

Methods and Tools Supporting Safe and Sustainable by Design for Textiles

Elena Semenzin



This project has received funding from the European Union's Horizon Europe research and innovation programme under Grant Agreement No. 101135372

The material presented and views expressed here are the responsibility of the author(s) only. The EU Commission takes no responsibility for any use made of the information set out.

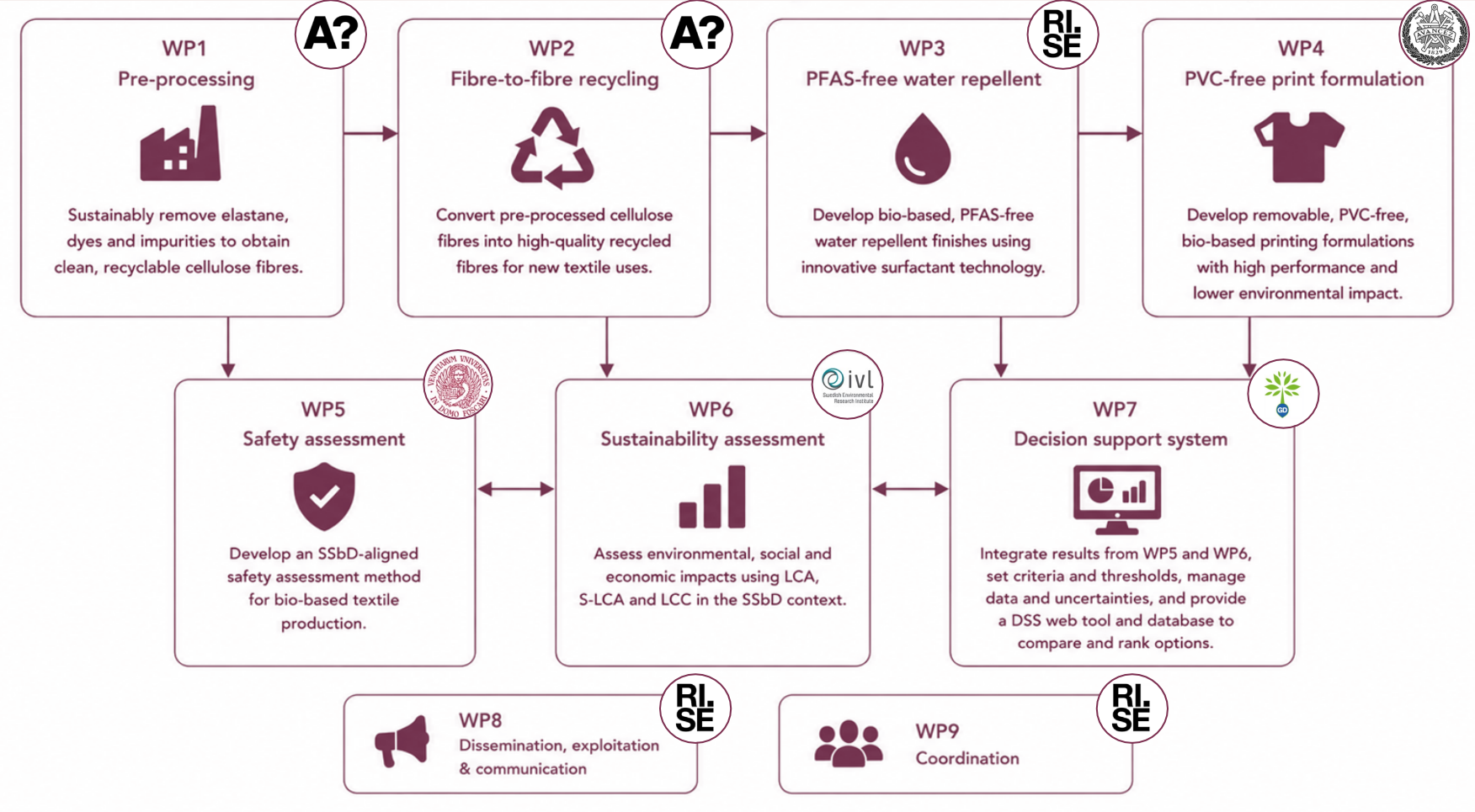


Ca' Foscari
University
of Venice

BioSusTex project

Towards absolute safe and sustainable biobased textile

GOAL: to advance sustainable innovation for cotton and cellulosic textiles, addressing recycling inefficiencies and harmful chemicals with cutting-edge technologies tailored to industry needs.



From Assessment to Decision

An integrated pathway from early screening to informed choices for safer and more sustainable bio-based textile solutions

Qualitative Life Cycle Screening Assessment



Identify hotspots and prioritise technology options along the value chain

Parallel SSbD Assessment

Safety



- Hazard assessment
 - Exposure & risk assessment
 - In-silico and experimental tools

Sustainability




- Life Cycle Assessment (LCA)
 - Social LCA (S-LCA)
 - Life Cycle Costing (LCC)
- Absolute Sustainability (AESAs)

Decision Support System (DSS)



- Multi-Criteria Decision Analysis (MCDA)
- Hierarchical aggregation of SSbD results

Qualitative Life Cycle Screening Assessments



Identify hotspots and prioritise technology options along the value chain

**LCBROM,
Scoping method**

Evaluate low-TRL textile technologies across:

- environmental,
- economic, and
- social dimensions.

To support:

- technology prioritisation,
- design improvement,
- and SSbD-oriented innovation.

