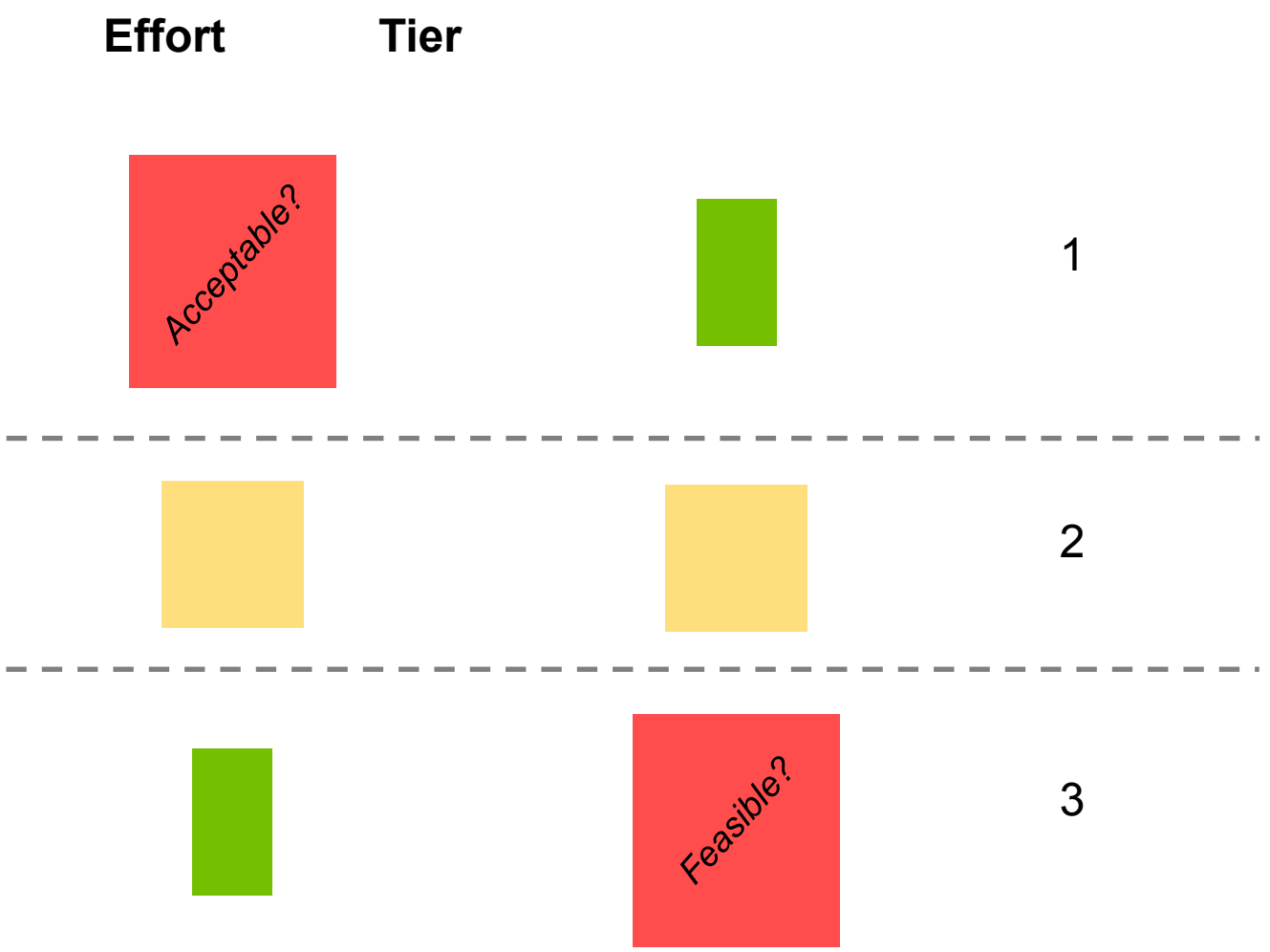
The scoping analysis determines the boundaries and provides focus for the SSbD assessment by answering the questions:

- (Re)design definition: **WHY** (**WHAT)**
- System definition: **WHAT**
- Actors in the life cycle: **WHO**
- The assessment: **HOW**

