

# CHEMATSUSTAIN: Implementing Innovative Methods for Safety and Sustainability Assessments of Chemicals and Materials particularly at Nano level in the European Union

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## 1. Abstract

In addition to contributing to the United Nations Sustainability Goals (UN SDG), the EU Green Deal includes the ambition of creating the first climate-neutral and circular economy continent by 2050. To do this, the policy goal of a zero-pollution economy for a toxic-free environment must be achieved. To this aim, the Chemicals Strategy for Sustainability (CSS) has been adopted, which aims to tackle the challenge of producing and using chemicals to address societal needs while respecting the planetary boundaries and safeguarding people and ecosystems, by dealing with pollution from all sources (Caldeira et al., 2022; European Commission, 2019; European Commission, 2020).

This CSS challenge gets operationalised through the development/implementation of two key R&I actions: 1) the Strategic Research and Innovation Plan (SRIP), and 2) the Safe and Sustainable by Design (SSbD) framework. Bearing in mind the pressing need to develop new methods or improve current ones, to support the improvement of safety and sustainability assessments of chemicals, the project "IMPLEMENTING INNOVATIVE METHODS FOR SAFETY AND SUSTAINABILITY ASSESSMENTS OF CHEMICALS AND MATERIALS PARTICULARLY AT NANO LEVEL IN THE EUROPEAN UNION (CheMatSustain)" will not only study the quantum effects from a fundamental point-of-view but also by identifying and measuring them through experimental techniques (high-resolution analysis, XPS and UPS), and determining the specific molecular recognition through their interaction with the environment, which is a quantum mechanical effect (in vitro, microfluidic in-vitro, and in-vivo models and proteomics and transcriptomics and methods). The information obtained on these descriptors will then be integrated into the development of novel in silico models for the prediction (eco)toxicity properties of advanced materials. Finally, in-silico model prediction results will be combined to develop a new methodology for the complementary use of Risk Assessment and Life Cycle Assessment to improve criteria for the SSbD implementation framework. To date, significant progress has been made, as reported by the JRC Technical Report on Safe and Sustainable by Design chemicals and materials (Caldeira et al., 2022). However, further methodological advances are needed to support the full implementation of the SSbD framework, i.e., going beyond traditional green chemistry

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innovation approaches and integrating both safety-based and lifecycle-based considerations to ensure sustainability along the entire value chain. Today, nanoparticles can be found in an increasing number and broad range of consumer products, from cosmetics to kitchenware, electronics, renewable energy, and aerospace (Khan et al., 2022; Mech et al., 2020). Nanotechnology is expected to revolutionise our style of living, holding great promise for a bright and sustainable future (Khan et al., 2022; Mech et al., 2020). The EU has identified nanotechnology as one of the key technologies that will enable Europe's competitiveness and capacity to tackle the global problems of our time (European Commission, 2017). Considering the above, the overall objective of the project CheMatSustain is to identify, develop, test and deploy a set of tools to improve and harmonise screening and testing protocols, strategies, and hazard, risk and sustainability assessments of a sample of chemicals and (nano)materials in the European Union by developing robust, reliable and fast (test) methods and models, including high-throughput and *in silico* models, with the goal of improving their safety and sustainability.

## 2. References

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