SSbD in the NSC field - Tiered SSbD approach and e-infrastructure

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GreenDecision
Innovative solutions

www.greendecision.eu

ABOUT GREENDECISION

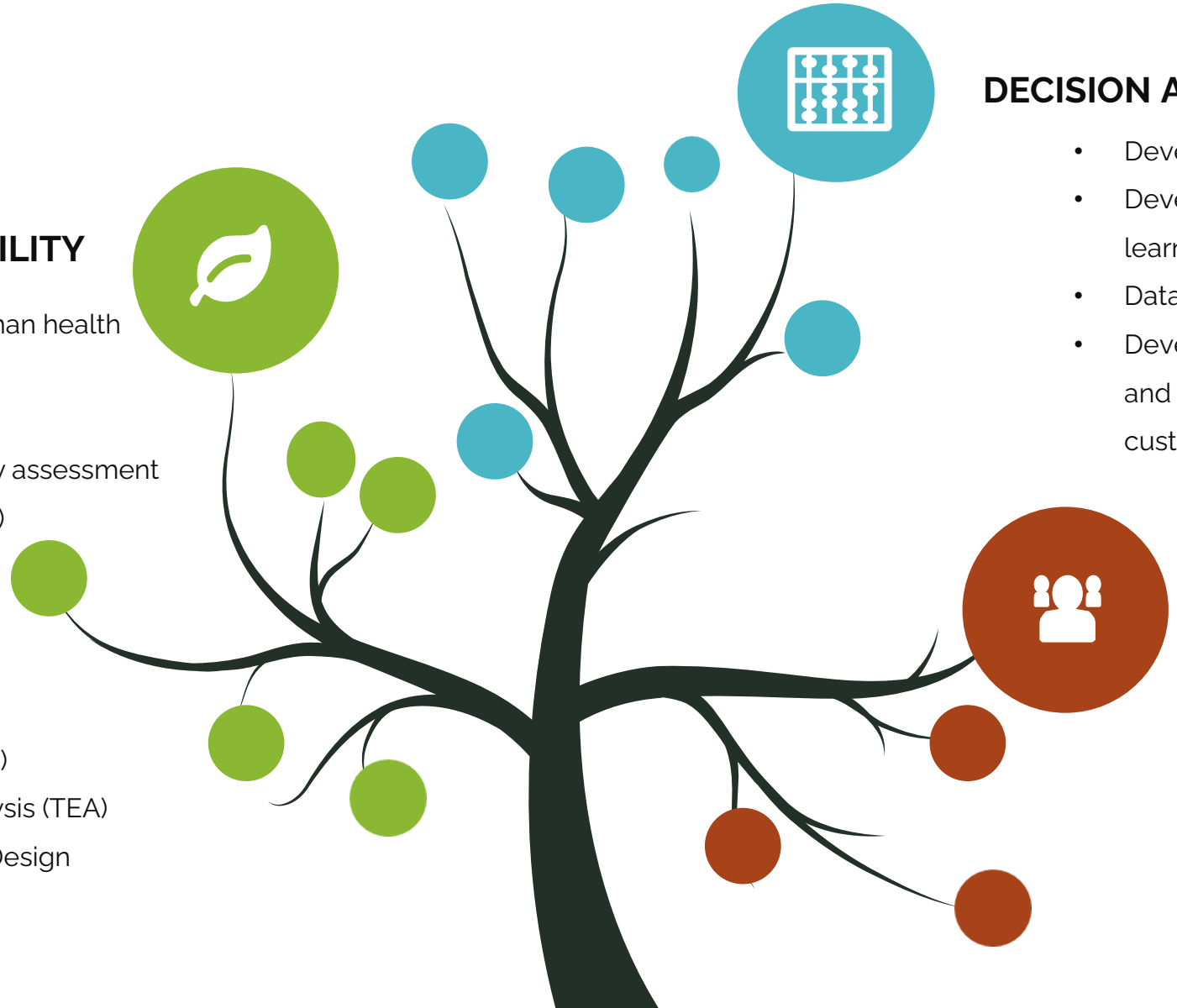
GreenDecision is a research focused SME born as spin-off of the Ca' Foscari University of Venice

