

Towards a Safe and Sustainable Future



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Introduction

Safe-and-Sustainable-by-Design (SSbD) is a transformative approach tailored to ensure safety and sustainability from the earliest stages of product development. For Industry, including small and medium-sized enterprises (SMEs), embracing SSbD principles means not only being prepared for regulatory requirements but also unlocking opportunities for innovation, cost savings, and competitive advantage. This fact sheet provides an overview of SSbD's relevance to industry and its practical benefits for businesses, giving examples across diverse value chains.

What is SSbD?

SSbD is a proactive framework for designing chemicals, materials, products, and processes that prioritize safety, sustainability, ensuring desired functionality and business viability. For companies, adopting SSbD means embedding these principles into their innovation processes to deliver value across the entire product lifecycle. Here's what it entails:

- **Design with all Safety aspects in mind:** Ensure that products are safe for workers, consumers, and ecosystems from development to disposal. This includes replacing hazardous substances (or substances of concern) with safer alternatives and designing processes that minimize risks of exposure (including solvents for example). This includes having an outlook on the full life cycle of your product.
- **Design with Sustainability along full lifecycle:** Evaluate and optimize environmental impacts at every stage—from sourcing raw materials to manufacturing, distribution, use, and end-of-life management. For instance, businesses can integrate renewable or greener resources, energy-efficient production methods (use of biogas or renewable electricity for example) and recyclable materials into their product designs.
- **Innovation as a Competitive Edge:** Using the SSbD concept should encourage forward-thinking design strategies that align with market trends and regulatory demands. For example, creating products that can potenti-

ally meet future regulations or certifications, which can provide a first-mover advantage, and therefore an increased value offer.

- **Collaboration Across Stakeholders:** A successful implementation of SSbD would involve working with suppliers, customers, and regulators. By collaborating across the value chain, companies can identify opportunities for improvements and align efforts towards safe and sustainable goals.
- **Transparency and Trust:** Communicating safety and sustainability qualifications to stakeholders would build confidence and foster stronger relationships with clients, suppliers, and consumers, even investors.
- **Economic and Operational Efficiency:** Designing for safety & sustainability often results in operational efficiencies, such as reduced resource consumption, lower waste management costs, and streamlined supply chains. These efficiencies not only benefit the environment but also lead to cost savings and improved profitability.

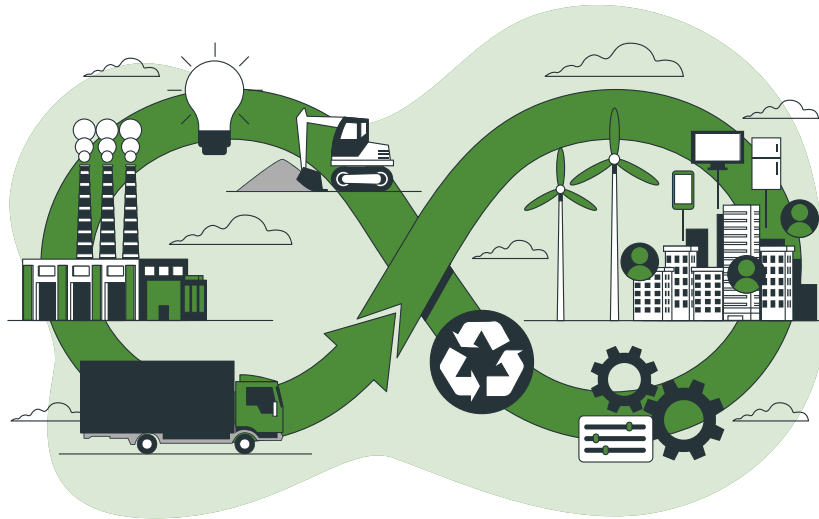
By adopting SSbD principles and communicating on it, companies position themselves as leaders in safe and sustainable innovation while mitigating risks and future-proofing their operations. This proactive approach is not only better for the planet but also offers tangible business benefits—from enhanced reputation to new market opportunities and compliance with emerging regulations.



Why should Industry and SMEs more specifically, apply SSbD?

Key Benefits:

- **Regulatory and Initiative Compliance:** Stay ahead of tightening EU regulations such as REACH, NetZero goals, and the Chemicals Strategy for Sustainability.
- **Cost Savings:** Optimize resource use, reduce waste, and lower production costs.
- **Market Opportunities:** Tap into growing demand for sustainable products across diverse industries.
- **Reputation and Trust:** Enhance brand image and customer loyalty by demonstrating a commitment to safety and sustainability.



