

Safe and sustainable by Design

The JRC framework: updates on ongoing activities and next steps

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The Joint Research Centre of the European Commission



As the science and knowledge service of the European Commission, the Joint Research Centre's mission is to support EU policy-making with independent evidence throughout the whole policy cycle.

Agenda

- Overview of the SSbD framework
 - Policy context
 - Main features
 - Challenges and ongoing activities
- Outlook the SSbD framework
 - Synergies
 - Next milestones

Overview of the SSbD Framework

Overview of the SSbD framework

Policy context

The EU Green Deal



Zero pollution



Climate neutrality



Circular economy

Chemicals Strategy for Sustainability (CSS)

- **phase out the most harmful** (not only SVHCs) **substances** and
- **substitute**, as far as possible, **all other substances of concern**, and otherwise minimise and track them.



New approaches to tackle releases and emissions across all life cycle stages, and move towards zero-pollution for air, water, soil and biota.

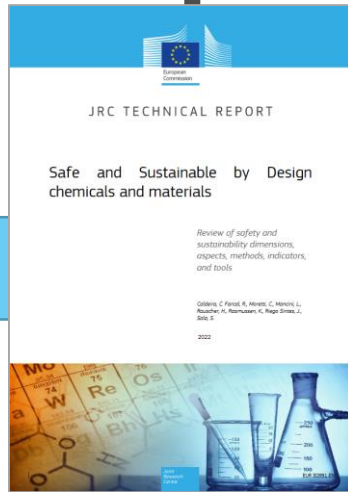
CSS Action Plan

Develop safe and sustainable-by-design (SSbD) criteria for chemicals

Overview of the SSbD framework

Policy context

Review of existing frameworks and initiatives



EC Recommendation



Testing by stakeholders and updates proposals



2022

2023

2024

Framework for the definition of criteria and evaluation procedure for chemicals and materials

Application of the framework to case study

Main features

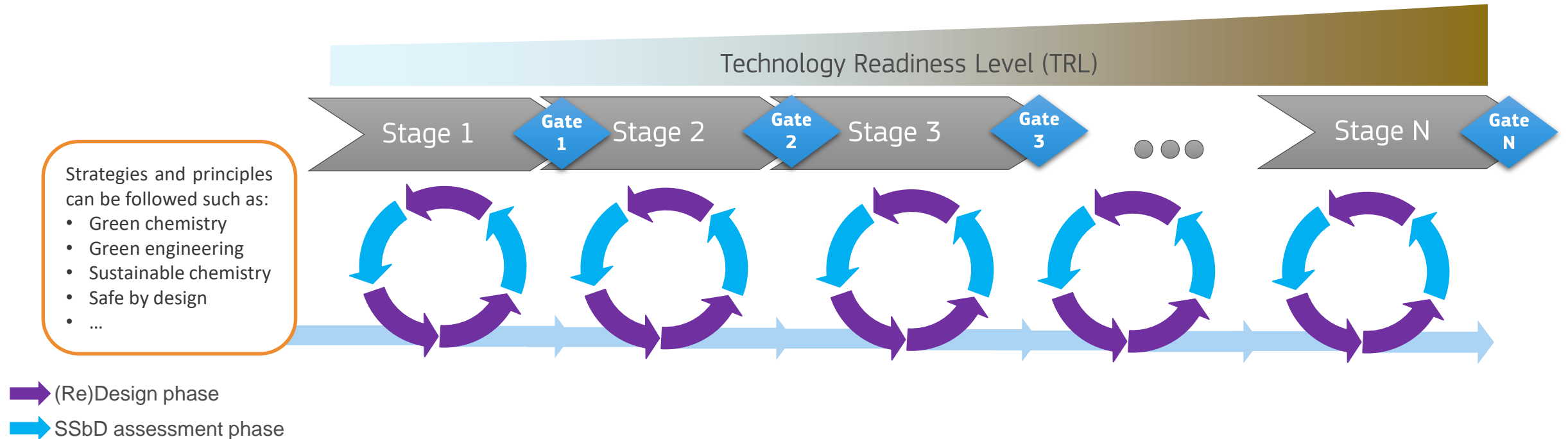
Scope of the SSbD framework

- a pre-market, **voluntary** approach, to steer innovation toward safe and sustainable **chemicals and materials**
- support the various stages of the innovation process (design, planning, experimental testing and prototyping) where decisions are taken to proceed with, abandon or tweak the innovation pathway
- applicable to the development of new chemicals and materials or to re-assessment of existing ones towards improving the overall performance of processes