Scoping: define & integrate your company's perspective



Decide about how to deal with uncertainty and data quality



Decision on acceptable alternatives

… a process of integrating information; a multi-criteria approach

Criterion

Physiochemical properties

Hazard characteristics

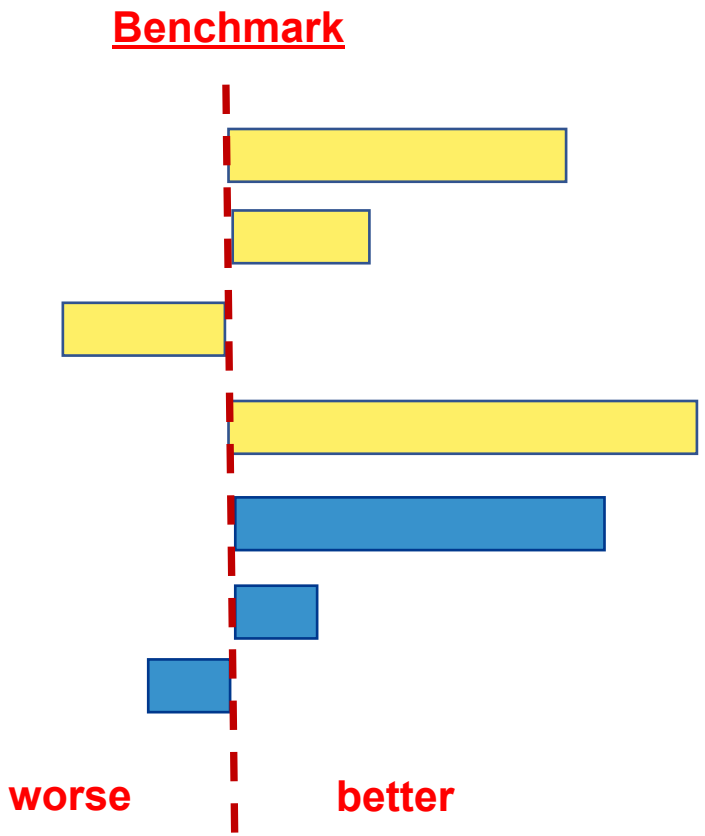
Intrinsic exposure potential

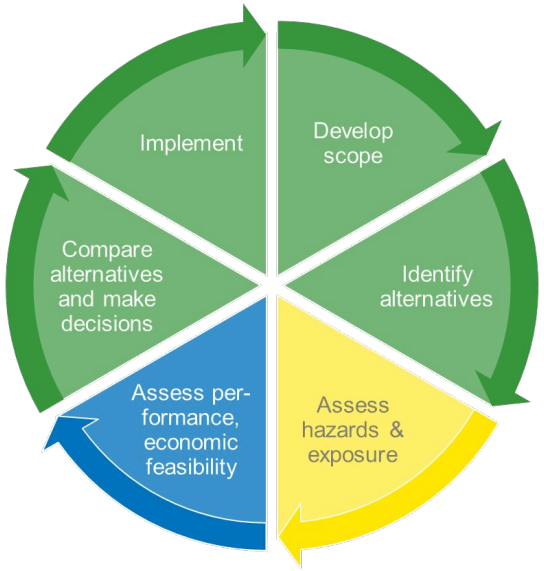
Potential lifecycle trade-offs

Technical feasibility

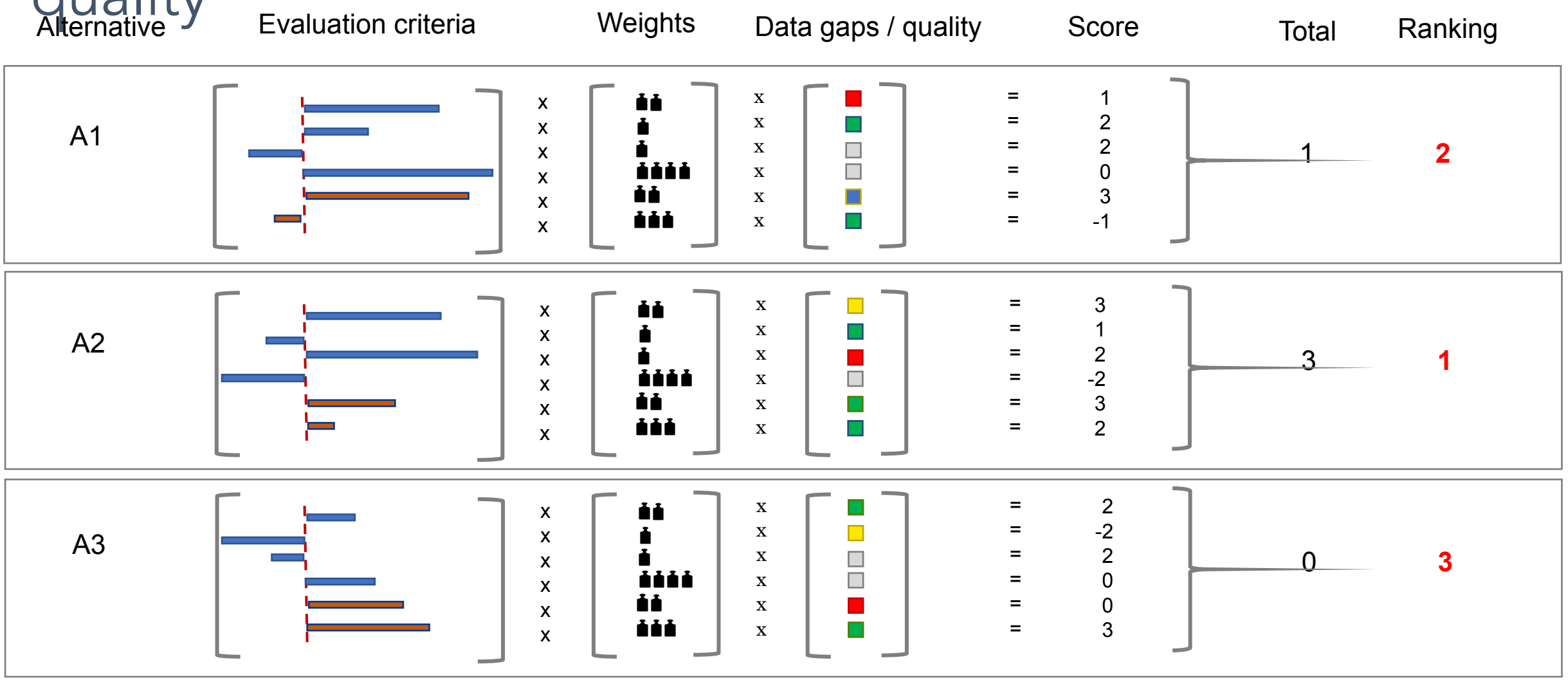
Economic feasibility

Availability of competences

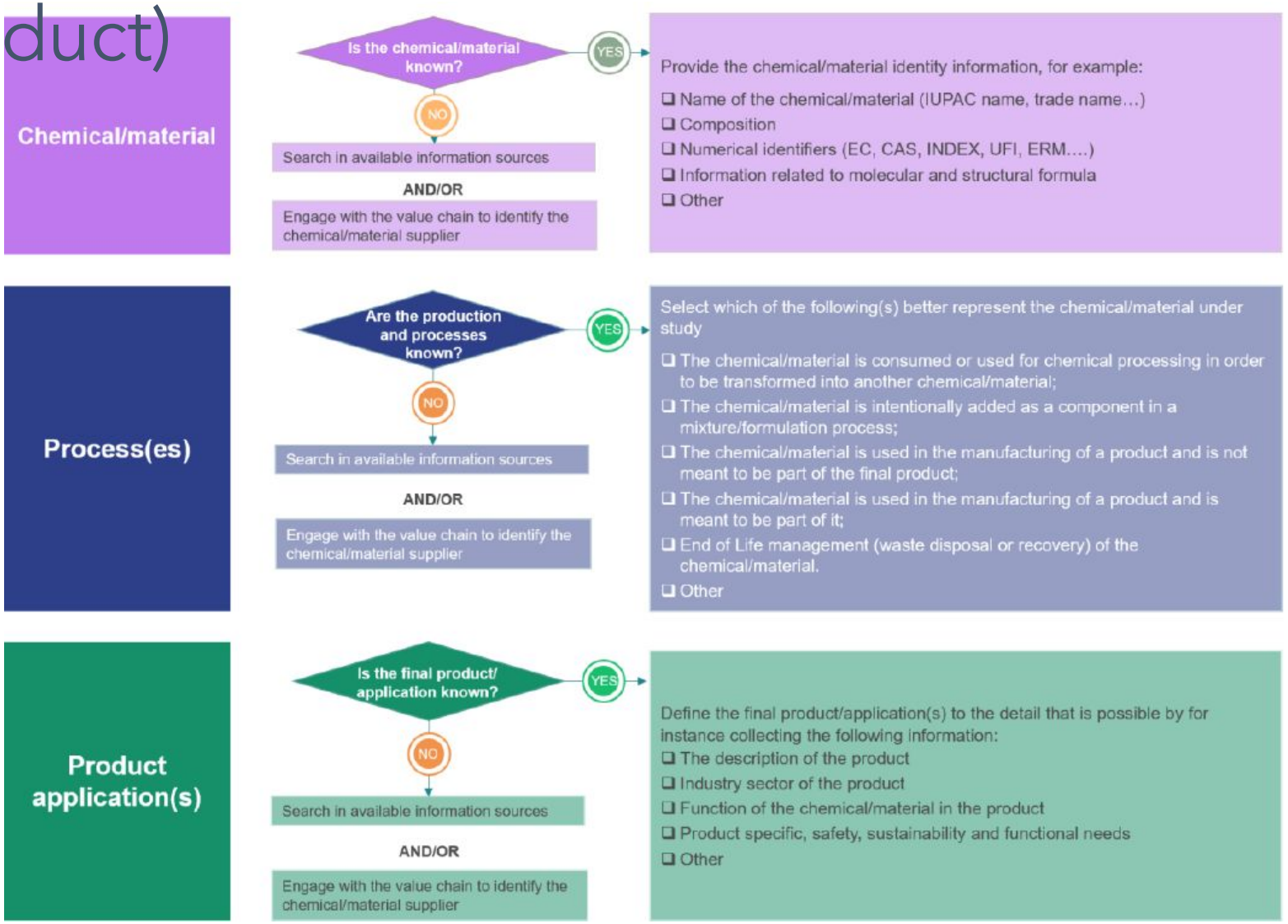




Assessing trade-offs & considering data gaps and quality

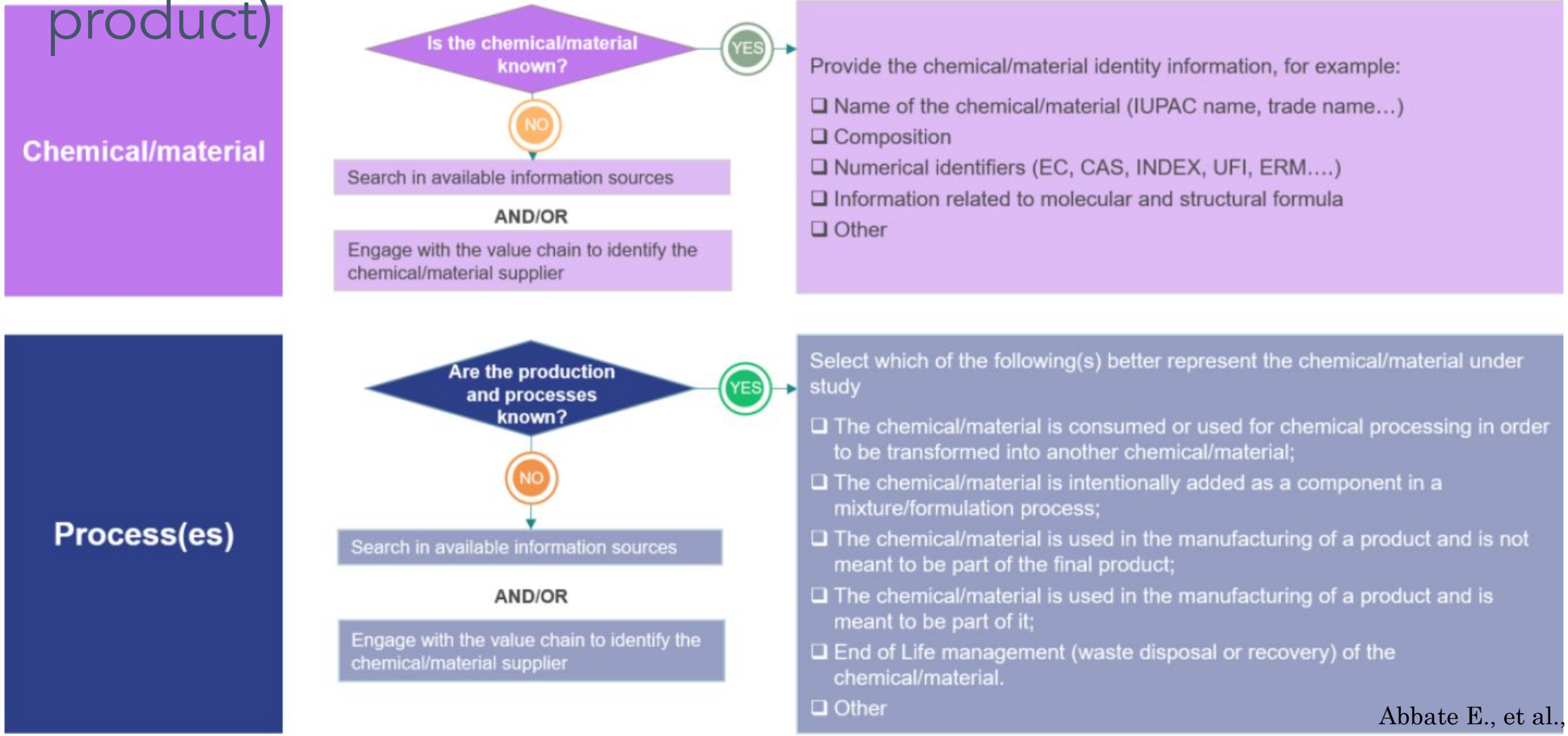


SSbD system elements (chemical/material, process, product)



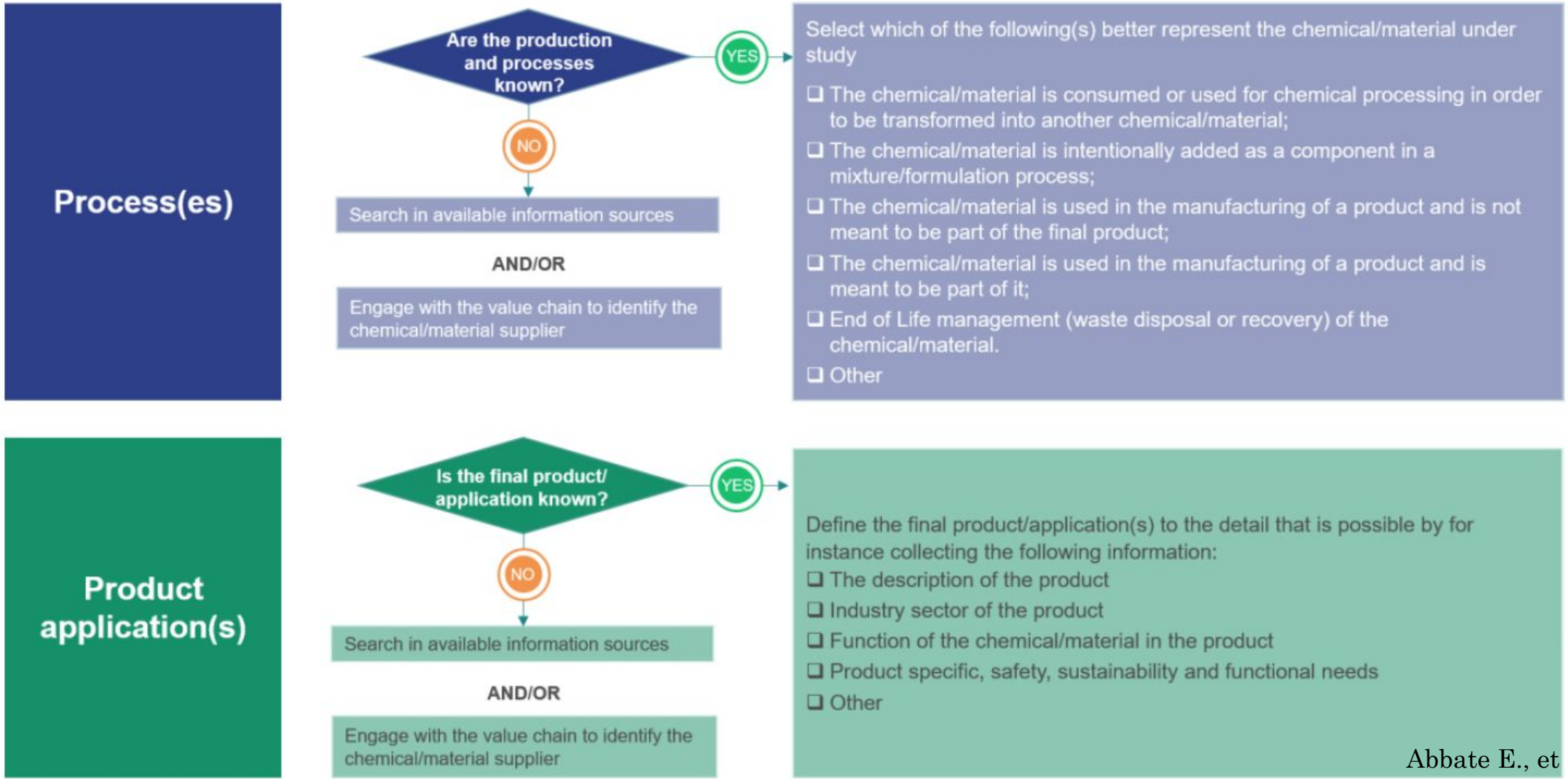
Abbate E., et al., 2024

SSbD system elements (chemical/material, process, product)