Two methodological approaches were used:

LCBROM

Pre-processing
Fibre-to-fibre recycling
PVC-free print formulation

**SSbD
Scoping
Method**

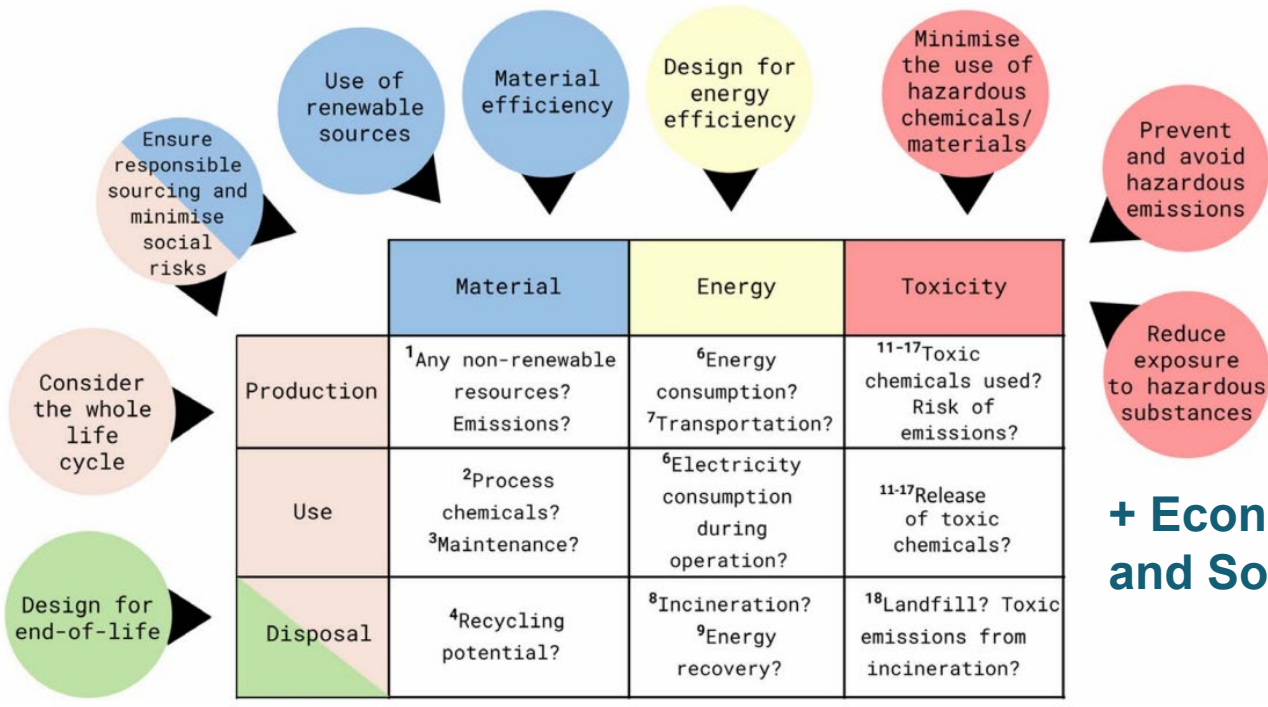
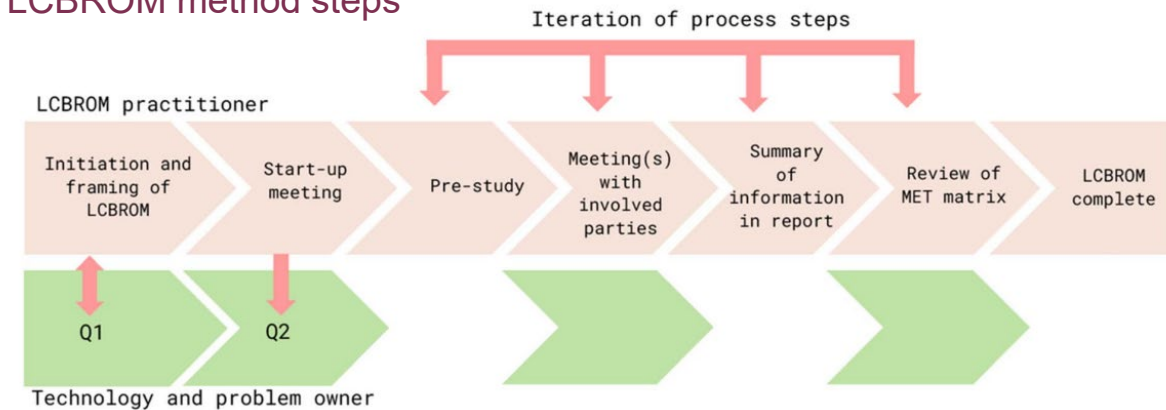
PFAS free water repellent

LCBROM



LCBROM (Kärnman et al. 2025) is applied as a sustainability screening (SuS) method to identify key environmental, economic, and social risks and opportunities in early-stage innovations of BioSusTex processes

LCBROM method steps



SSbD design principles connection to the MET+Ec+S matrix used in LCBROM


+ Economic (Ec) and Social (S)

Article
Early-Stage Simplified SSbD Screening of a Removable, PVC-Free Screen-Printing Ink: A Qualitative Life Cycle Perspective
 Olga Lysenko ^{1,*}, Sahar Safarian ^{2,*}, Pavinee Hasselberg ², Nilay Elginöz ¹, Tomas Rydberg ², Maja Halling ¹, Steffen Schellenberger ³, Jutta Hildenbrand ², Gustav Ulas ⁴, Yiming Jia ^{4,5} and Romain Bordes ⁵