We are a team of experts in **safety**, **sustainability** and **decision analysis** who joined together to develop innovative and smart solutions to the daily problems of business and organizations

AREAS OF EXPERTISE

SAFETY & SUSTAINABILITY

- Environmental and human health safety/risk assessment
- Contaminated sites
- Integrated sustainability assessment
- Lifecycle Analysis (LCA)
- Carbon Footprint
- Water footprint
- Social LCA
- Circularity assessment
- Life Cycle Costing (LCC)
- Technoeconomic Analysis (TEA)
- Safe & Sustainable by Design



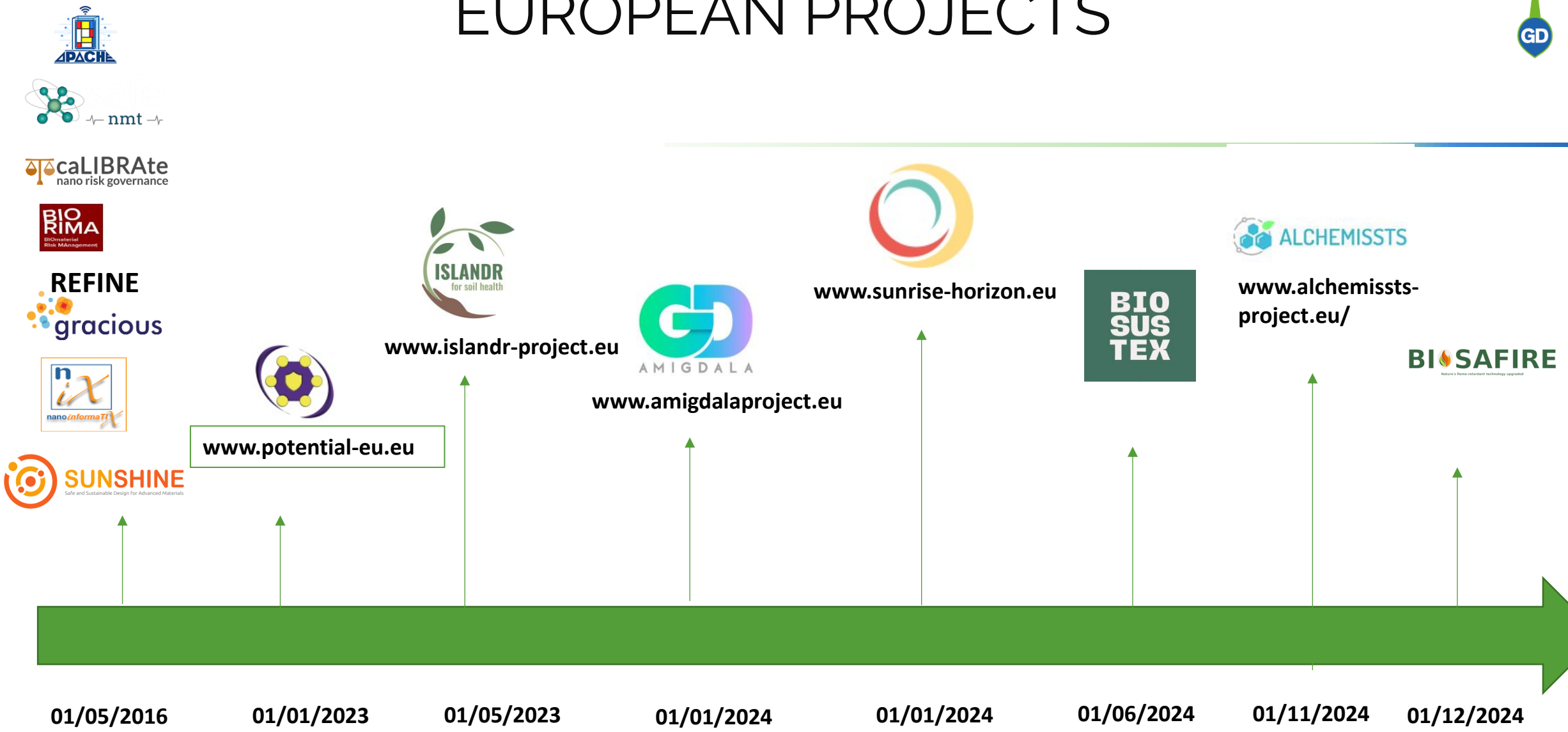
DECISION ANALYSIS & IT systems

- Development of decision support systems
- Development of in silico models (machine learning, AI)
- Data management
- Development of decision analytical models and software systems tailored to specific customers' needs