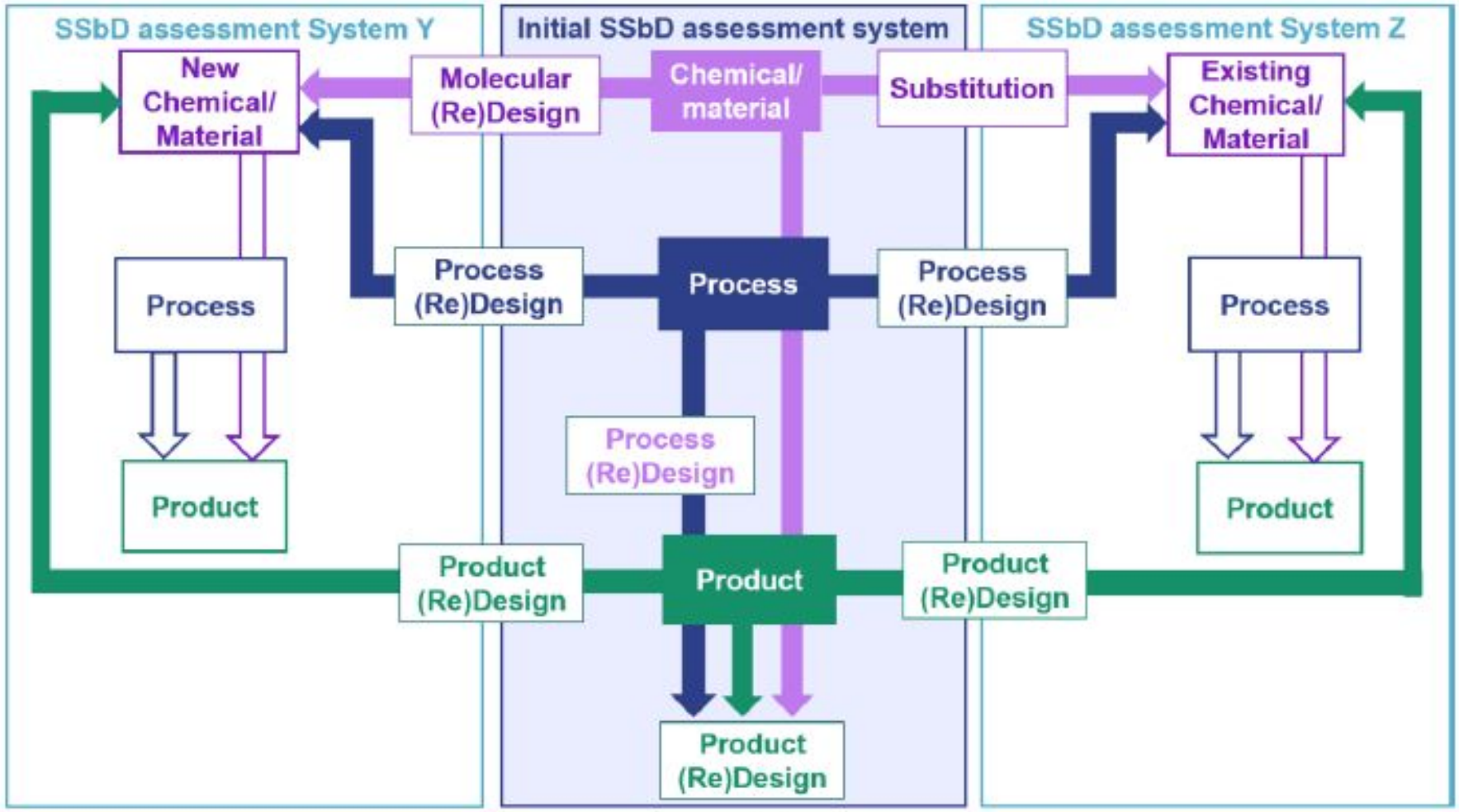
Abbate E., et al., 2024

SSbD system elements (chemical/material, process,



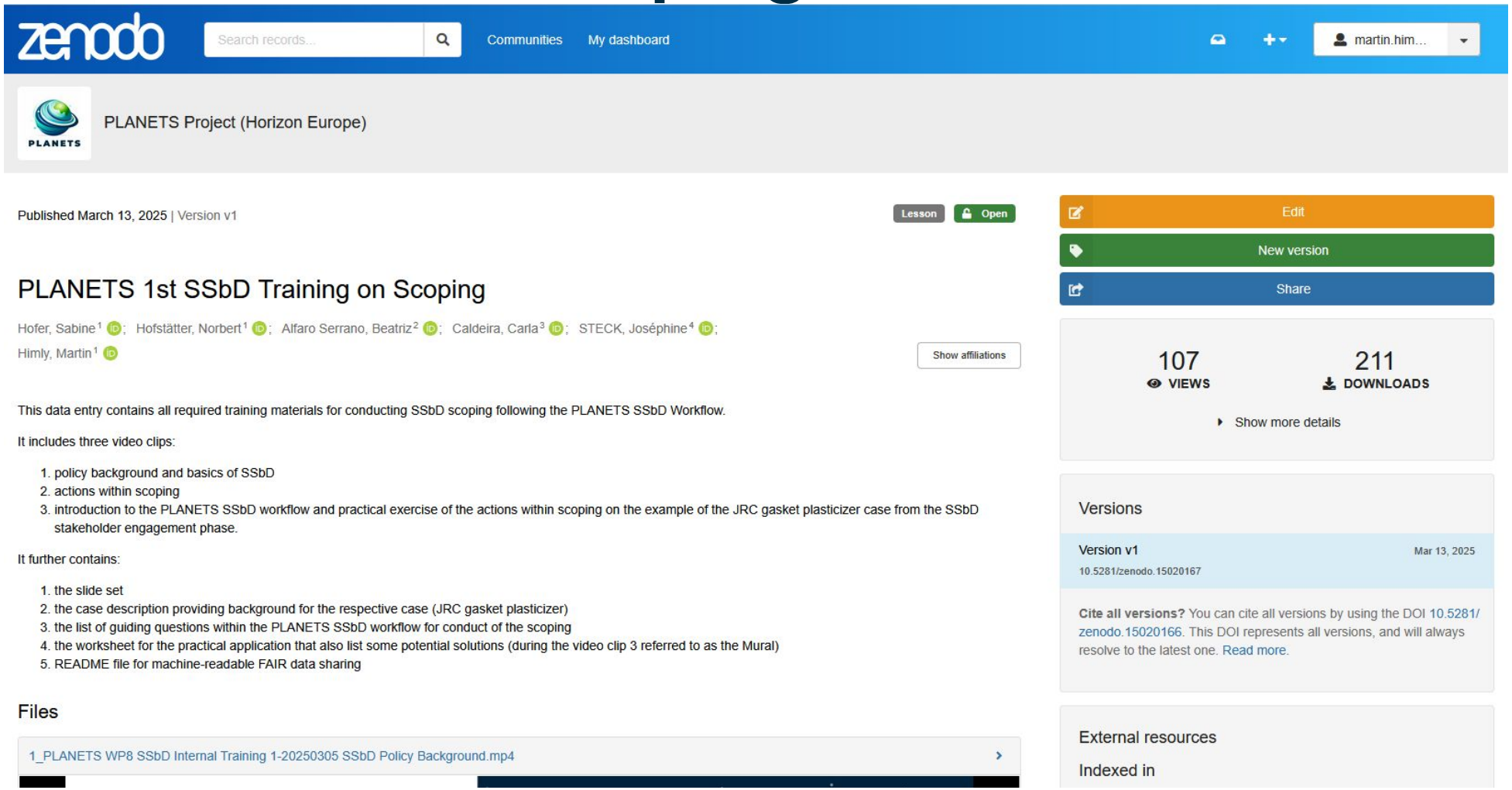
Abbate E., et al., 2024

Changes in the initial SSbD system

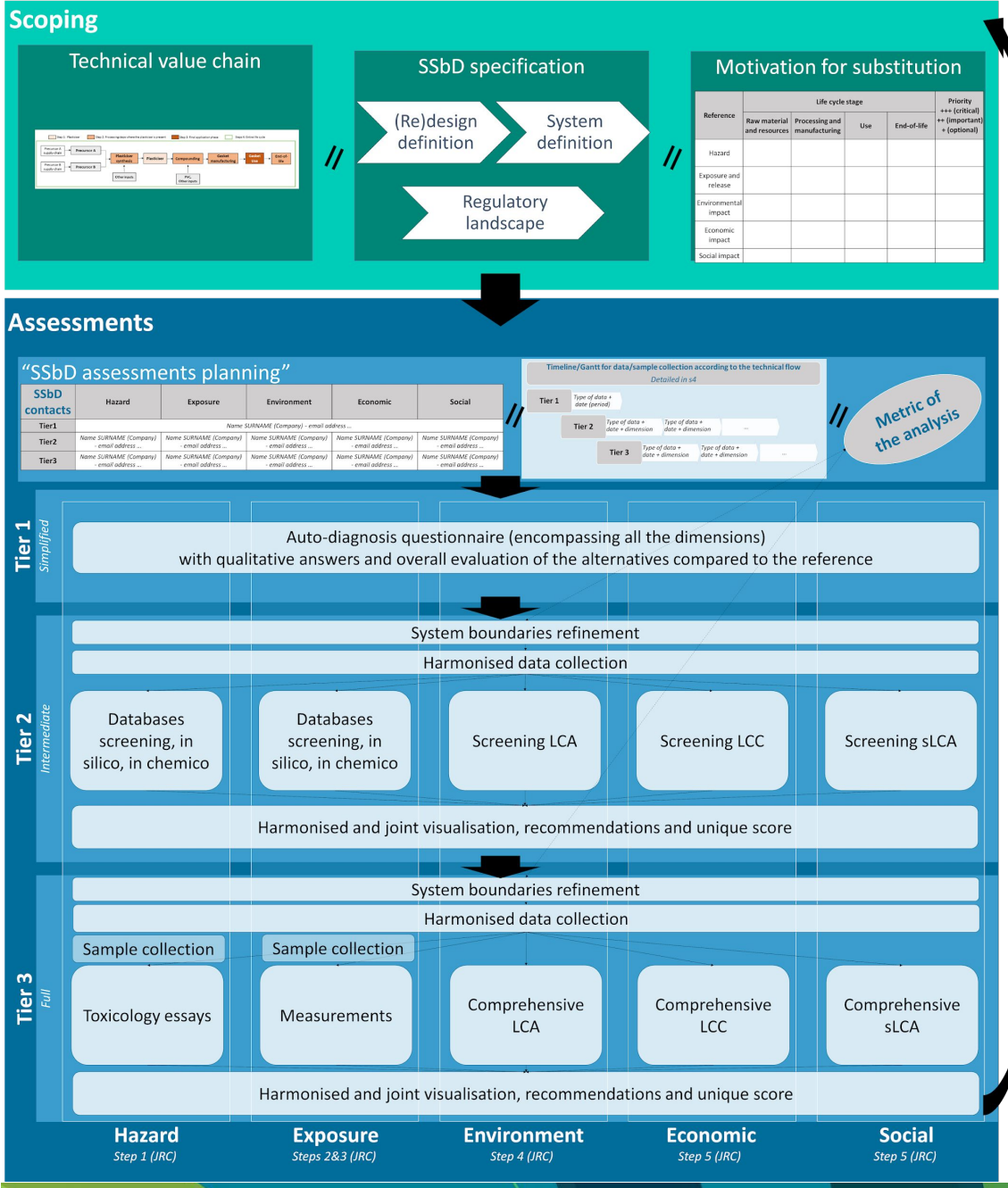


Abbate E., et al., 2024

PLANETS' Scoping at Zenodo



Hofer, S., Hofstätter, N., Alfaro Serrano, B., Caldeira, C., Steck, J., & Himly, M. PLANETS 1st SSbD Training on Scoping. https://doi.org/10.5281/zenodo.15020167



WHY? WHO? WHAT?

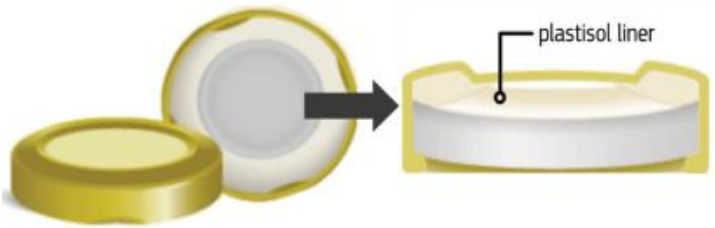
How?