SSbD in Action: Value Chain Opportunities examples

1. Packaging

Example: *MultiNanoLayers Packaging Film*

The design of a semi-finished product was used to apply SSbD on packaging Value Chain. The case study is a MultiNanoLayers film designed during SURPASS Horizon Europe project with specific SSbD and recyclability targets. It was necessary to apply an iterative SSbD approach and select hotspots, with a simplified assessment first to select viable solutions followed by the full SSbD assessment of retained solution.

SSbD helps to anticipate future or new EU regulations: evolution of REACH, PPWR and ESPR.

Business Impact:

Thanks to applying and practices of SSbD, the different safe and sustainable criteria could be unified into a single approach. End of life was better considered during packaging design, as well as hazard and exposure during production. SSbD also helps to reduce uncertainties on Safe or Sustainable aspects related to packaging products' value chain.

2. Textiles

Example: *Protective clothing value chain*

Focusing on the (re)design phase of processes and products in the protective clothing value chain, specifically the application of the SSbD Design Principles, this case study tests the applicability of the SSbD framework. It demonstrates the complexity of aspects that need to be taken into consideration when trying to optimise overall safety and sustainability performance in the protective clothing sector.

Business impact:

The SSbD framework as whole can help any stakeholder in the textile value chain from chemical and material innovators, to producers, rental and service companies all the way to public procurers, industrial end users or engaged consumers to think more holistically about safety and sustainability of textile-based protective clothing products and pinpoint hotspots for potential action without necessarily applying the entire framework in a complex assessment process.

3. Construction Materials

Example:

The SSbD framework was tested on several construction chemical value chains, with concrete admixtures selected as a key example due to their role in improving concrete properties. Among the five classes of concrete admixtures, superplasticizers were chosen to assess the framework's applicability. Applying SSbD principles is challenging, as some material designs that enhance overall sustainability from a life cycle perspective may not fully meet the initial safety and sustainability criteria.

Business Impact:

Integrating SSbD into superplasticizer innovation supports safer, more sustainable concrete formulations. While industry efforts have already reduced carcinogenic content and explored alternative formulations with less hazardous raw materials, SSbD principles can drive further advancements in product safety, functionality, and long-term market competitiveness.

4. Automotive

Example:

Moulded polyurethane (PU) foams play a vital role in automotive seating, providing comfort, durability, and safety while meeting strict industry standards. However, their production heavily relies on fossil-based materials, contributing to CO₂ emissions, and their end-of-life recyclability remains a challenge due to their integration with metals and sensors in car seats. The Safe-and-Sustainable-by-Design (SSbD) approach aims to overcome these challenges through material innovation—such as bio-based polyols from renewable sources and recycled polyols derived from end-of-life foams. Additionally, energy-efficient manufacturing processes help reduce environmental impact, while chemical recycling advancements offer new pathways for recovering raw materials. These strategies align with the European Green Deal and Circular Economy

Action Plan, ensuring a more sustainable future for automotive PU foams.

Business Impact:

Adopting SSbD principles in PU foam production brings significant business benefits, from regulatory compliance with stringent EU recyclability and emissions standards to cost savings through energy-efficient production. By investing in sustainable material innovations, automakers gain a competitive advantage, appealing to eco-conscious consumers and original equipment manufacturers looking for greener solutions. Additionally, integrating circular economy strategies enhances supply chain resilience, reducing dependence on volatile fossil-based raw materials. Companies that lead in sustainable automotive solutions strengthen their brand reputation, drive market differentiation, and position themselves for long-term profitability in an industry increasingly focused on environmental responsibility.

5. Energy: Sub-value chain Li Ion Batteries

In line with the EU regulation, the Critical Raw Materials Act, SSbD is a critical criterion through the product life cycle from the innovation phase of advanced materials to manufacturing and end-of-life processes. An SSbD use case has been developed for emerging Solid-State batteries based on increased safety using non-flammable electrolytes.

Business impact:

The entire lithium-ion battery chain, from mining through recycling, could grow by 2030 to a value of more than \$400 billion and a market size of 4.7 TWh in a resilient, sustainable, and circular approach (McKinsey 2023). The potential economic impact of the solid-state technology is forecasted to become substantial in the medium term.

6. Electronics

Example:

The SSbD framework was tested using the information for power electronics as an example of a sub-value-chain in Electronics. GaN is one of the few novel materials used to design and produce devices for controlling or transforming electrical power. The industrial production of GaN-based devices required adjustments across all the steps from raw materials to fabrication. The main impacts are associated with the energy and other resources used during the fabrication; these impacts can be estimated using existing methodology. The main risks associated with the introduction of GaN as a material in electronics are from its handling and disposal

at the end of its life cycle. Currently, there is insufficient data to quantitatively assess the potential hazards and risks or to specifically attribute them to GaN.