Overview of the SSbD framework

Main features

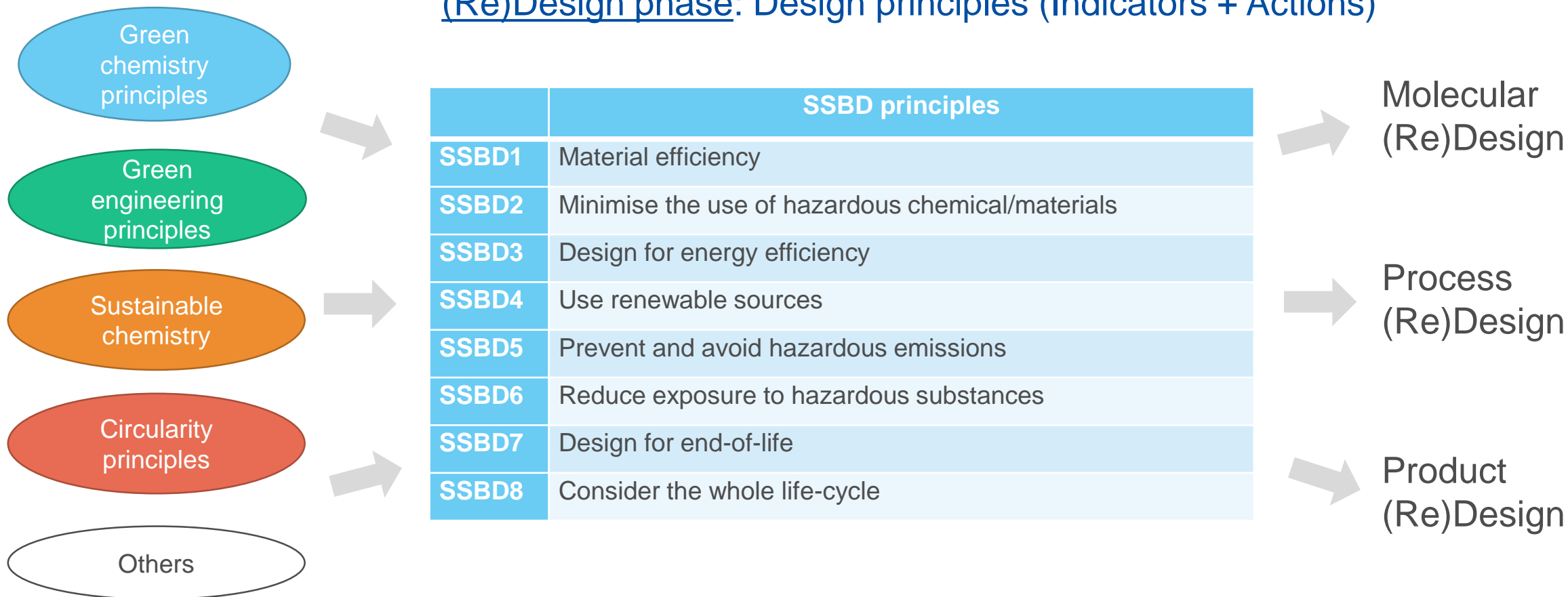
Structure of the framework: Stage-gate and Iterative approach



- It is essential to **test the application of design principles** against **safety and sustainability** aspects