The PLANETS generic SSbD workflow

A two phases approach aiming to guide the CS through SSbD:

- **Scoping** – Formalise the system under study to ensure efficient SSbD assessments
- **Assessments** – Conduct evaluations of the alternatives in comparison to a benchmark

Practical work in break-out teams



Plasticizer in food contact materials sealing gaskets for glass jars
- use: 6-48 mo @RT; 7-10 d @+4°C, 2-4 mo -20°C
- content: alcohol, free fat, pH (fruit acids, *etc.*)
- EoL: single use, end up in municipal waste

Plasticizer add to 35-40% by weight of material workability, extensibility, flexibility

Di(2-ethyl-hexyl)phthalate, DEHP (*i.e.* SVHC: toxic for reproduction cat 1B, endocrine disruptor for humans & environment) *vs*. 2 alternatives (epoxidised soybean oil, ESBO; acetyl tributyl citrate, ATBC)

Action 1 Draw the **technical value chain** of the product (10 min)
Action 2 Clarify the **motivation for substitution** (15 min)
Action 3 Define the **re-design** (identify purposes, SSbD principle, design level: material/chemical - process – product) & conduct the **system boundary definition** (30 min)

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Practical work in break-out teams

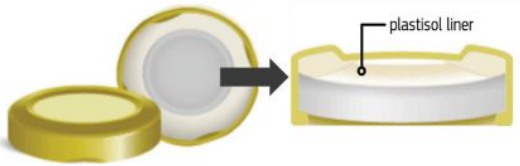
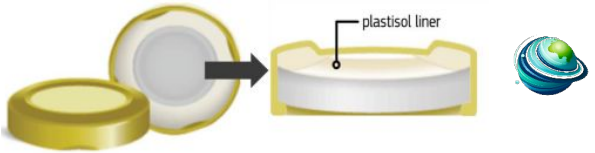


Table 2. Identity information on the plasticisers used in the case study indicating the IUPAC (International Union for Pure and Applied Chemistry) name, CAS (Chemical Abstracts Service) number and EC (European Community) number

Common name	Acronym	IUPAC[2] name	CAS[3] number	EC[4] number	Molecular weight (g/mol)
Di-(2-ethyl hexyl) Phthalate	DEHP	Bis(2-ethylhexyl) benzene-1,2-dicarboxylate	117-81-7	204-211-0	390.57
Acetyl Tributyl citrate	ATBC	Tributyl 2-(acetyloxy)propane-1,2,3-tricarboxylate	77-90-7	201-067-0	402.48
Di(2-ethyl hexyl) adipate	DEHA	Bis(2-ethylhexyl) hexanedioate	103-23-1	203-090-1	370.57
Di (2-ethylhexyl) terephthalate	DEHT	Bis(2-ethylhexyl) benzene-1,4-dicarboxylate	6422-86-2	229-176-9	390.56
Di(isononyl) cyclohexane-1,2-dicarboxylate	DINCH	Bis(7-methyloctyl) cyclohexane-1,2-dicarboxylate	166412-78-8	605-439-7	424.67
Epoxidized soybean oil	ESBO	-	8013-07-8	232-391-0	975.41[1]

[1] Average molecular weight; [2] International Union of Pure and Applied Chemistry, [3] Chemical Abstract Service, [4] European Community

Practical work in break-out teams



Di(2-ethyl-hexyl)phthalate, DEHP (*i.e.* SVHC: toxic for reproduction cat 1B, endocrine disruptor for humans & environment):

Di-(2-ethyl hexyl) Phthalate (DEHP) is an organic compound, liquid at room temperature, transparent and soluble in oil. It is the diester of the phthalic acid and 2-ethylhexanol. It is one of the most common plasticisers in the global market, especially for PVC application.

The production of DEHP is done through an esterification process in two steps. The first reaction between the phthalic anhydride and the 2-ethylhexanol gives the ester mono-2-ethylhexyl phthalate and water as a by-product. The equilibrium of this reaction leads to complete conversion of the reactants. The second reaction is the formation of the DEHP, to push the equilibrium of this reaction towards the product as much as possible, the water is eliminated before the second reaction by distillation and the reactor works with an excess of alcohol.

The reactors operate at medium (140-160°C) or high temperatures (200-250°C) depending on the catalyst used. After the second reactor, the unreacted alcohol is recovered with a distillation column and fed back to the reactors (COWI et al., 2009).

vs. 2 alternatives

1. epoxidised soybean oil, ESBO:

Vegetable oils may be a promising route to renewable plasticisers since they are biodegradable and have low toxicity. Different types of vegetable oils from different sources can be used: soybean, linseed, palm, castor bean. Among the different vegetable oils, Epoxidized soybean oil (ESBO) is the most common oleochemical used for PVC compounding. Nowadays, its global production is about 240000 t/year, with a European production of 90000 t/year.

ESBO and also other epoxidised vegetable oils are used as stabilisers and plasticisers for PVC, to improve its flexibility and elasticity.

The production process involves soybean oil, an aqueous solution containing hydrogen peroxide (H_2O_2) and formic or acetic acid and sulfuric or phosphoric acid (Alhanish Abu Ghalia, 2021). The organic acid reacts with hydrogen peroxide to form a peroxy acid, which can diffuse into the oil and epoxidise it. This reaction regenerates the initial organic acid which then acts similarly to a catalyst. The reaction, normally, requires 6-10 hours to be completed keeping the temperature between 60 and 75°C.

The reaction is highly exothermic (ΔH= -55 kcal/mol for each double bond), which requires to slowly add the mixture of H_2O_2 and formic or acetic acid to the mixture of oil and acid catalyst, to avoid a steep increase in temperature (Alhanish Abu Ghalia, 2021). For this reason, the reaction takes place in pulse-fed-batch or fed-batch reactors in industry, by gradually adding the oxidants to the oil that allows to control the reaction temperature. The reaction is followed by hydrogen peroxide decomposition step, by using sodium hydroxide and a neutralization step (Kralisch et al., 2012). Afterwards, the aqueous phase is separated and the product is washed and filtered.

, ATBC:

Citric acid plasticisers are considered the first choice as nontoxic and safe plasticisers in many applications such as food packaging, medical equipment, and toys for children (Jia et al., 2018). Its basic raw material of, citric acid, is obtained via fermentation process of organic biomass.

ATBC is partly a bio-based plasticiser, due to the presence of citric acid. It has various uses: as plasticiser in food packaging film, for biomedical and biodegradable materials (Fang et al., 2018).

ATBC is produced via a two-step reaction. In the first step, Tributyl Citrate (TBC) is produced by the reaction of citric acid and n-butanol at the presence of a catalyst (H_2SO_4) (Osorio-Pascuas et al., 2015). The reaction conditions are 120°C of reaction temperature, and 0.5–1.5% of catalyst concentration.

Afterwards, ATBC can be produced through direct esterification of TBC with acetic acid (Sakakura, Nakagawa, et al., 2007) or through acetylation with acetic anhydride (Sakakura, Kawajiri, et al., 2007). The latter synthesis route produces acetic acid as a by-product and it was used to model the reaction.

The acetic acid produced was considered as part of the wastewater sent to treatment, since its low concentration makes it difficult to recover it.

Practical work in break-out teams

Plastisol production:

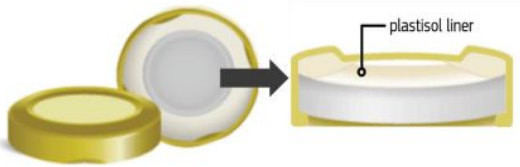


Table 3. Summary of the composition of the gasket for each of the selected plasticisers

Component of the gasket	DEHP	ATBC	ESBO
Substitution factor	1	1.06	1.1
Plasticiser	35.8%	37.2%	38.0%
PVC	47.8%	46.8%	46.1%
Blowing Agent (sodium bicarbonate)	0.6%	0.6%	0.6%
Stabiliser (zinc stearate)	1.2%	1.2%	1.2%
Lubricant (stearic acid)	4.1%	4.0%	3.9%
Pigment (TiO_2)	0.6%	0.6%	0.6%
Filler (calcium carbonate)	10.0%	9.8%	9.7%

Plastisol is a colloidal suspension of small dispersed PVC particles, with a diameter of 0.1–5 μm, in a liquid plasticiser matrix (Saeki Emura, 2002). A description of its production steps and operation conditions is reported hereunder.

In the plastisol production, the PVC used is an emulsified PVC (E-PVC) (Saeki Emura, 2002). E-PVC and the other additives (e.g. stabilisers, fillers, pigments, etc.), which are reported in Table 3, are all added into a blender, named Banbury mixer, along with a plasticiser, by forming a paste (Yalcin, 2015). During this process that can last about 60 min, the intensive mixing applied can cause a temperature increase. To avoid this issue of heating-up to 50-75°C, the blender is cooled with an external jacket fed with water (Graham, 1973).

The material formed by this step is a paste, named plastisol. It has the properties of a visco-elastic liquid at room temperature.

In most cases, plastisols are de-aerated after mixing and stored at controlled temperatures, preferably below 23°C, to prevent heat-induced viscosity increase and other changes in their desired rheology caused by aging (Wilkes et al., 2006).

When combined with PVC, plasticisers convert the rigid, intractable resins into workable compounds which can exhibit a wide range of properties depending on the type and concentration of plasticisers used (Arkema, 2013).

Gasket manufacturing:

The gasket production involves the following steps: i) pre-heating the plastisol, then ii) the plastisol is injected into the article (i.e. metal cap) and finally iii) it becomes solid when cured in the oven and the gasket is formed.

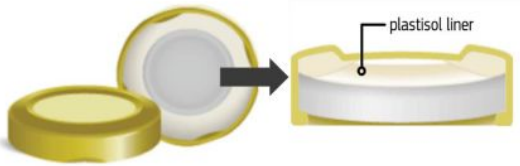
During the pre-heating, the plastisol produced in the previous stage (the compounding step) is heated up to 70-110°C at which the gelation process happens: the adsorption of plasticiser by PVC particles takes place because of an increase of the temperature and/or a drastic ageing (Marcilla et al., 2017). Once the pre-heating step is completed, plastisol is then injected into the metal cap and it is casted in the final step. Data are not available for this process, therefore the energy consumption for injection was estimated as part of the heating of the material, since the energy consumed in injecting a viscous liquid is mostly transformed in heat and therefore in temperature increase of the material.

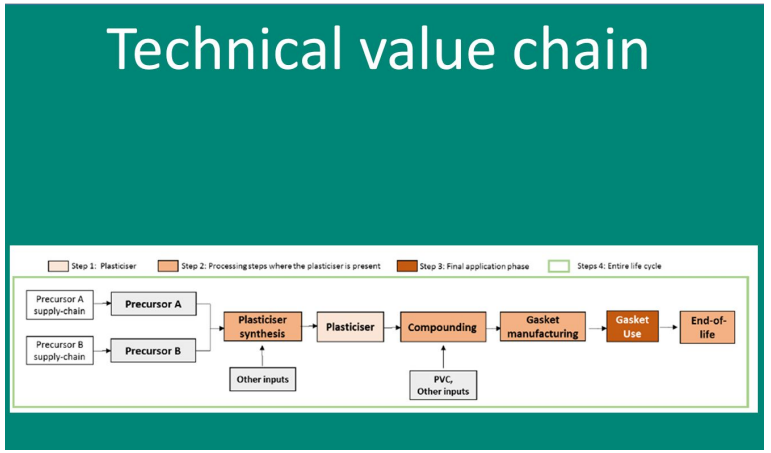
The final step is the curing of the material by passing through an oven (Graham, 1973). In this step fusion mechanism takes place, thus the PVC particles and the plasticiser melt together to form a homogeneous material with the desired mechanical properties when it is cooled down (Marcilla et al., 2017). Temperature varies from 150°C to 190°C (Graham, 1973). The energy requirement for this step, has been estimated from a previous work, in which a similar mixture is cured in a high-velocity hot-air tunnel oven (Boluk et al., 1990).