Business impact:

The use of GaN-based power electronics leads to improved efficiency of devices in applications across multiple value chains, including solar micro-inverters, servers, telecom equipment, adapters/chargers, wireless charging and audio transmission, and vehicle electrification. In many cases, the performance achievable with GaN-based devices becomes an enabling feature for novel designs that take advantage of miniaturization, reduced heat generation, and extended robustness and longevity.

7. Fragrances

Example:

The SSbD framework, applied to methyl salicylate as a case study, highlights the complexities of balancing safety and sustainability. It offers a holistic approach but should focus on areas for improvement, avoiding duplication with existing EU regulations and leveraging expert knowledge to prevent regrettable substitutions. Data availability, sharing, and transparency remain key challenges, particularly for LCA. Overcoming these barriers requires collaborative efforts to enhance databases while integrating existing resources.

Business impact:

The IFRA case study focused on a single fragrance ingredient, but a typical fragrance mixture contains 60-80 ingredients in household products and hundreds in fine fragrances. This means SSbD assessments would need to be multiplied accordingly, significantly increasing the resource demand. With SMEs generating half of the industry's output in Europe, SSbD must remain accessible to all operators. The current draft framework would benefit from clearer criteria and standardised methodologies to enhance consistency and ease of evaluation. To be effective, SSbD should serve as a guiding tool, steering innovation while preventing regrettable substitution or unnecessary reformulation.



Practical Steps for companies:

- 1. Start with a Gap Analysis:** Assess current innovation processes, R&D projects and identify areas for improvement using SSbD dimensions, whatever the innovation stage you are in.
- 2. Engage with the SSbD Community:** Leverage resources from initiatives like IRISS to access to experts, tools, guidance, and networking opportunities.
- 3. Use SSbD concept in scaling up Innovation:** When testing new materials or processes, partnering with your customer, evaluating not only functionality but also safety and sustainability and its impact.
- 4. Train and Inform Staff:** Ensure employees, especially in R&D, engineering, toxicology, sustainability, circular economy, engineering and production, understand the benefits and principles of SSbD. For SMEs, special training attention also should be given in purchasing function.
- 5. Communicate your Compliance:** At highest level of the company the SSbD efforts and commitment should lead the example. Also in marketing, corporate reporting, in communication should help building trust with stakeholders.



Alignment with EU Policies

SSbD is included in the European Green Deal (Chemicals strategy for Sustainability) supporting key objectives such as:

- **NetZero and Climate Goals:** By reducing emissions and enhancing energy efficiency.
- **Circular Economy:** Encouraging resource reuse and waste reduction.
- **Toxic-Free Environment:** Eliminating hazardous substances from supply chains.

IRISS and Industry Support

The "International SSbD Network" (IRISS) supports Industry and SMEs with:

- Expertise in safe and sustainable design.
- Case studies and best practices across sectors.
- Access to tools to evaluate and implement SSbD principles.

Learn More

The IRISS SSbD Community is a growing network dedicated to promoting Safe-and-Sustainable-by-Design principles across industries. Join the community to gain:

- **Access to Resources:** Explore guidelines, best practices, and tools to implement SSbD effectively in your value chains.
- **Training Opportunities:** Participate in workshops and training sessions designed to build capacity and expertise in SSbD.
- **Networking and Collaboration:** Engage with like-minded organizations, researchers, and policy makers to exchange ideas and tackle shared challenges.

- **Expert Guidance:** Benefit from the collective knowledge of the IRISS network, including collaborations with leading universities, research institutes, and international organizations.
- **Policy Synergies:** Stay informed on policy developments and contribute to shaping the SSbD framework at the EU level.

Membership is open to SMEs, larger companies, researchers, NGOs, and other stakeholders. To join the IRISS SSbD Community or learn more, visit www.iriss-ssbd.eu. Take advantage of this opportunity (free of charge till May 2025), and position your business at the forefront of sustainable innovation.

Join us today! *(free until May 2025)*

Visit the website www.iriss-ssbd.eu



IRISS – International SSbD network



Final Note

Joining the IRISS SSbD Community offers businesses the unique opportunity to lead in sustainability and innovation. It's not just about staying compliant with regulations—it's about gaining a competitive edge, accessing cutting-edge tools and knowledge, and building strong partnerships across industries. By adopting SSbD principles, your company signals a commitment to responsible business practices and forward-thinking innovation that resonates

with customers, investors, and policy makers. Together, we can drive a safer, more sustainable future for all—and ensure that your business thrives as a part of this transformation.

Act now to shape a sustainable tomorrow—join the IRISS SSbD Community, lead the change, and unlock new opportunities to grow your business sustainably!

