



# HARMLESS

## HARMLESS Decision Support System for SSbD of Advanced Materials

Advanced High Aspect Ratio and Multicomponent  
materials: towards comprehensive intellIgent  
tEsting and Safe by design Strategies

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[www.harmless-project.eu](http://www.harmless-project.eu)



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To facilitate practical implementation of the Safe and Sustainable by Design (SSbD) approach in industrial innovation processes of advanced materials, the HARMLESS project developed a SSbD Decision Support System (DSS) for complex multi-component nanomaterials (MCNMs) and high-aspect ratio nanomaterials (HARNs) that considers data availability and resources along the innovation process <sup>[1]</sup>.

## Background

The SSbD-DSS is aligned with the EU SSbD framework <sup>[2]</sup> and Methodological Guidance <sup>[3]</sup>. It recommends the use of tools and methods, including New Approach Methodologies (NAMs) tailored to advanced nanomaterials as well as the innovation stage of the material under development. The HARMLESS DSS includes 3 flexible

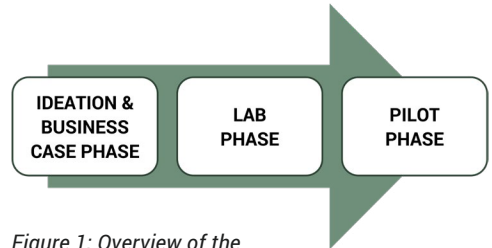


Figure 1: Overview of the flexible stage-gate model

innovation stages: 1) the ideation and business case phase, 2) the laboratory phase and 3) the pilot phase.

## HARMLESS SSbD-DSS

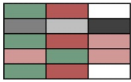
Designers are guided through a workflow of several (online) tools, including AMEA, WASP and ASDI (see Figure 2).



The **Advanced Material Earliest Assessment (AMEA)** tool consists of only 3 questions and is used for early categorization and subsequently advice on design principles and applicability of the SSbD approach. If the approach is applicable, the designer is advised to continue with step 2. <sup>[4]</sup>



The second tool, named **Warning flags, design Advice, Screening Priorities (WASP)**, is based on the AMEA advice and several other existing tools as a simplified approach that requires less information. This approach consists of 12 questions to identify early warning flags on safety and sustainability and to provide design and assessment advice. <sup>[5]</sup>



To help industrial innovators to make an informed decision for the most optimal SSbD version in the lab phase, another tool, named **Alternative SSbD Design Inspector (ASDI)** was developed. Based on the early warning flags from WASP, ASDI provides a) guidance on which descriptors to measure and b) insight into the differences between the SSbD versions within the various dimensions (safety, sustainability and performance).<sup>[6]</sup>



More detailed assessment tools, including LICARA 4.0 and predictive exposure and hazard models based on physicochemical, in chemico and/or in vitro data, are suggested and directly available in the DSS for the pilot phase.

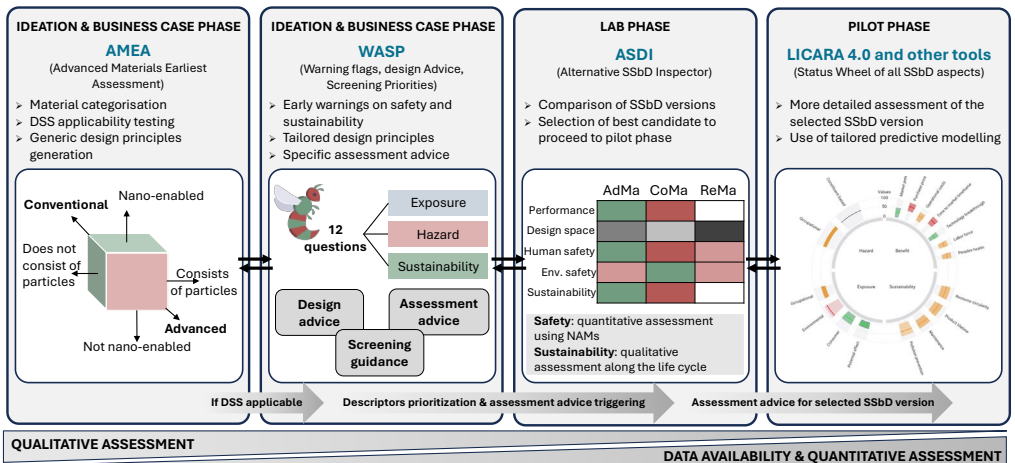


Figure 2: The workflow of the SSbD-DSS showing its components in relation to the innovation stages and the data availability.

### Benefits:

- ★ Online tools
- ★ User-friendly
- ★ Most tools can be used individually
- ★ Freely available

### Users:

- ★ Innovators or designers (at large industrial companies or SMEs)
- ★ SSbD consultancies

## Conclusions:

The SSbD-DSS has been tested and improved with industrial case studies from the HARMLESS project. The SSbD-DSS provides an overview of the positive and negative impacts on the various SSbD aspects, but does not provide one aggregated SSbD score. The balancing of the trade-offs between the various SSbD aspects is done by the designer and not by the SSbD-DSS. This enables the designer to take the aim of the design, the available budget for SSbD assessment and the priorities and policies of the company developing the product into consideration in the decision making at each innovation stage.

## References

To see the full references, scan the QR code:



## Partners involved: TNO (as main contributor)

**TNO**  
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