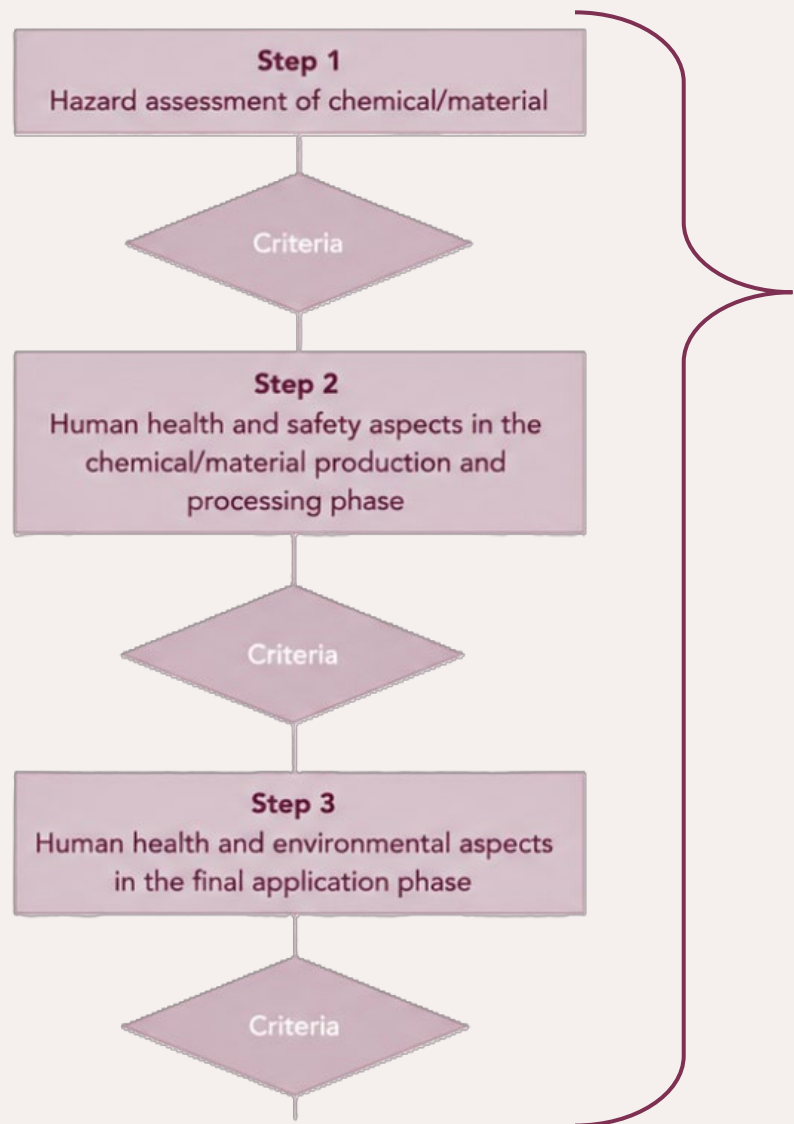
¹ IVL Swedish Environmental Research Institute, 11428 Stockholm, Sweden; nilay.elginoz.kanat@ivl.se (N.E.); maja.halling@ivl.se (M.H.)
² IVL Swedish Environmental Research Institute, 41133 Gothenburg, Sweden; pavinee.hasselberg@ivl.se (P.H.); tomas.rydberg@ivl.se (T.R.); jutta.hildenbrand@ivl.se (J.H.)
³ RISE Research Institutes of Sweden, Environment and Sustainable Chemistry Unit, 11428 Stockholm, Sweden; steffen.schellenberger@ivl.se
⁴ Vividye AB, 41133 Gothenburg, Sweden; gustav@vividye.com (G.U.); yiming@chalmers.se (Y.J.)
⁵ Department of Chemistry and Chemical Engineering, Chalmers University of Technology, 41258 Gothenburg, Sweden; bordes@chalmers.se
 * Correspondence: olga.lysenko@ivl.se (O.L.); sahar.safarian@ivl.se (S.S.)



SSbD Safety Assessment



- Hazard assessment
- Exposure & risk assessment
- In-silico and experimental tools



Safety assessment data as input
for LCIA toxicity modelling



Calculation of characterization
factors

Proscale

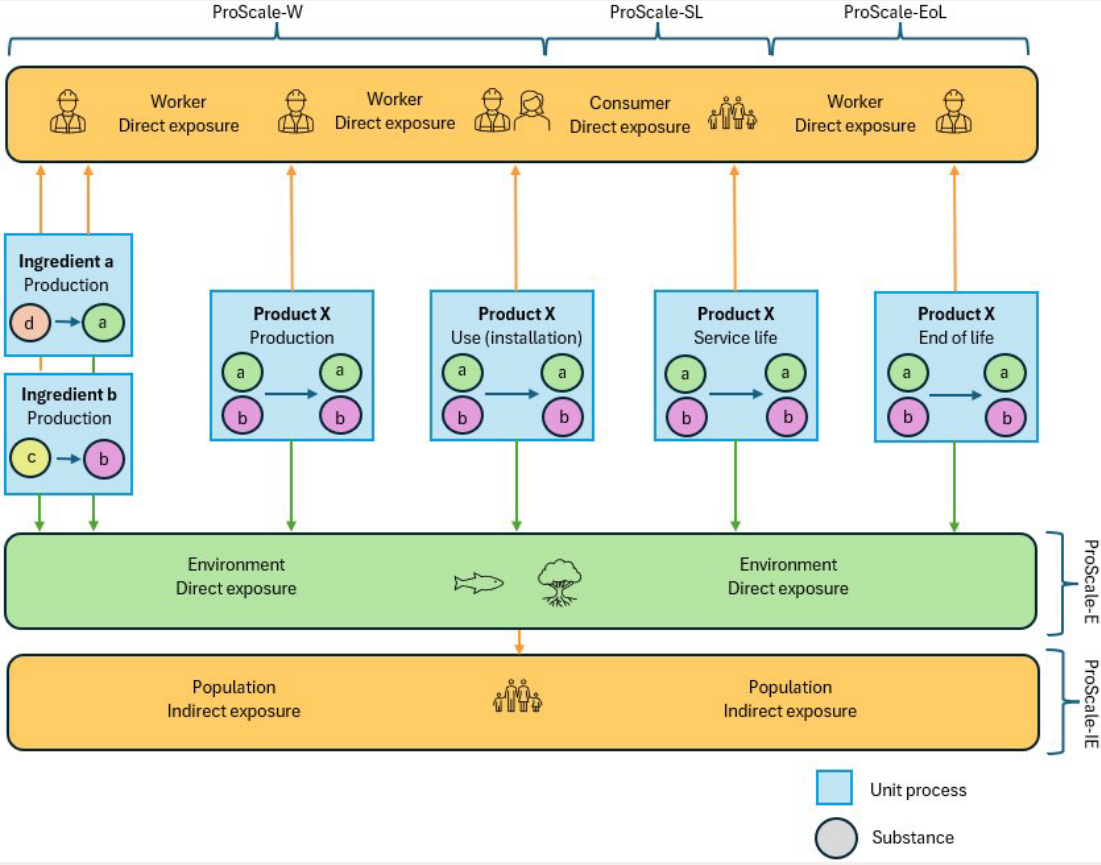
USEtox

ProScale

What is ProScale?