Overview of the SSbD framework

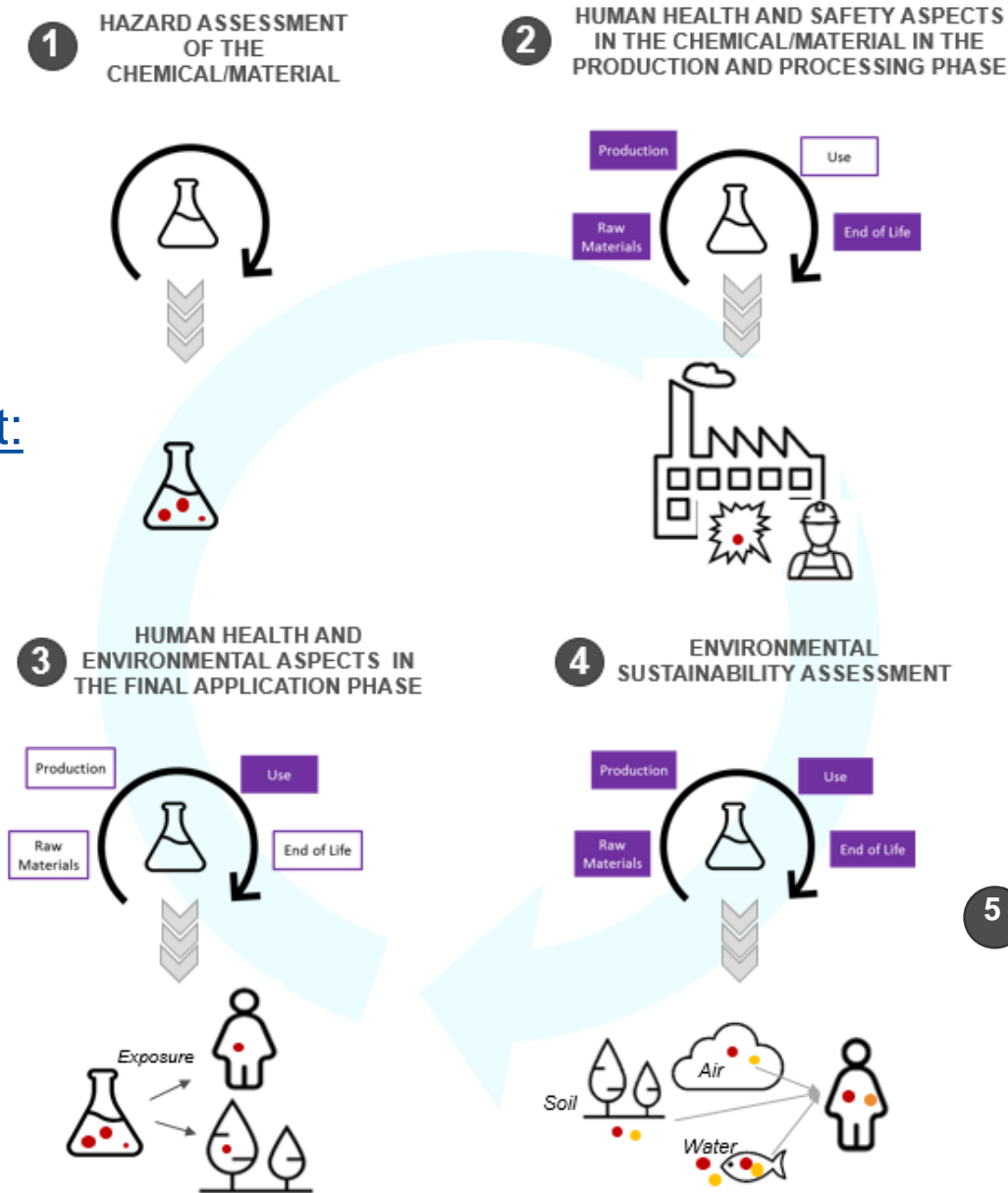
Main features



Overview of the SSbD framework

Main features

Safety and sustainability assessment:
a stepwise approach



For each step the framework refers to:

Aspects and indicators

Methodology and tools

Proposal for the definition of criteria

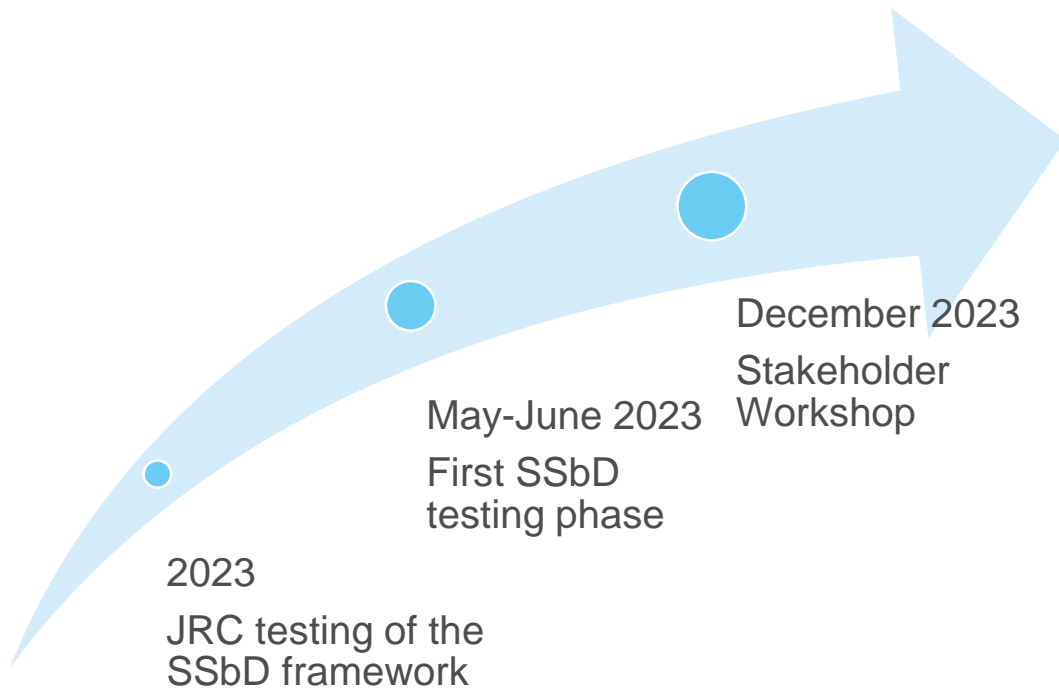
Evaluation procedure

5 SOCIO ECONOMIC SUSTAIBALITY ASSESSMENT

Overview of the SSbD framework

Challenges and ongoing activities

Inputs received to the framework (1)



Workability

Data

- harmonisation and availability of data, especially in early stage of innovation
- minimum data requirements and the generation of new data
- dealing with confidentiality of data and the exchange in the value chain