SOCIETY

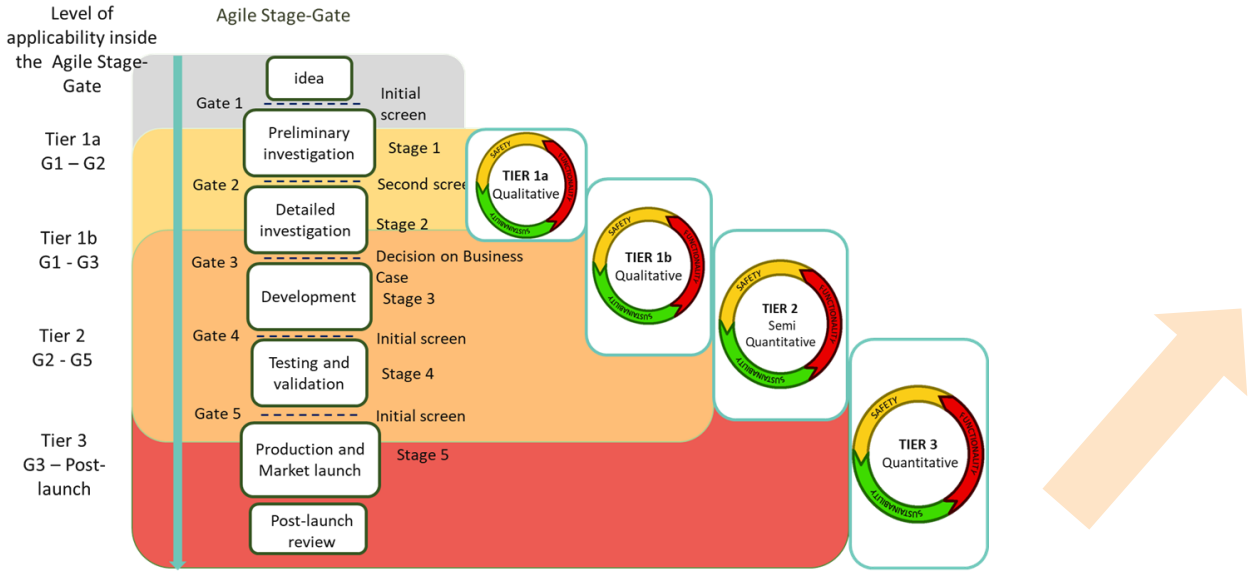
- Stakeholder engagement
- Network analysis

EUROPEAN PROJECTS



FOCUS on SSbD

Tiered approach for SSbD assessment and decision making



Market launch

Implementation in digital e-infrastrucure

Consumer products
Bio-based nanocapsules composed of polymer-encapsulated essential oils for use in biocidal coatings and cleaning agents

Marine and offshore applications
Anticorrosive/antifouling coatings based on hybrid metal (oxide) nanoparticles and flakes

Food and feed
Sugar-protein bioconjugates for use in food additives

Cosmetics
E.g., TiO^2 /ZnO surface-modified advanced materials for use in sun creams

Healthcare
E.g., hyaluronic acid based advanced materials for use in bone junction fillers, biopolymers for wound healing