- A method providing a hazard- and exposure-based scoring system
- Aims to assess and compare chemical risks of products

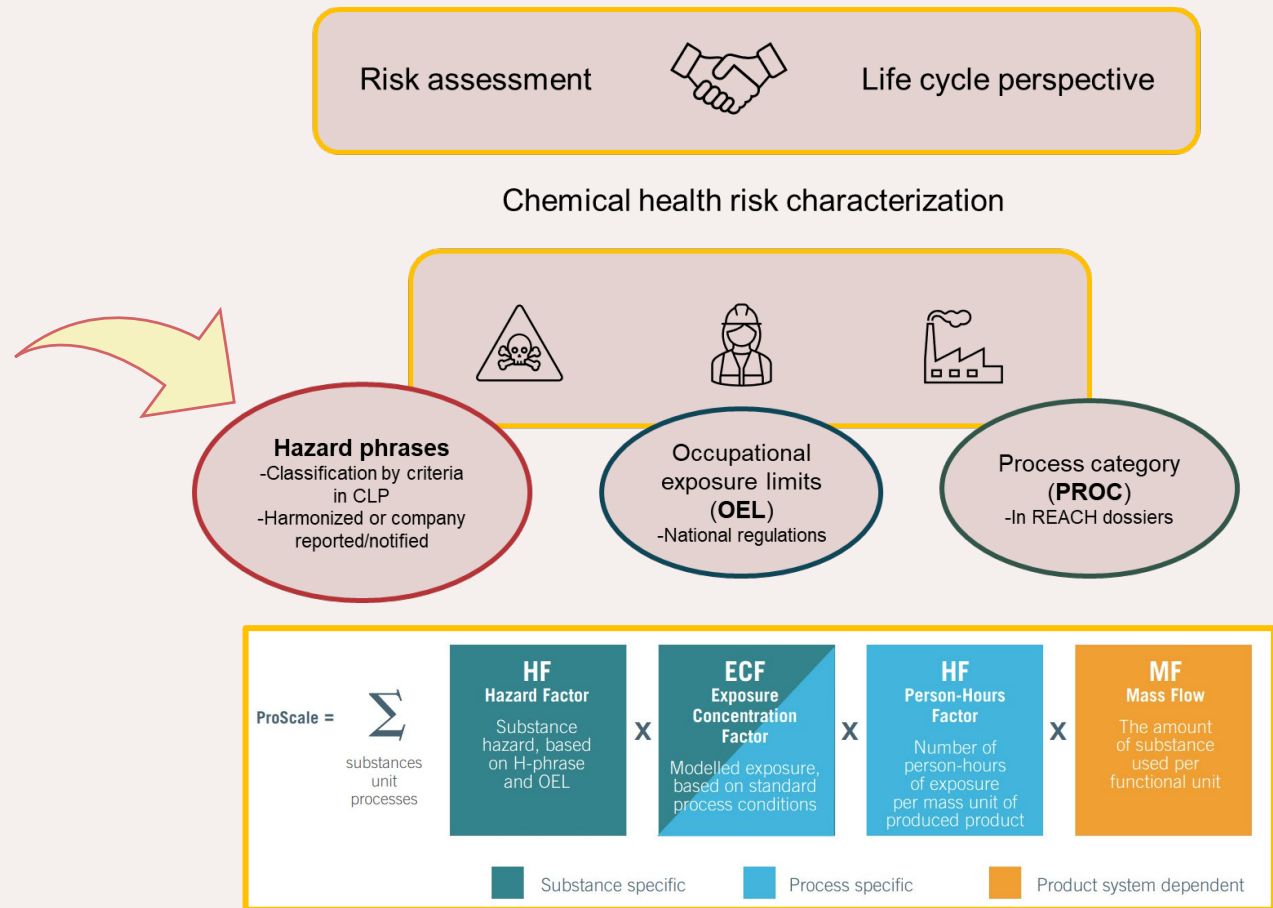
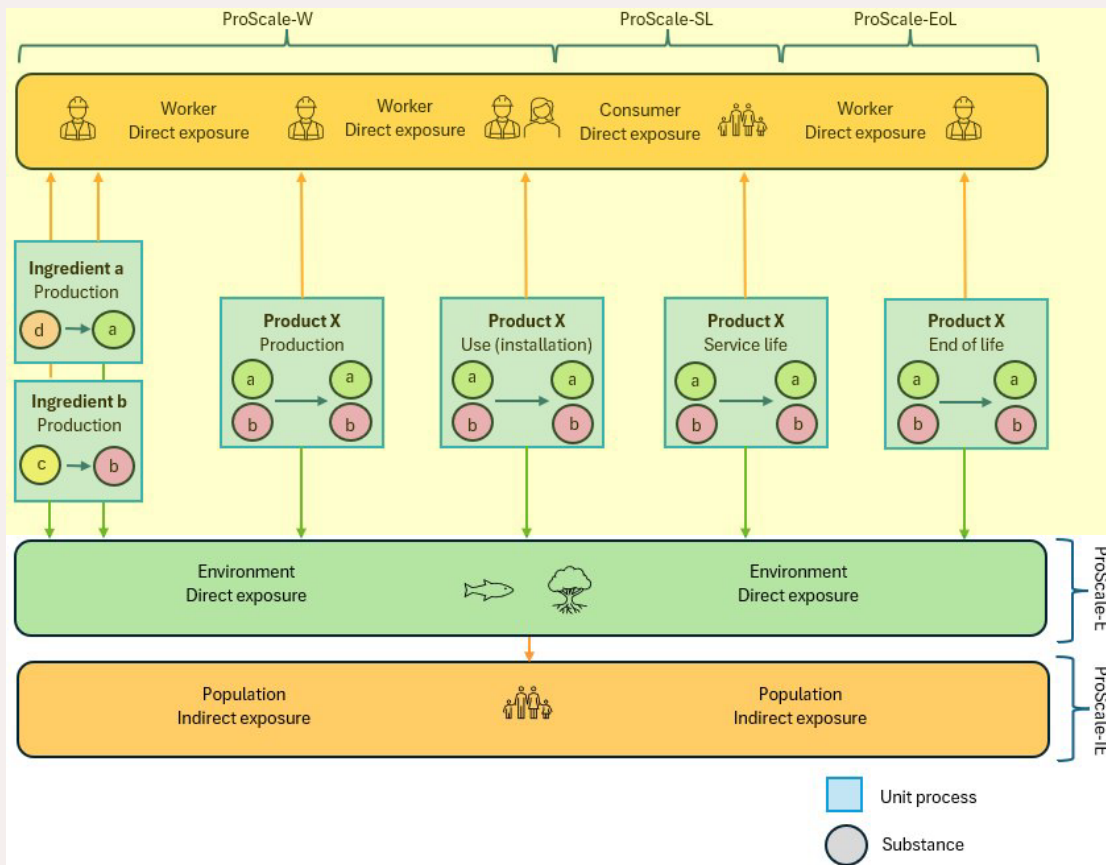
Risk assessment  Life cycle perspective