Expertise

- expertise in the value chain, especially for SME

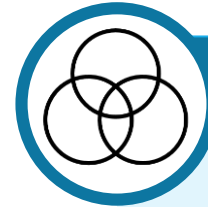
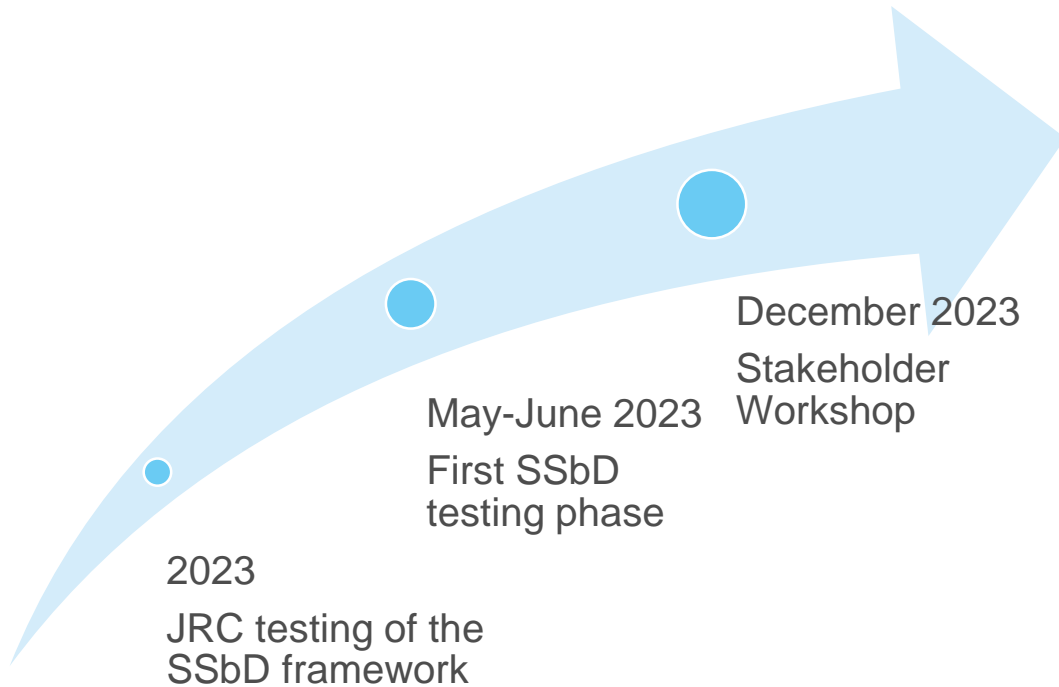
Tool

- availability of tools for the different Steps
- applicability of the tool, especially for SMEs

Overview of the SSbD framework

Challenges and ongoing activities

Inputs received to the framework (2)



Methodology

Goal, scope and structure

- integration design principles and SSbD assessment: definition of scope of the assessment, systems boundaries
- flexibility of the framework and integration with R&I
- simplified methodology according to TRL
- chemicals/materials with multiple applications

Criteria, trade-off and decision making

- dealing with functionality
- defining indicators and scoring system
- integration RA and LCA, also in terms of terminology
- dealing with uncertainty of data when comparing alternatives with different data quality

Dias, L. C., Caldeira, C., & Sala, S. (2024). Multiple criteria decision analysis to support the design of safe and sustainable chemicals and materials. *Science of The Total Environment*, 916, 169599.

Overview of the SSbD framework

Challenges and ongoing activities

SSbD methodology (1) – Scoping analysis

Integration between design principles
and the SSbD assessment

Integration of Risk Assessment (RA)
and Life Cycle Assessment (LCA)

Multiple uses and applications of the
chemical/material



Definition of the case study

- Development of a tiered approach coherent with the TRLs
- Exploration of integrating risk assessment and LCA

Overview of the SSbD framework

Challenges and ongoing activities

SSbD methodology (2) – Iteration within LCA

DEHT				
Impact category	Impacts	% change	Score	Level
Human toxicity, cancer	1.90E-09	-1%	1	
Human toxicity, non cancer	3.83E-08	0%	1	X
Ecotoxicity, freshwater	57.2	-1%	1	
Climate change	4.137	-1%	1	X
Ozone depletion	9E-07	0%	1	
Particulate matter	1E-07	-11%	2	
Ionizing radiation	0.772	0%	1	
Photochemical ozone formation	0.009	-9%	2	
Acidification	0.016	-4%	1	X
Eutrophication, terrestrial	0.034	-2%	1	
Eutrophication, freshwater	0.00155	-1%	1	
Eutrophication, marine	0.003	-3%	1	
Water use	5.1	-1%	1	
Land use	104.4	-1%	1	X
Resource use, fossil	85.5	-2%	1	
Resource use, minerals and metals	0.00005	3%	1	