Heat-treatment: what kind of thermal treatment is used and for how long, considering that shelf-stable foods are subject to sterilising treatment to eliminate all spores and vegetative bacteria able to grow in the food, so that they can be stored at ambient temperature while sealed (Koutsoumanis et al., 2021).
Time: based on the study of McCombie et al. (2012), most of the sampled products showed significant plasticiser migration from one to four years from the end of their shelf-life. Furthermore, compliance of the product should be tested at the end of the shelf life. Therefore, three scenarios can be considered (or a combination of the first with the other two):

- For 6, 12, 24, 36 or 48 months unopened glass jar at ambient temperature (to be selected in the step 3);
- 7, 10 days in the fridge (4°C) as opened package;
- 2, 4 months in the freezer (-18°C) opened glass jar.

Other relevant properties of the food such as alcohol content, free fat content and pH.





Objective 1: Define the technical value chain

The technical value chain refers to the **series of interconnected processes** and **stakeholders that contribute to the creation, development, and delivery of the final product.**

It defines the **roles of technical actors** and **outlines their contributions at each stage of the product life-cycle**, from initial concept through design, production, and maintenance. Each link in the chain adds technical value by refining processes, improving efficiency, and ensuring the quality and functionality of the end product.

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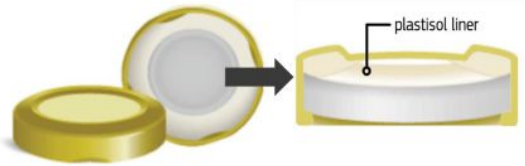
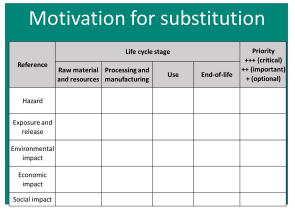
Hands-on Tue afternoon

Objective 2: Motivation for re-design





Reference	Life cycle stage				Priority +++ (critical) ++ (important) + (optional)
	Raw material and resources	Processing and manufacturing	Use	End-of-life	
Hazard					
Exposure and release					
Environmental impact					
Economic impact					
Social impact					

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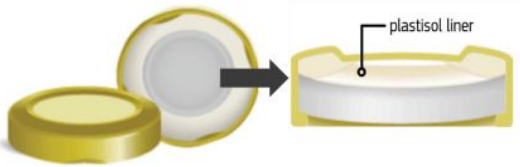
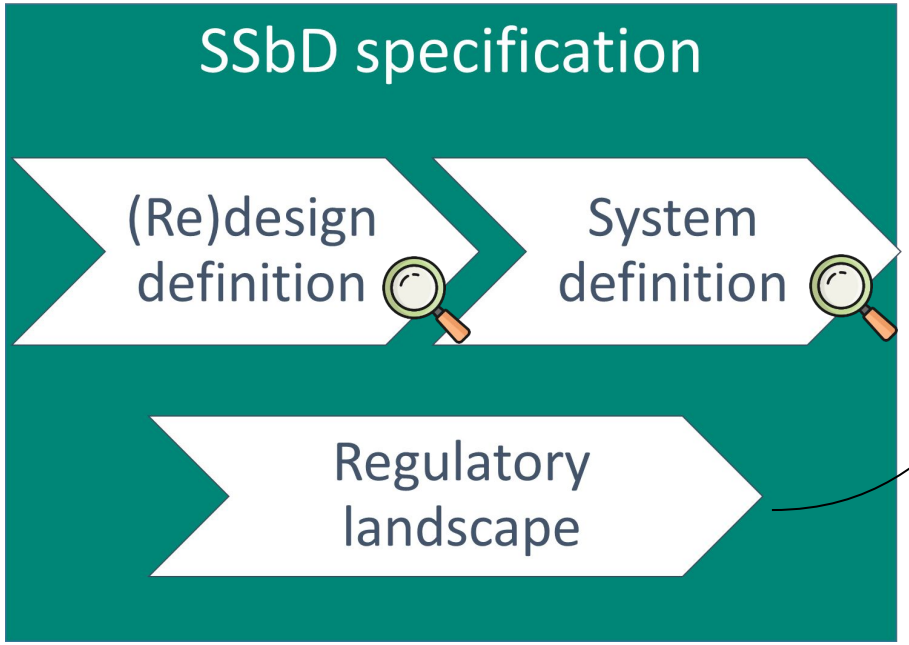


Objective 3: (Re)Design and system boundaries definition



Hierarchy of norms

General EU legislative acts

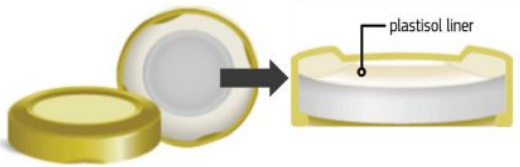
Sector-dependant legislative acts

Non-mandatory standards or labels

REACH Registration, Evaluation, Authorization and restriction of Chemicals Regulation (EC) No 1907/2006	CLP Classification, Labelling and Packaging of substances and mixtures Regulation (EC) No 1272/2008	CSRD Corporate Sustainability Reporting Directive Directive (EU) 2022/2464
General regulation	General regulation	General description
CS specific Regulated substances and Limits	CS specific	CS specific

Substance related *Description of the substance*	**Sector/end product related** *Description of the sector and end-product*
Directive No... + description Regulation No...+ description	Directive No... + description Regulation No...+ description

ISO standards	**Labels**
ISO No... + interest	Name of label + interest



Objective 3: (Re)Design and system boundaries definition

1/3

Purposes	What are the goals of your innovation: • Development of a new chemical /material • Finding of chemical /material alternative(s) • Developing a new process • Improvement of the production processes • Developing a new product • Improving the functionality of the product /application • Other	• Reduction of the hazard properties of the chemical /material • Increase of the safety of production and processing of the chemical /material • Increase of the safety of the chemical /material during the application • Improvement of the environmental sustainability of the chemical /material • Improvement of the socio-economic sustainability of the chemical /material • Other

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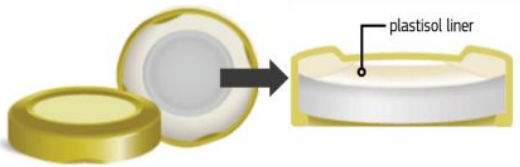

Objective 3: (Re)Design and system boundaries definition

2/3

Principles	What are the SSbD principles relevant for your CS that should be assessed: • Material efficiency • Minimise the use of hazardous chemicals or materials • Design for energy efficiency • Use renewable sources • Prevent and avoid hazardous emissions • Design for end of life • Consider the whole life cycle • Other principles (please specify)

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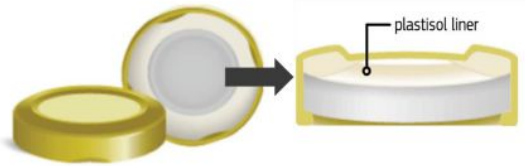
Hands-on Tue afternoon

Objective 3: (Re)Design and system boundaries definition



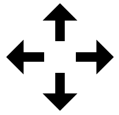
3/3

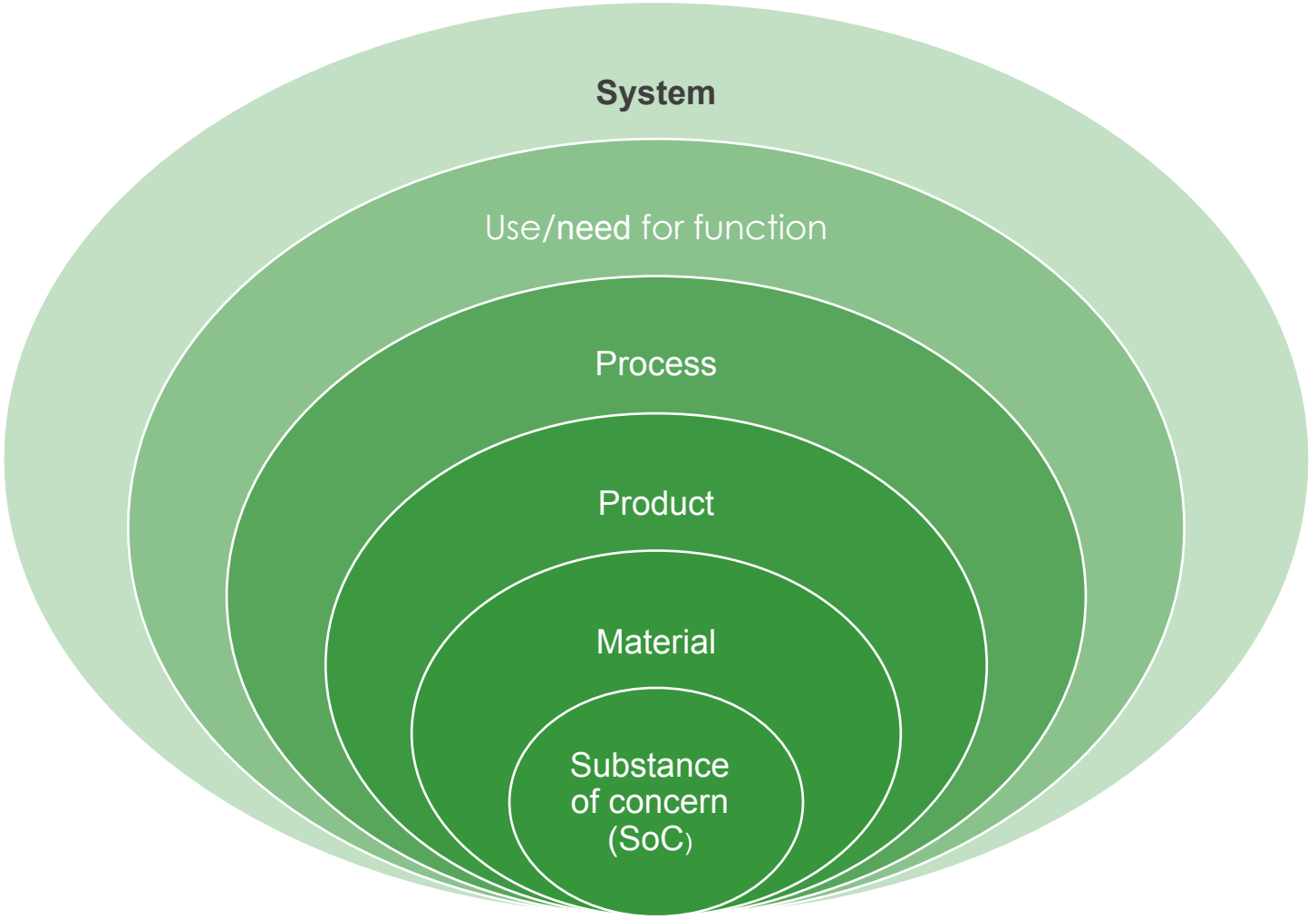
Molecular (re)design	Process (re)design	Product (re)design
Is there any existing chemical/material that can be used as a reference to compare the results of the SSbD study? If no reference chemical/material has been selected, the reference might be chosen with one of the following aspects: • Chemical/material with similar structure • Chemical/material fulfilling the same function • Representative Chemical/material as for the definition of Representative Product in the PEF method • Other criteria to define the benchmark At which Technology Readiness Level (TRL) is chemical/material under development?	Does the improvement of the process require a new technology? If yes, at which Technology Readiness Level (TRL) is the new technology(ies) for the process improvement? Provide information about the new technology needed for the improvement of the process, for instance the characteristics, the energy and auxiliaries consumed, its emissions and waste generated…	Does the (re)design of the product/application involve a new application? If yes, at which Technology Readiness Level (TRL) is the new technology(ies) for the process improvement? Provide information about the new technology needed for the improvement of the product/application

Link to material: https://drive.google.com/drive/folders/1wrwO95Z-BVj6BReEBrhJmziWu8XVn_GK