ProScale

What is ProScale?

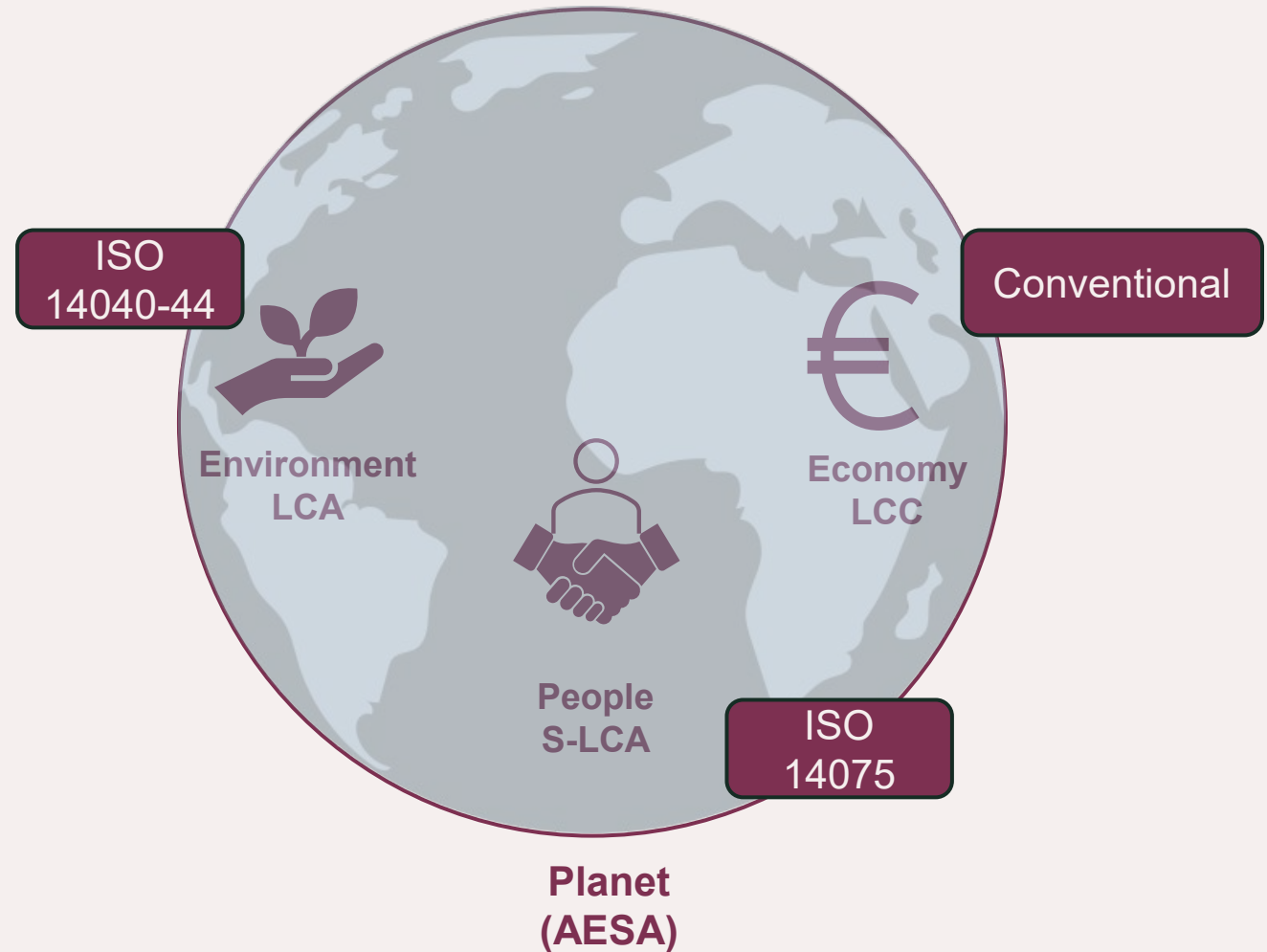
- A method providing a hazard- and exposure-based scoring system
- Aims to assess and compare chemical risks of products