1° iteration

DEHT	
Score	Level
2	
2	X
1	
2	V
1	
3	
3	
3	
2	X
2	
3	
3	
3	
2	
2	X
1	

2° iteration

DEHT	
Score	Level
2	
2	V
2	
2	V
1	
3	
3	
3	
2	V
2	
3	
3	
3	
2	V
2	
2	



Hotspot analysis



Application of design principles



Application of design principles

Overview of the SSbD framework

Challenges and ongoing activities

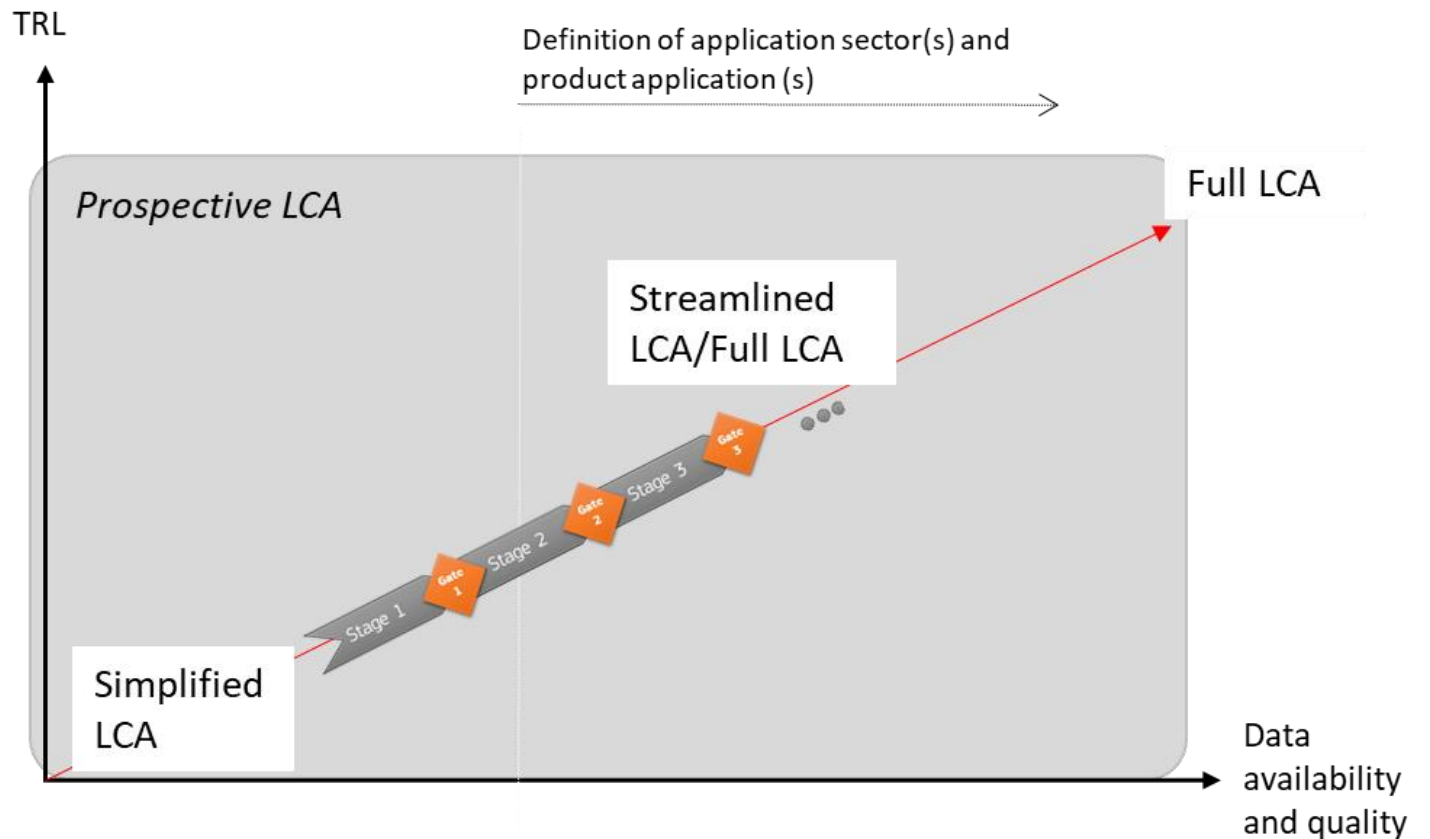
SSbD methodology and data - simplified LCA