SSbD assessment system

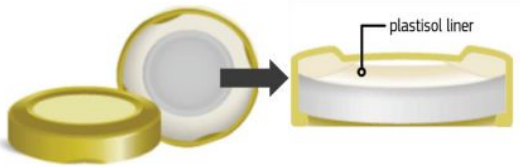
Change





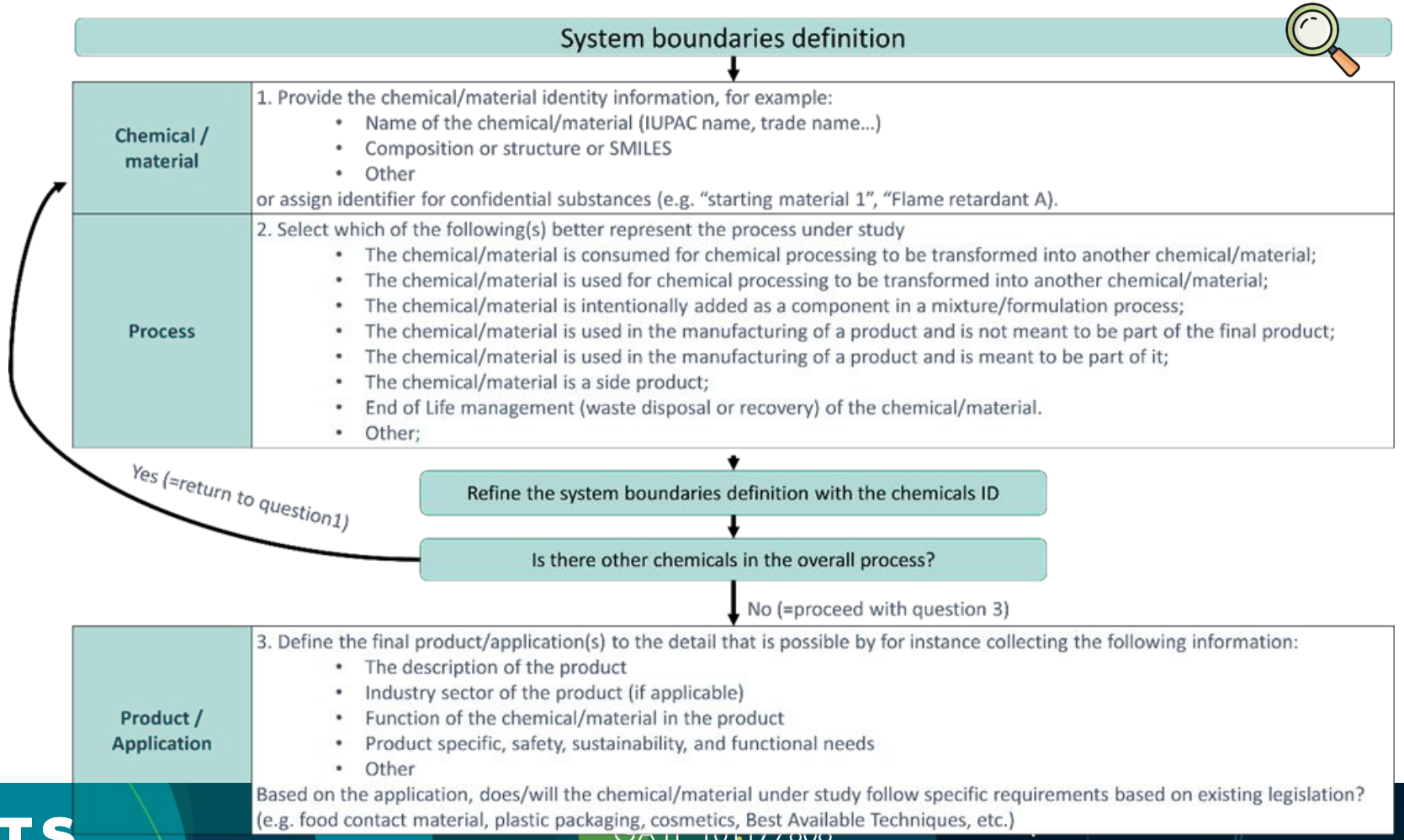
Eliminate / Substitute

Re-Design



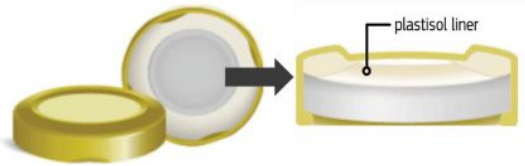
Objective 3: (Re)Design and system boundaries definition

(Re)design definition → System definition



Hands-on Tue afternoon

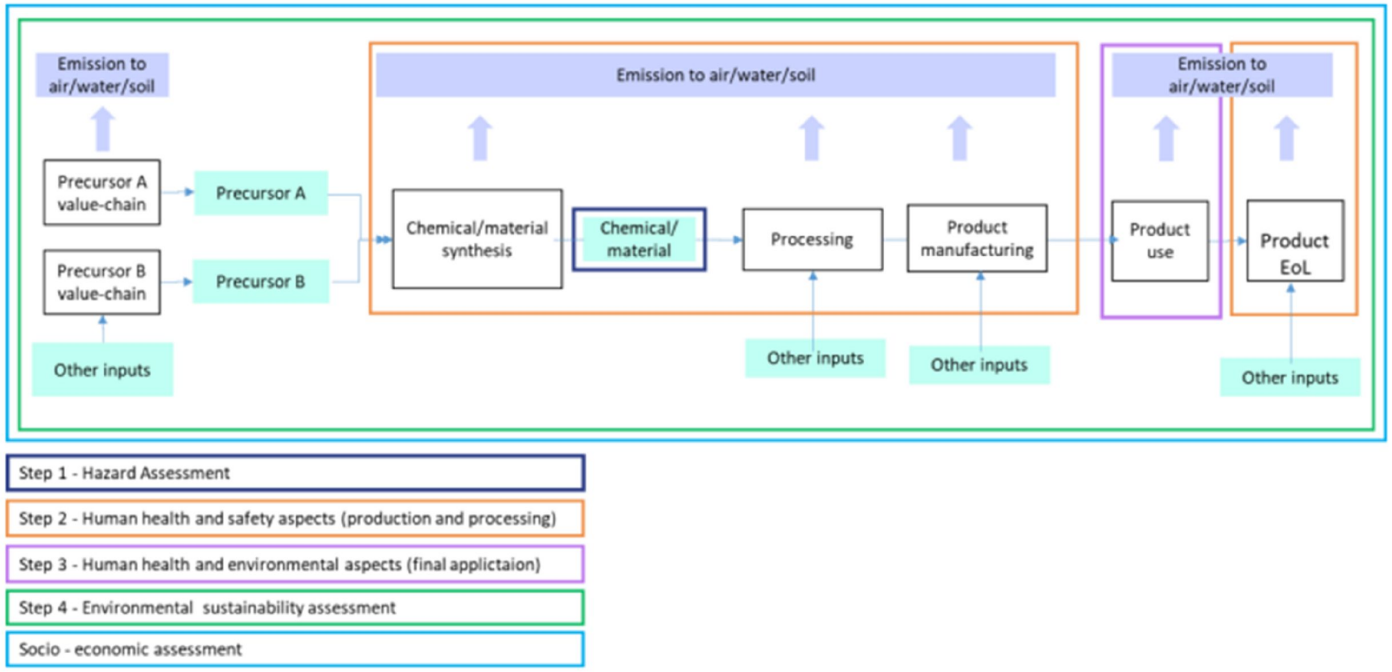
Objective 3: (Re)Design and system boundaries definition



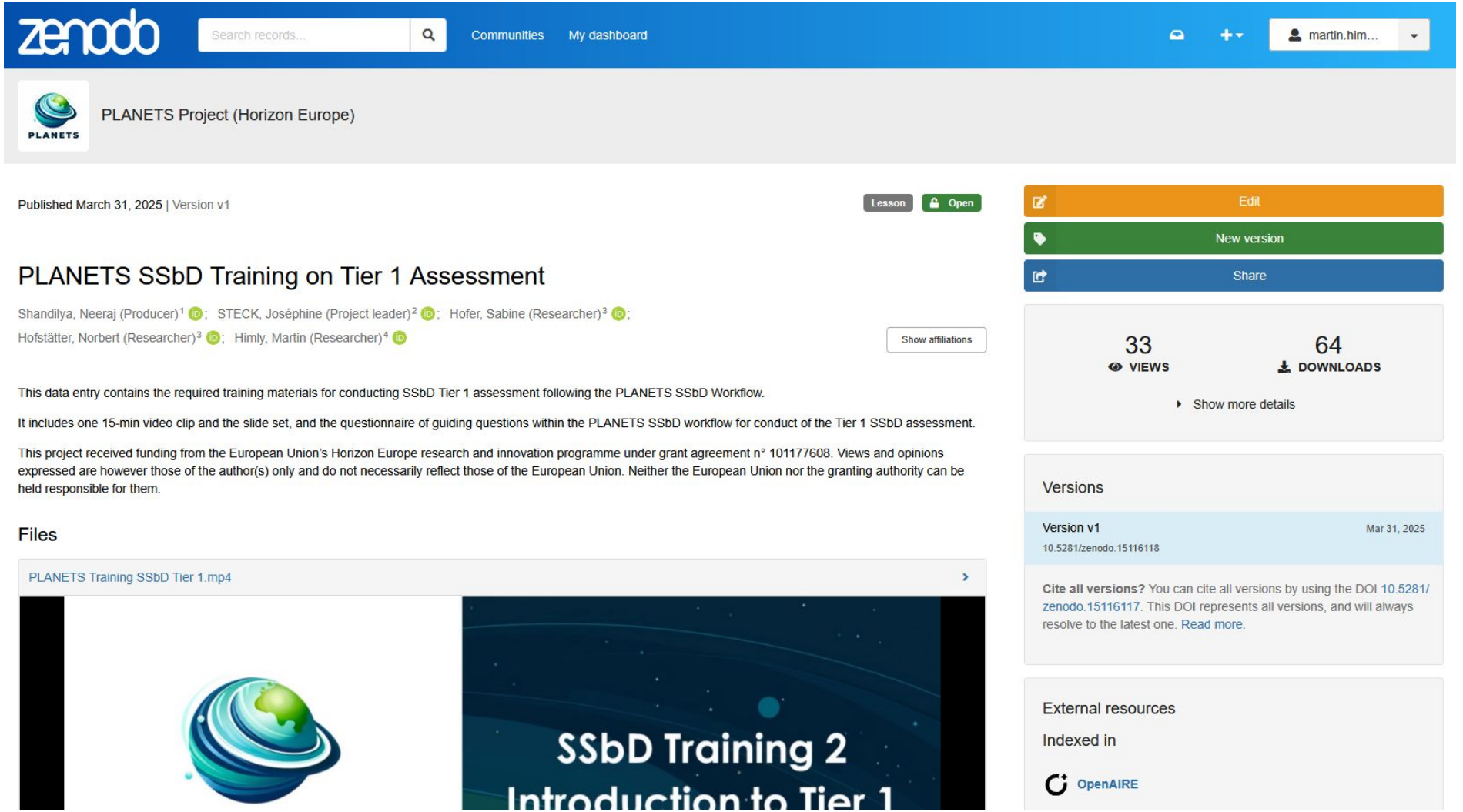
System boundaries defintion

from European Commission, Joint Research Centre, Abbate, E., Garmendia Aguirre, I., Bracalente, G., Mancini, L., Tosches, D., Rasmussen, K., Bennett, M.J., Rauscher, H. and Sala, S., Safe and Sustainable by Design chemicals and materials - Methodological Guidance, Publications Office of the European Union, Luxembourg, 2024, https://data.europa.eu/doi/10.2760/28450, JRC138035.