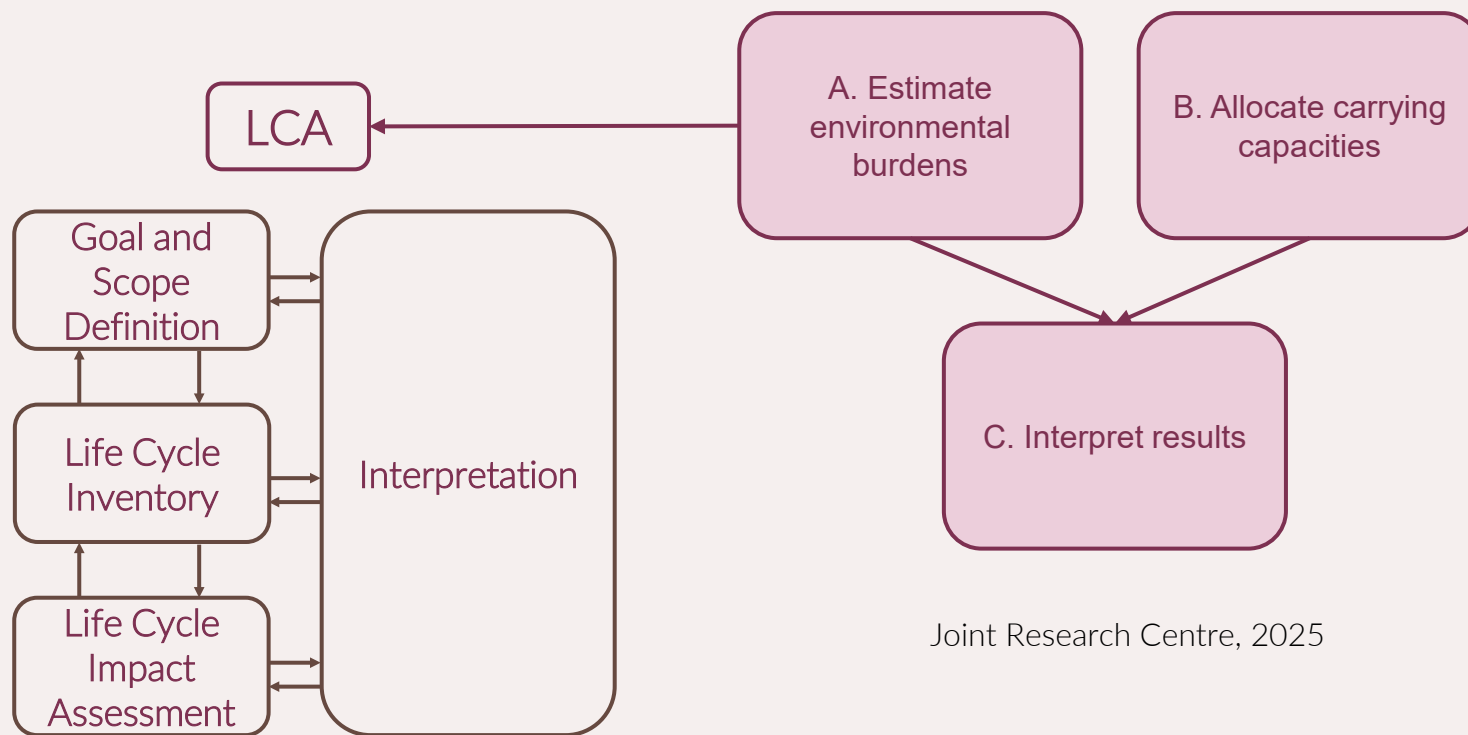
SSbD Sustainability Assessment



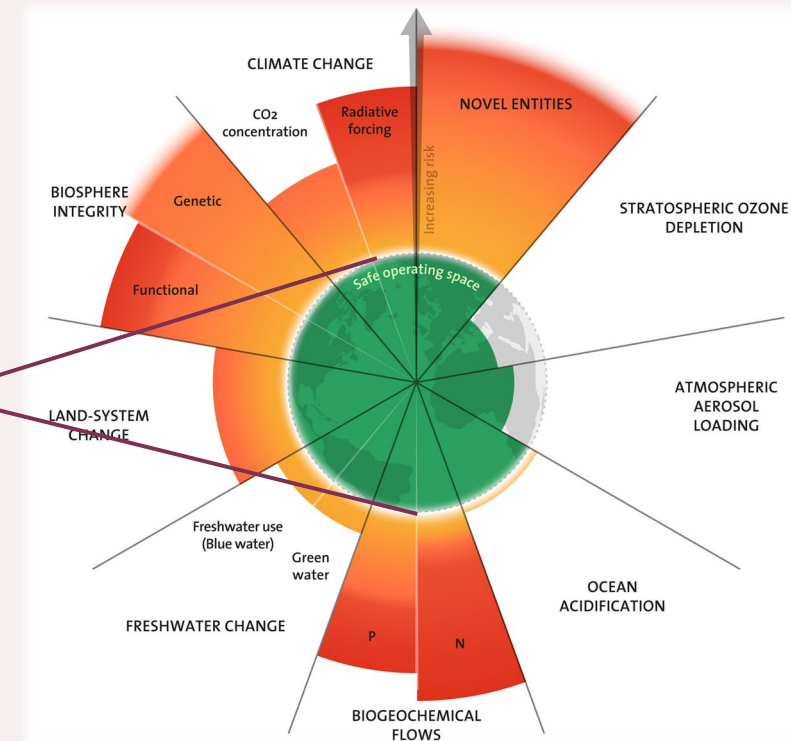
- Life Cycle Assessment (LCA)
 - Social LCA (S-LCA)
- Life Cycle Costing (LCC)
- Absolute Environmental Sustainability Assessment (AESAs)