Screening LCA

- Usually at low TRL
- Data from laboratory
- Un/known application

Full LCA

- Increasing TRL
- Data from industrial or pilot scale
- Known application



Outlook for the SSbD framework

Outlook of the SSbD framework

Synergies

SSbD related projects



Operationalisation of the SSbD framework developed by the EC. Including via the creation of a SSbD toolbox



Designing innovation roadmaps for textiles, construction, electronics, energy, automotive, packaging and fragrance in close cooperation with industries



Many others projects at European and MS level are on-going, involving different stakeholders, including Industries, Academia, Research organizations, NGOs

Caldeira et al 2024 Safe and sustainable chemicals and materials: a review of sustainability assessment frameworks. Green Chemistry

Outlook of the SSbD framework

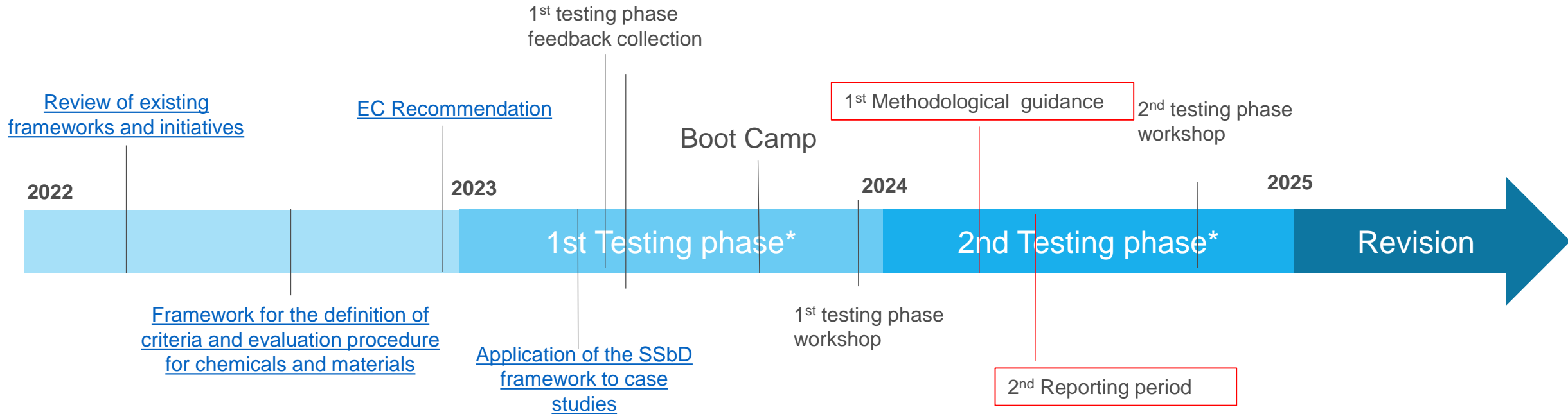
Synergies

Existing and future EU policy framework

- Pre-market, voluntary approach, to steer innovation toward safe and sustainable chemicals and materials
- Anticipation of potential safety and sustainability-based requirements from recent/new pieces of EU legislation
 - REACH (Registration, Evaluation, Authorization of Chemicals) restriction: cut-off criteria in Step 1 of SSbD to avoid “regrettable substitution”
 - ESPR (Ecodesign for Sustainable Product Regulation): setting performance requirements for Substances of Concern in articles
 - AM (Advanced Materials) communication, steering the design of Advanced Material
 - Biotechnology communication, steering the design of bio-based products
 - IED (Industrial Emission Directive): promoting the use of safe and sustainable by design chemicals
- Safety and sustainability data will be made available towards the implementation of 1S1A (One Substance One Assessment) Regulation

Outlook of the SSbD framework

Next milestones



Thank you and keep in touch

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JRC SSbD Team



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