

Integration of Safety and Sustainability Dimensions Towards an Operational Safe and Sustainable by Design Decision Support System

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PLANETS



Safe & Sustainable by Design (SSbD)

What is it?

SSbD embeds sustainability and safety directly into innovation, guiding the development of chemicals, materials, and processes that are safe, sustainable, and high-performing throughout their life cycle.

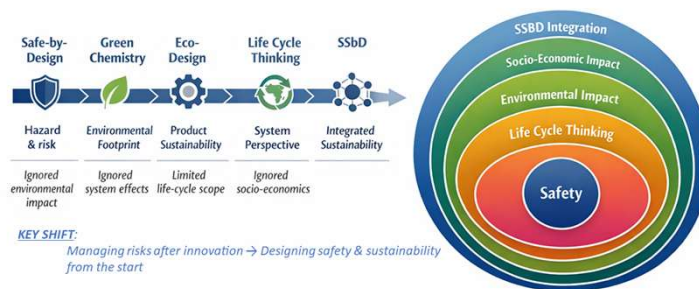
From Concept → Framework → Innovation Enabler

Why SSbD matters?

- Aligns innovation with EU sustainability and regulatory goals
- Avoids regrettable substitution and hidden impacts
- Anticipates risks early in the design process
- Supports competitive, future-proof products

Evolution from Safe-by-Design to Safe & Sustainable-by-Design (SSbD)

From risk control to system-level sustainability integration



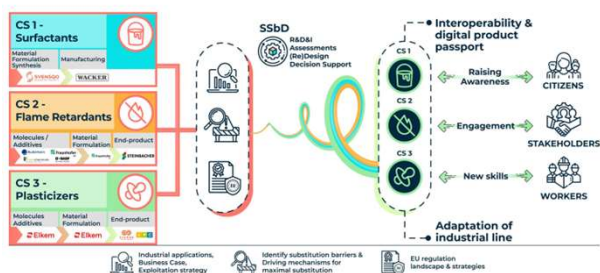
SSbD does not replace Safe-by-Design — it expands it by integrating environmental, life-cycle, socio-economic and performance dimensions into a system-level design approach.

Objective

The PLANETS EU project demonstrates the application of the Safe-and-Sustainable-by-Design (SSbD) framework in developing safer substitution alternatives for surfactants, flame retardants, and plasticizers. By integrating life-cycle thinking and multi-dimensional sustainability assessment with R&D and decision-support tools, the project supports sustainable chemical innovation and informed industrial decision-making..

SSbD integrated structure

The framework integrates multiple SSbD dimensions—human health, environmental, social, economic impacts, and performance. Through sensitivity analysis, multi-objective optimisation, and multi-criteria decision analysis, it supports the evaluation, comparison, and prioritisation of safer and more sustainable design alternatives.



From the scoping phase and selection of relevant aspects, the framework evaluates alternatives across SSbD dimensions and applies sensitivity analysis, multi-objective optimisation, and multi-criteria decision analysis to support informed and sustainable design decisions.

CONCLUSION

The three case studies—**surfactants, flame retardants, and plasticizers**—demonstrate the application of the integrated SSbD structure to support safer substitution. So far, the scoping phase, using the tier-1 tool, **Early-Stage Responsible Innovation (ESRI)**, has identified key **hotspots and potential red flags** for each case study. This includes defining the most relevant **SSbD dimensions, life-cycle stages, exposed populations, hazard end-points, and exposure routes** to guide the subsequent assessments.

Following the **funnel-shaped approach** of our integrated structure, current work focuses on further streamlining our approach which consists of identifying the **most influential factors** for decision-making. The next steps will apply the sensitivity analysis, optimisation, and multi-criteria decision analysis pipeline presented earlier.

More information and access to the ESRI tool are available via the QR code.



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