Absolute Environmental Sustainability Assessment (AESAs)




Joint Research Centre, 2025

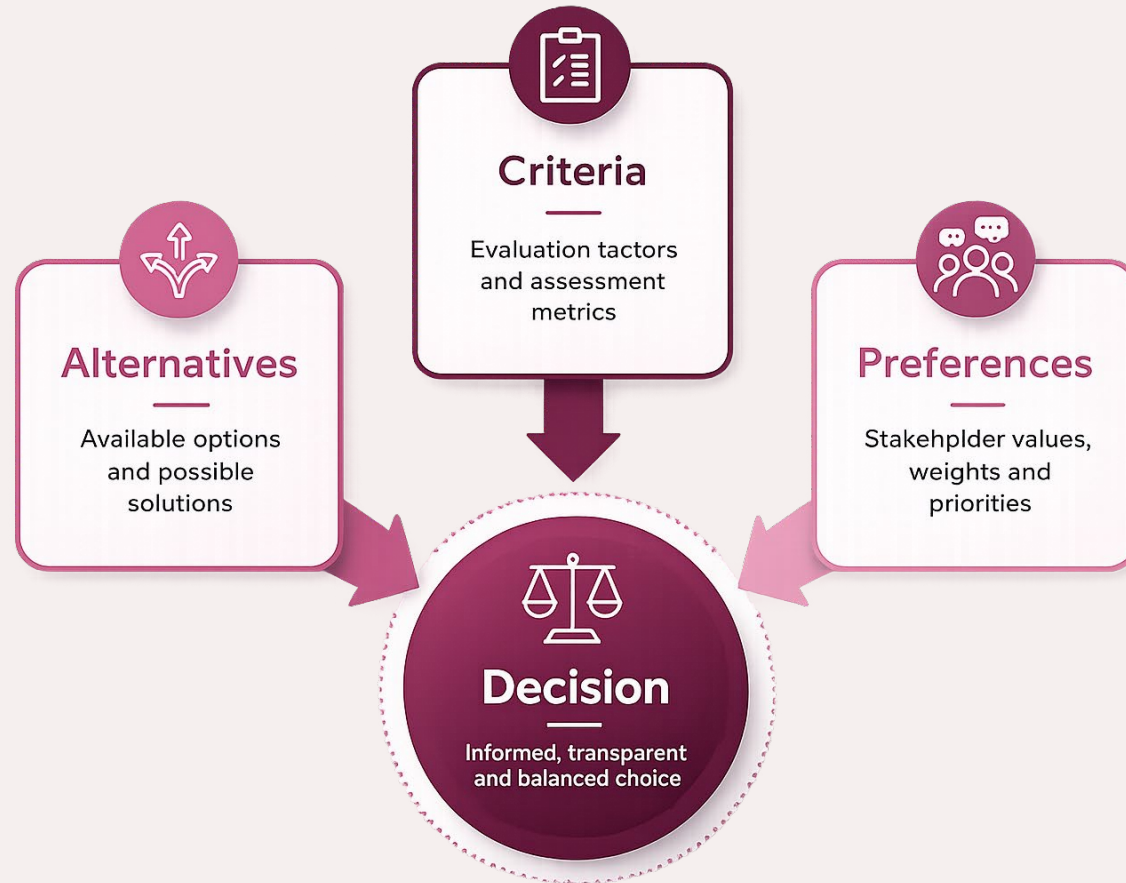


Azote for Stockholm Resilience Centre, based on analysis in Sakschewski and Caesar et al. 2025

Decision Support System (DSS)



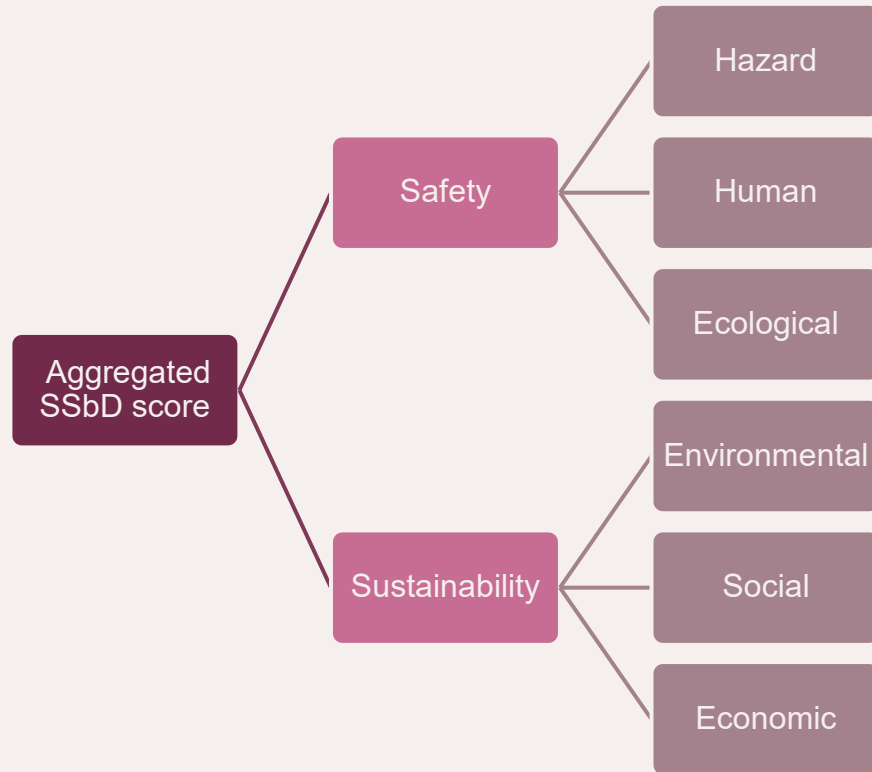
- Multi-Criteria Decision Analysis (MCDA)
- Hierarchical aggregation of SSbD results