SUNSHINE
Safe and Sustainable Design for Advanced Materials

SUNRISE
Safe and Sustainable by Design Advanced Materials

ALCHEMISSTS

BIOSAFIRE
Nature's flame-retardant technology upgraded

Testing & demonstration in supply chain case studies

TIERED SSbD APPROACH

3 Tiers covering:

all 5 steps of the EC's JRC SSbD framework

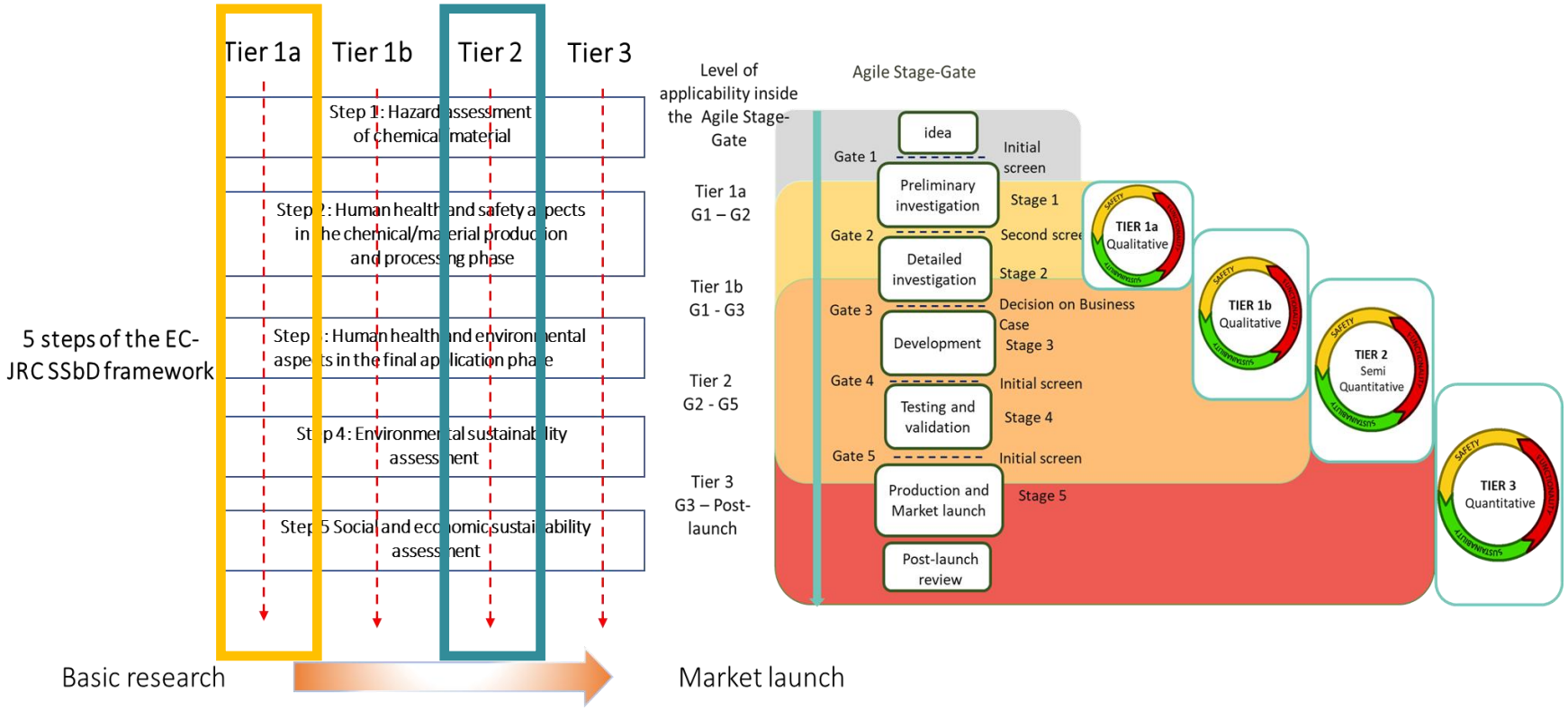
all 5 stages of the Agile Stage-Gate Idea-to-Launch concept:

Tier 1 can be applied before the strategic decision 'Go to development' at Gate 3

Tier 2 provides feedback during performance optimisation in the development Stages, without incurring too much cost

Tier 3 is applied before the decision 'Go to launch' at Gate 5 to ensure regulatory compliance and sustainability performance in commercially viable/competitive ranges

From SUNSHINE to SUNRISE



SUNSHINE
Safe and Sustainable Design for Advanced Materials

SUNRISE
Safe and Sustainable by Design Advanced Materials

SSIA DIGITAL E-INFRASTRUCTURE

Digital e-infrastructure based on the Safe & Sustainable Innovation Approach (SSIA) designed to:

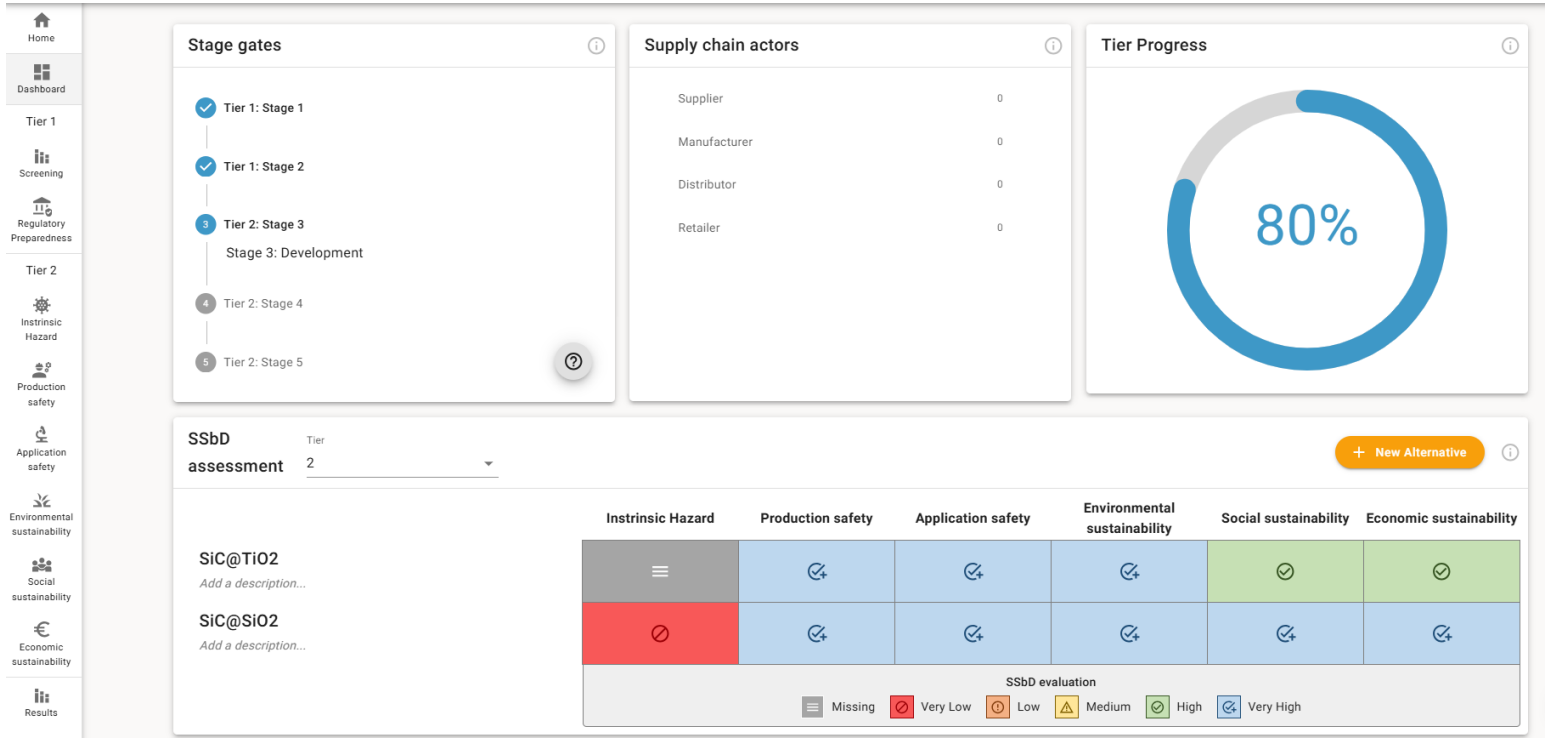
Facilitate exchange of information between nanotechnology supply chain actors

Provide access to the knowledge, data and tools needed to develop and validate SSbD strategies for advanced materials

Facilitate the creation of a trusted environment between industry and regulators

Enable tiered assessment of safety, functionality and sustainability at each stage of the innovation process

SSIA e-infrastrucure landing interface



TIER 1 RESULTS

Raw Materials And Resources - Product... ✓ | Production Of The MCNM ✓ | Production Of The Product Incorporatin... ✓ | Use Of The Product ✓ | End-Of-Life Of The Product ✓