Figure 10. Representation of the alignment between the chemical/material life cycle and the progressive required broadening of the SSbD assessment steps and boundaries (boxes in white are processes stages, coloured boxes are inputs and outputs of the processes). [EoL: end of life]



PLANETS' Tier 1 at Zenodo



Shandilya, N., Steck, J., Hofer, S., Hofstätter, N., & Himly, M. PLANETS SSbD Training on Tier 1 Assessment. https://doi.org/10.5281/zenodo.15116118

Tier 1 assessment

Innovation process

Data availability

Tools

Product Idea & Screening

Gate2

Lab Scale

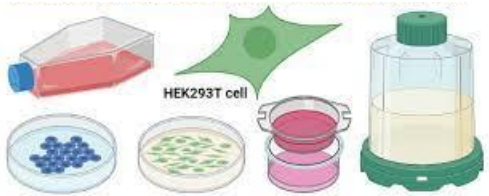
Gate3

Pilot scale

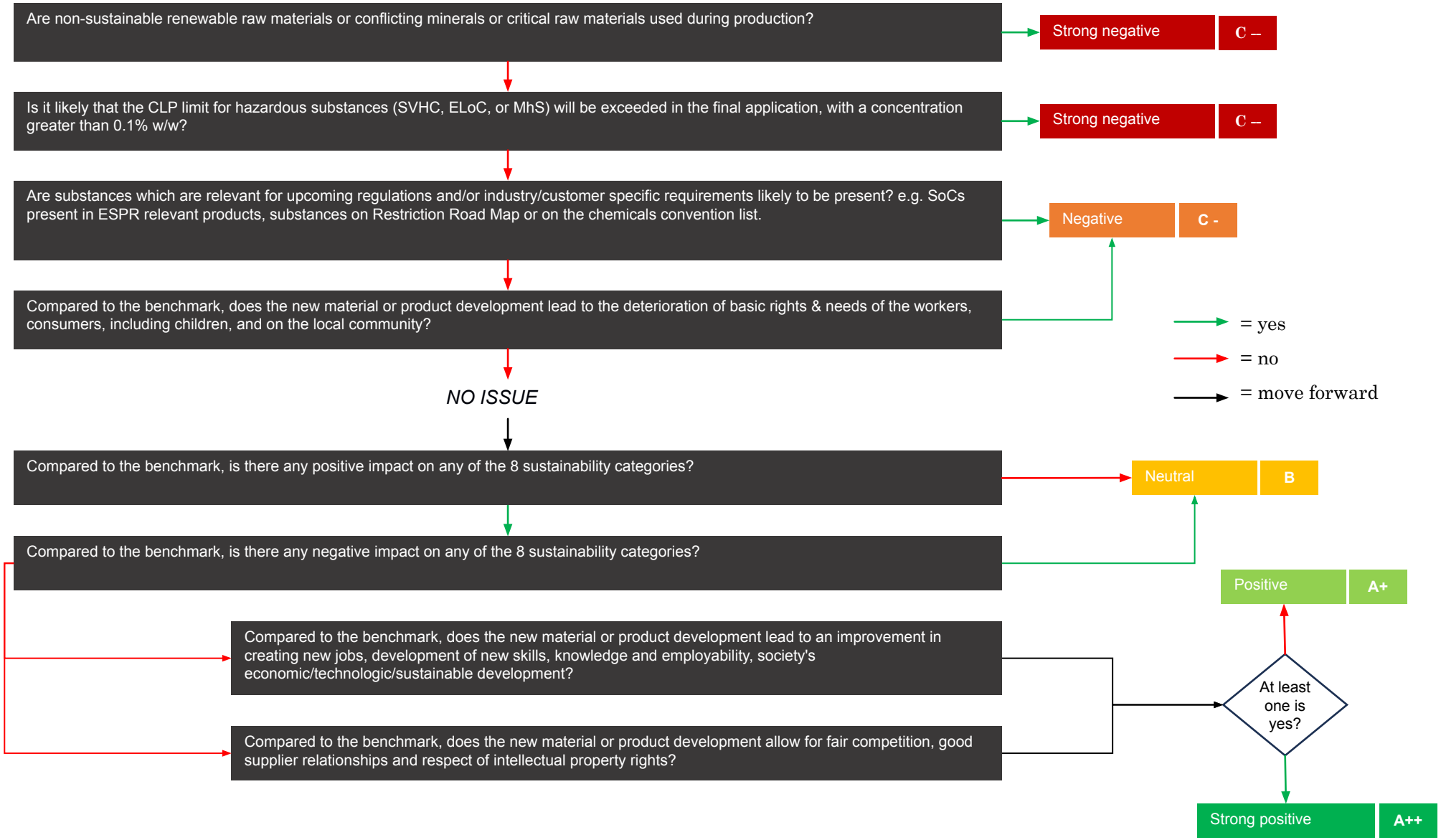
Gate4

Qualitative assessment

Quantitative assessment



Tier 1 assessment decision scheme



Points of attention

- No “show-stoppers”
- Make innovators aware of the potential SSbD issues
- Each PoA triggers a higher tier assessment

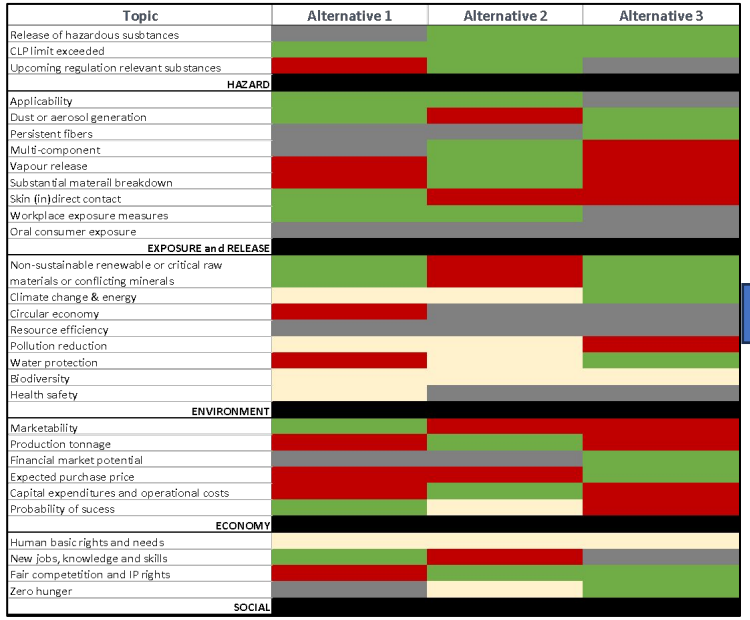
= yes

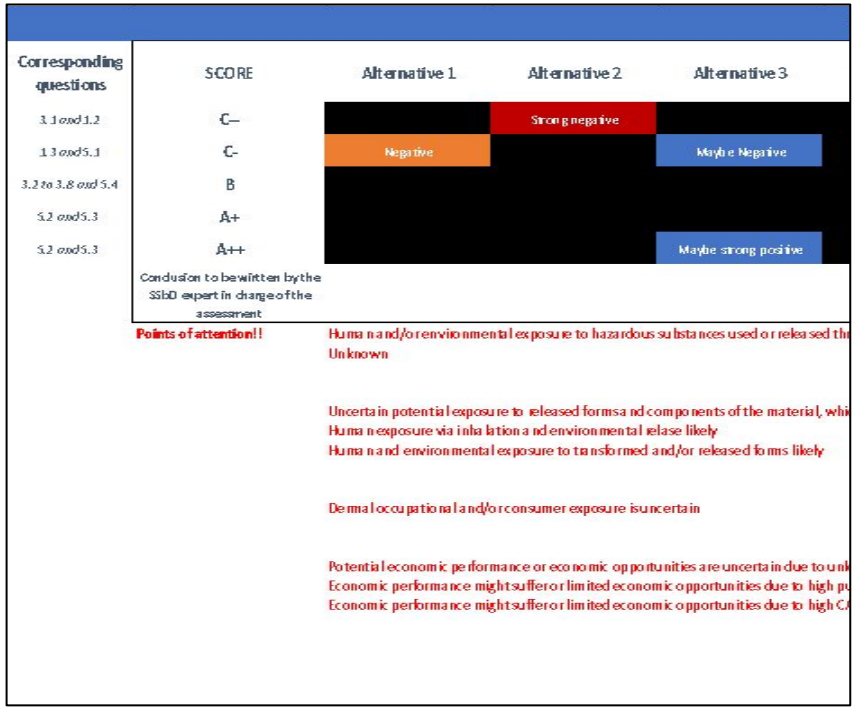
= no

= point of attention

Tier 1 assessment tool

	Dimension	Reference	Alternative 1	Alternative 2	Alternative 3
	1: Hazard				
1.1	Is the human and/or environmental release of hazardous substances (Substances of very high concern, Equivalent level of concern, Substances of concern, or hazard band C, D, or E) likely at any stage of the product's life cycle?	Yes	Unknown	No	No
1.2	Is it likely that the CLP limit for hazardous substances will be exceeded in the final application, with a concentration greater than 0.1% w/w?	Unknown	No	No	No
1.3	Are substances which are relevant for upcoming regulations and/or industry/customer specific requirements likely to be present? e.g. SoCs present in ESPR relevant products, substances on Restriction Road Map (https://ec.europa.eu/docsroom/documents/49734) or on the chemicals convention list.	No	Yes	No	Unknown
	2: Release and exposure				
2.1	Do you identify the potential use/applicability of the final material/product?	No	Yes	Yes	Unknown
2.2	At any life cycle stage, is your material or product in powder form and/or is it possible that dust or aerosols are released?	No	No	Yes	No
2.2a	If yes, does your material contain rigid, persistent fibres (length > 5 µm and diameter < 3 µm)?	Unknown	Unknown	Unknown	No
2.3	Is your material, product multi-component?	Yes	Unknown	No	Yes
2.4	At any life cycle stage, is your material or product in a liquid/vapour (with vapour pressure > 1 Pa) and/or is it possible that vapours are released?	No	Yes	No	Yes
2.5	Is there a possibility of substantial material breakdown during production, use and/or end of life?	No	Yes	No	Yes
2.6	Is there a possibility of (in)direct contact with worker and/or consumers kin?	No	No	Yes	Yes
2.7	Are there any exposure prevention measure(s) applied at the workplace?	No	Yes	Yes	Unknown
2.8	Is there a possibility of oral consumer exposure?	Unknown	Unknown	Unknown	Unknown
	3: Environmental impact				
3.1	Are non-sustainable renewable raw materials or conflicting minerals or critical raw materials used during production?		No	Yes	No
3.2	What is the impact of the new material or product compared to the conventional material or product on the following sustainable development category: Climate change mitigation & energy conservation?* (Click on this cell for more information)		Equal	Equal	Positive
3.3	What is the impact of the new material or product compared to the conventional material or product on the following sustainable development category: Circular economy?* (Click on this cell for more information)		Negative	Unknown	Unknown
3.4	What is the impact of the new material or product compared to the conventional material or production on the following sustainable development category: Resource efficiency?* (Click on this cell for more information)		Unknown	Unknown	Unknown
3.5	What is the impact of the new material or product compared to the conventional material or production on the following sustainable development category: Pollution reduction?* (Click on this cell for more information)		Equal	Equal	Negative
3.6	What is the impact of the new material or product compared to the conventional material or production on the following sustainable development category: Water protection?* (Click on this cell for more information)		Negative	Equal	Positive
3.7	What is the impact of the new material or product compared to the conventional material or product on the following sustainable development category: Biodiversity protection?* (Click on this cell for more information)		Equal	Equal	Equal
3.8	What is the impact of the new material or product compared to the conventional material or product on the following sustainable development category: Health safety?* (Click on this cell for more information)		Equal	Unknown	Unknown
	4: Economic performance				
4.1	Is the marketability of the new material or product better or equal to the benchmark due to, for instance, improved or new functionality or a clear image advantage? (Click on this cell for more information)		Yes	No	No
4.2	Is the foreseen production tonnage of the new material or product ≥ 1 tonne per year? Calendar year is from 1 Jan to 31 Dec.		No	Yes	No
4.3	Is the foreseen market potential of the new material or product ≥ 1M€ in Europe?		Unknown	Unknown	Yes
4.4	Is the (expected) purchase price per unit of the new material or product lower or equal to the benchmark?		No	No	Yes
4.5	Are the capital expenditures and operational costs (e.g. maintenance, energy use) during the production and/or use phase of the new product or application lower or equal to the benchmark?		No	Yes	No
4.6	What is the aggregated probability of success to manufacture of the new product on a commercial scale?		>50%	10% to 50%	<10%
	5: Social				
5.1	Compared to the benchmark, does the new material or product development lead to the deterioration of basic rights & needs of the workers, consumers, including children, and on the local community? (Click on this cell for more information)		No	No	No
5.2	Compared to the benchmark, does the new material or product development lead to an improvement in creating new jobs, development of new skills, knowledge and employability, society's economic/technologic/sustainable development?		Yes	No	Unknown
5.3	Compared to the benchmark, does the new material or product development allow for fair competition, good supplier relationships and respect of intellectual property rights?		No	Yes	Yes
5.4	What is the impact on the following sustainable development category: zero hunger?* (Click on this cell for more information)		Unknown	Equal	Positive