BioSusTex DSS and database



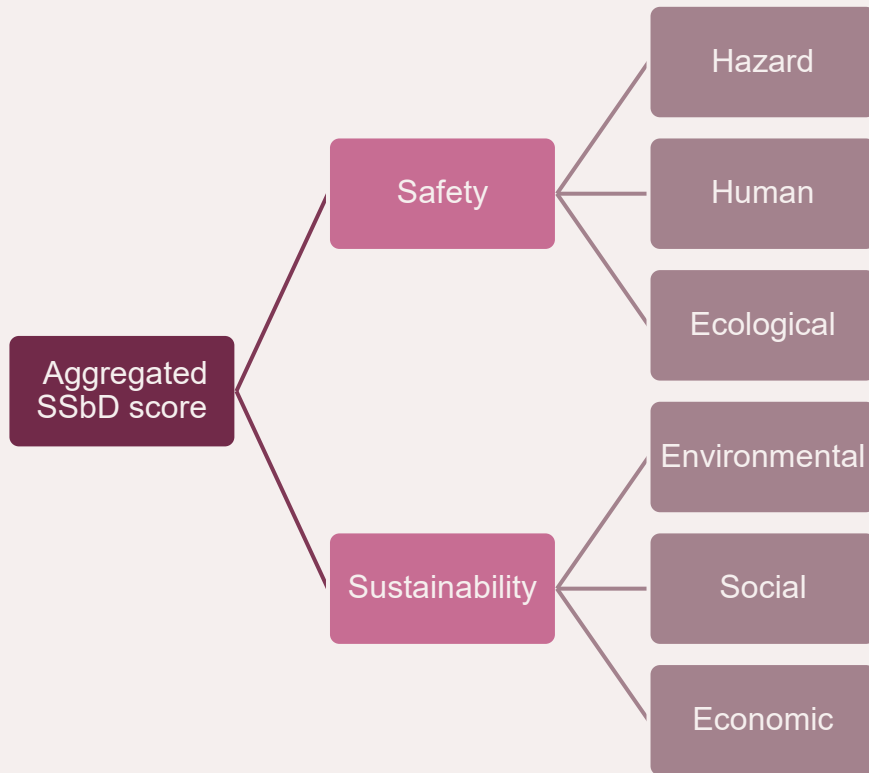
MCDA is used to support the results aggregation and to facilitate the decision-making process



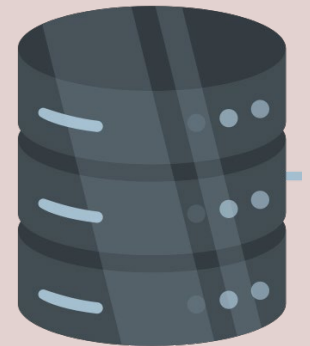
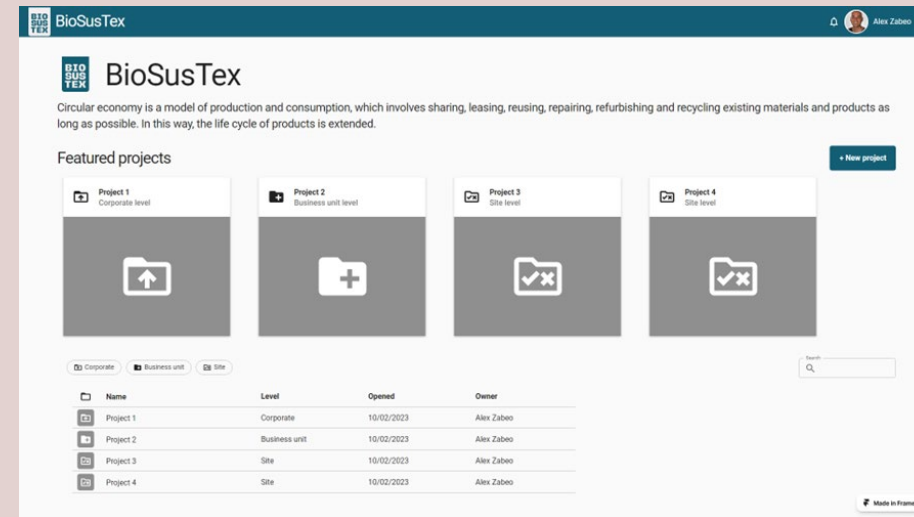
BioSusTex DSS and database



MCDA is used to support the results aggregation and to facilitate the decision-making process



BioSusTex Decision Support Software Tool & Database



The software will present an assessment matrix presenting results of alternatives along the SSbD phases. Users will be able to dig into the data to discover causes of SSbD scores.

Alternative	Score	Safety			Sustainability		
		Hazard	Human	Ecological	Environmental	Social	Economic
Alt 1	0.90	Green	Yellow	Green	Red	Green	Green
Alt 2	0.75	Green	Green	Yellow	Green	Red	Green
Alt 3	0.53	Red	Green	Green	Green	Yellow	Green



Thanks for your attention!

Coordinator



RISE - Research
Institutes of Sweden



Aalto University -
School of Chemical
Engineering



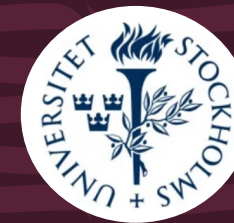
Ca' Foscari
University of
Venice



IVL - Swedish
Environmental
Research
Institute



Chalmers
University of
Technology



Stockholm
University



GreenDecision



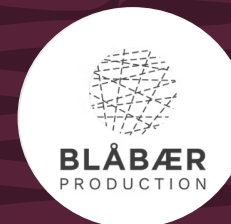
Texia



Vividye



Sun Tekstil



Blåbær



MoRE



Bee Granted