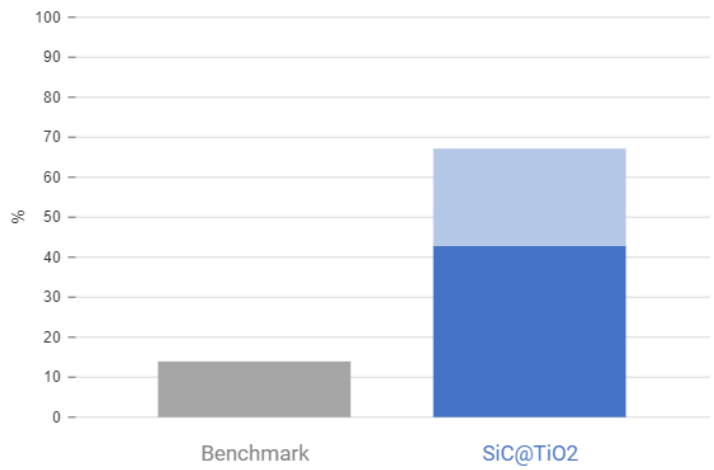
Functionality
Safety
Environment sustainability
Social sustainability
Economic sustainability
Results

Questions

Answer where YES means NEGATIVE impact to sustainability

Answer where YES means POSITIVE impact to sustainability

Questions	Benchmark	SiC@TiO2
Are any of the chemical components used to produce the Material/Product included in any authoritative lists of restricted and hazardous chemicals (e.g. candidate list of SVHC according to Article 57 of REACH)?	Yes	No
Are any of the raw materials carcinogenic?	Yes	No
Are any of the raw materials genotoxic (mutagenic)?	Yes	No
Are any of the raw materials toxic to the reproduction?	Yes	No
Any of the raw materials have endocrine disrupting properties relevant to human health?	Yes	No
Are any of the raw materials respiratory sensitiser?	Yes	Yes



Answering the question, the graph changes simultaneously

General information related to the internal survey:

1. Time needed to fill out it: 3-4 hr
2. Difficulty: 5/6 in a scale of 1 to 10 (10 represents very hard)
3. Helpfulness: 5-7 in a scale of 1 to 10 (10 represents not helpful)
4. 8 out of 10 people don't ask for external help to fill it out

TIER 1 RESULTS

CASE STUDIES:

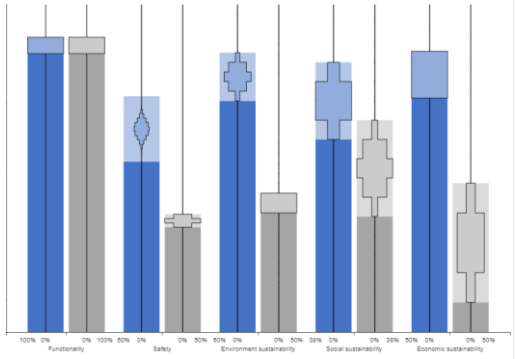
Laurentia

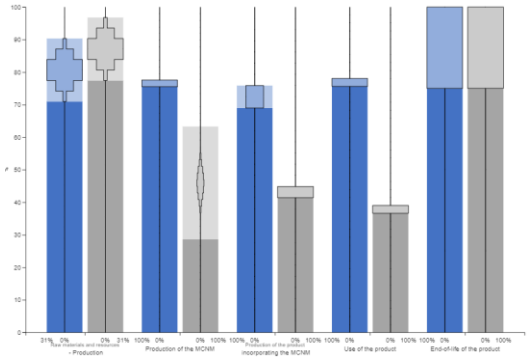
Encapsulae

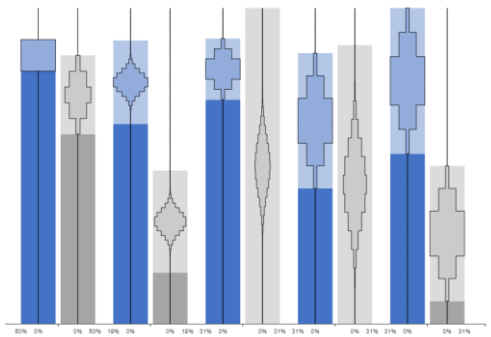
Avanzare

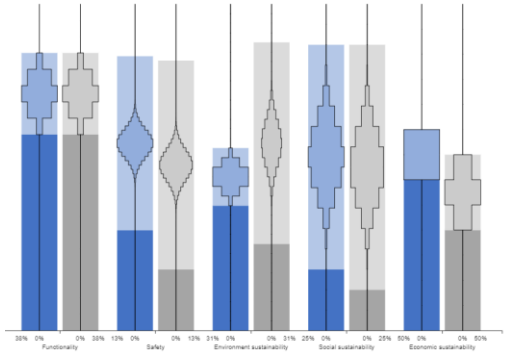
CIAC

BY INDICATORS

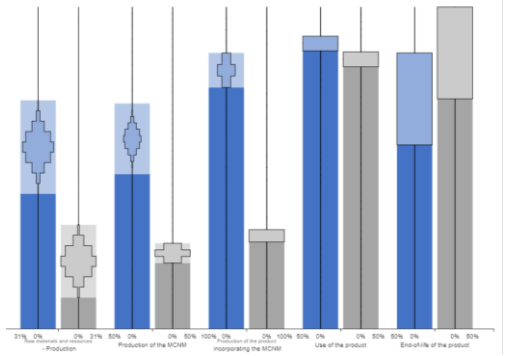


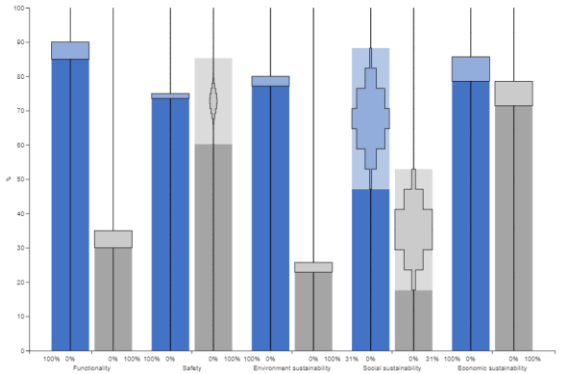


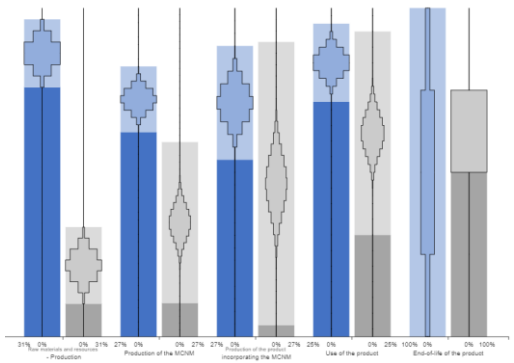


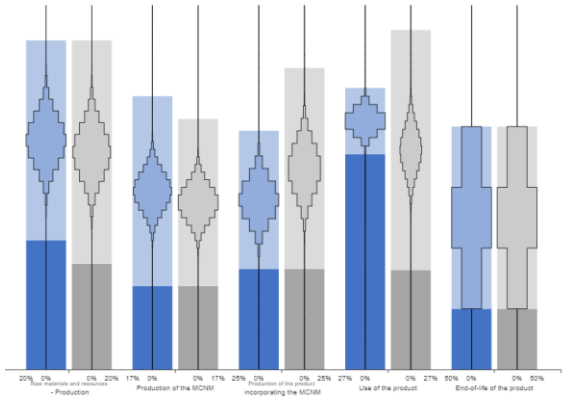


BY LIFE CYCLE STAGES

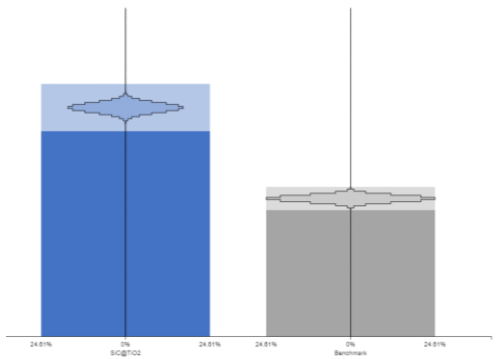


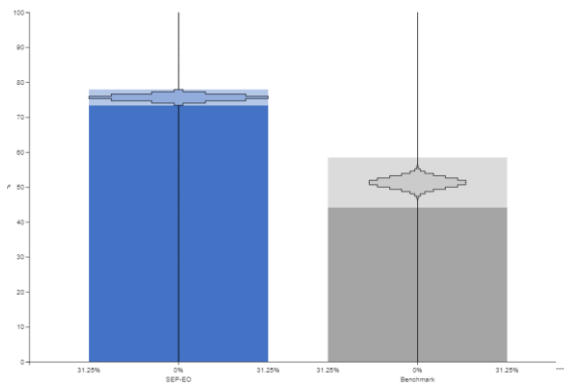


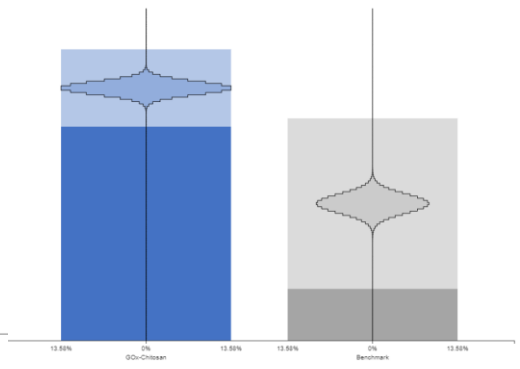


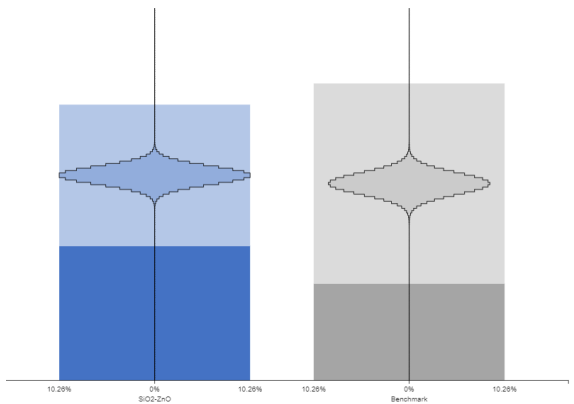


BY INTEGRATING ALL INDICATORS









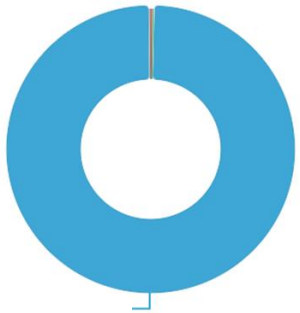
TIER 2 RESULTS

Step 1 Intrinsic hazard

Home
Dashboard
Most harmful substances
Substances of concern
Other hazard classes
Results

Questions	Answers
Carcinogenicity Cat. 1A and 1B	I don't know
Germ cell mutagenicity Cat. 1A and 1B	I don't know