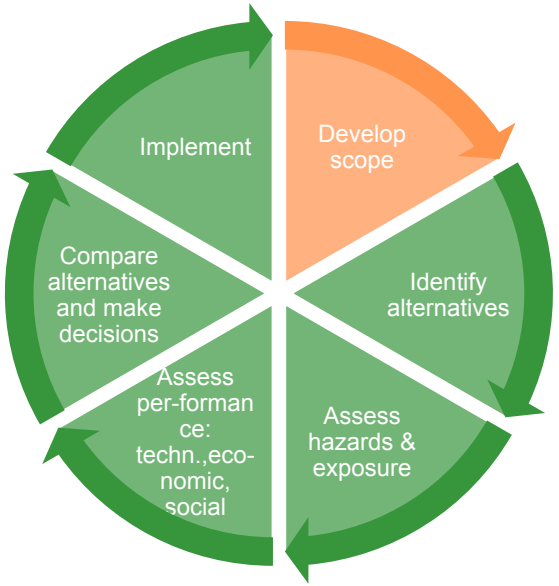




SSbD Hands-on

Location / Time	Monday, 9th June	Tuesday, 10th June CA22143 EuMINe Training Day 1	Wednesday, 11th June CA22143 EuMINe Training Day 2	Thursday, 12th June	Friday, 13th June
	Auditorium Santa Margherita of Universitá Ca'Foscari Venezia				
08:30-09:00		Arrival, Check-in, Registration			
09:00-10:30		Welcome to the School Setting the scene: Latest advancements in SSbD Intrinsic hazard properties characterization	Environmental life cycle assessment	Integrating functionality into SSbD workflows Multidimensional analysis and decision-making tools	Philosophical reflections on SSbD Award giving for pitch talks Presentations & discussions of results of Case Study 1 & 2
10:30-11:00		Coffee Break	Coffee Break	Coffee Break	Coffee Break
11:00-12:30		New Approach Methodologies for risk assessment In silico modeling approaches	Group work: Focus groups on SSbD in Intermediate/Late Innovation Stages • Focus 1: Safety • Focus 2: Sustainability	Group work: Focus groups on MCDA for Case Study 1 & 2 – linking safety and sustainability with functionality	Continuation of Case Study 1 & 2 results discussion DPP Spotlight Presentation & Plenum Discussion
12:30-14:00		Lunch	Lunch	Lunch	Feedback - Closing Remarks
14:00-15:30		Group work: Focus groups on SSbD in Early Innovation Stages • Focus 1: Safety • Focus 2: Sustainability	Continuation group work	Continuation group work	
15:30-16:00		Coffee Break	Coffee Break	Coffee Break	
16:00-18:00		In vitro vs. in vivo studies Risk assessment Pitch presentations – Slot 1 by Training School participants	Socio-economic life cycle assessment FAIR data Pitch presentations - Slot 2 by Training School participants	Co-creation workshop: Science2Policy, Science2Industry, Science2Citizens Publishing ethics Pitch presentations - Slot 3 by Training School participants	
	Welcome Reception & Networking starting at 17:30	Social Program: Guided Walking Tour of Venice		Social Dinner & Networking starting at 19:30	

SSbD Hands-on



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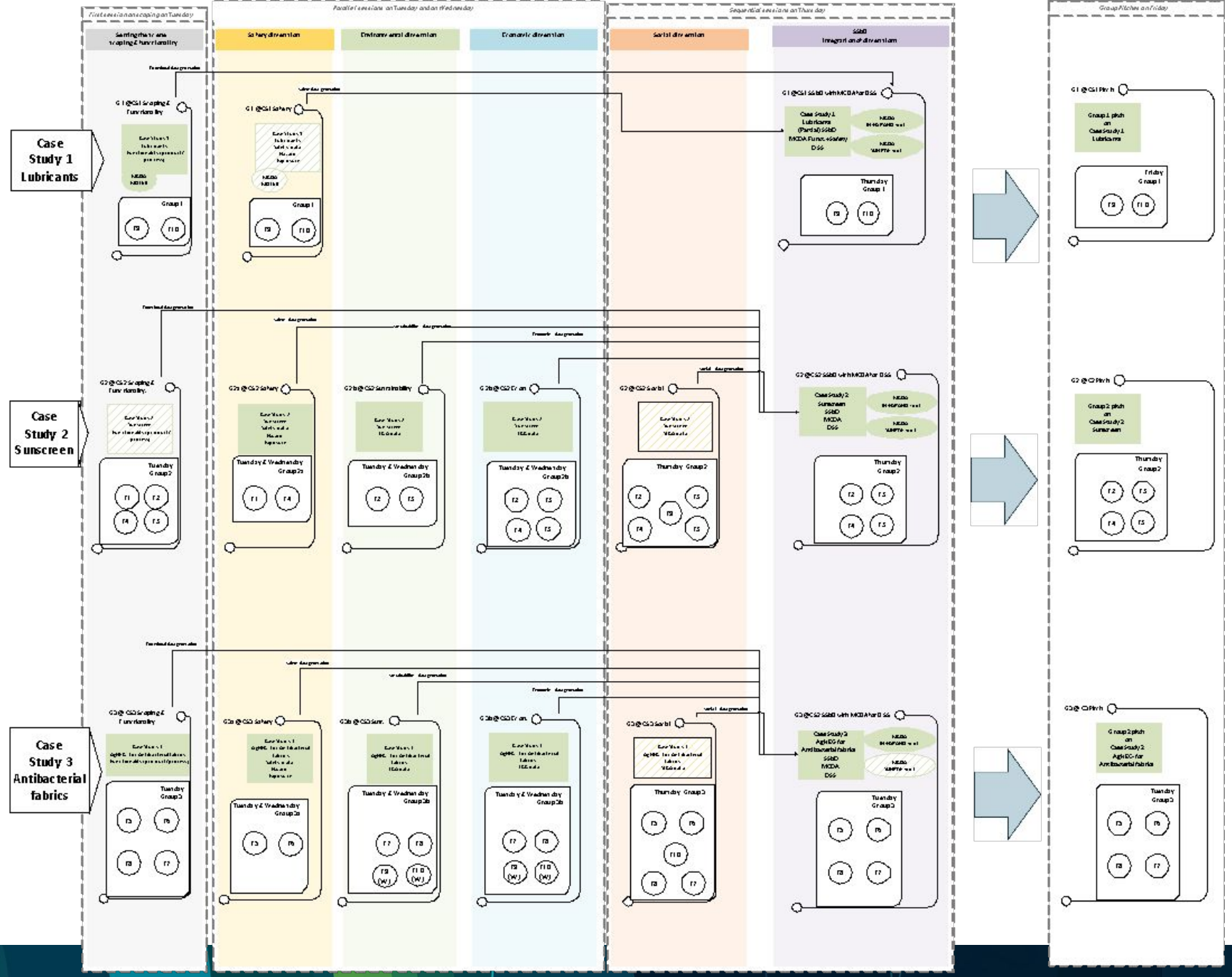

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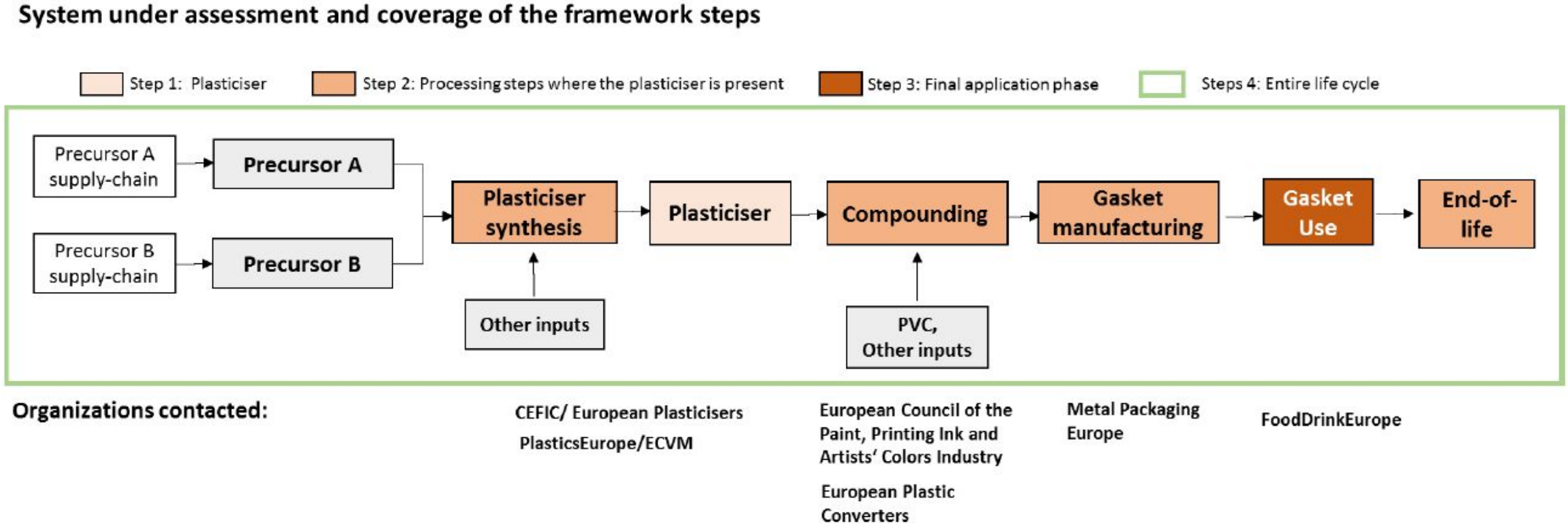
Funded by the European Union

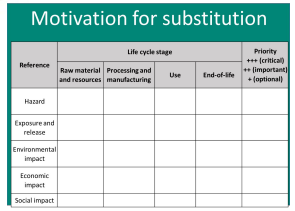
This project received funding from the European Union's Horizon Europe research and innovation programme under grant agreement n° 101177608. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them.

Technical value chain incl. potential stakeholders

- Plasticizer in food contact material

Figure 2. Description of the case study system and sources of information for each step





Objective 2: Motivation for re-design

Reference	Life cycle stage				Priority +++ (critical) ++ (important) + (optional)
	Raw material and resources	Processing and manufacturing	Use	End-of-life	
Hazard		Repro tox + endocrine disrupt.	Repro tox + endocrine disrupt.	Material burnt	+++
Exposure and release			May be released into food by time		+++
Environmental impact					
Economic impact					
Social impact					