Reproductive / developmental toxicity Cat. 1A and 1B	I don't know
Endocrine disruption Cat. 1 (human health)	I don't know
Respiratory sensitisation Cat 1	I don't know
Specific target organ toxicity - repeated exposure (STOT-RE) Cat. 1, including immunotoxicity and neurotoxicity	I don't know

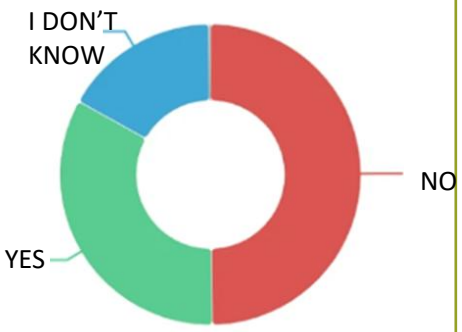
Advanced material (AdMa)



I DON'T KNOW

Answers
Yes
I don't know
No
Yes
No
No

AdMa and components



INPUT

Evaluation Table

Overall Score: - **Overall Level:** NONE

Observation related to the level

Level	Aspects	Total	Percentage	Score	Evaluation
Most harmful substances	Human health hazard	0	0 %	-	
Substances of concern	Human health hazard	0	0 %	-	
Other hazard classes	Human health hazard	0	0 %	-	

From AdMa to AdMa and components

Evaluation Table

Overall Score: 3 **Overall Level:** OTHER HAZARD CLASSES

Observation related to the level

The chemicals and materials that do not pass this criterion should be:

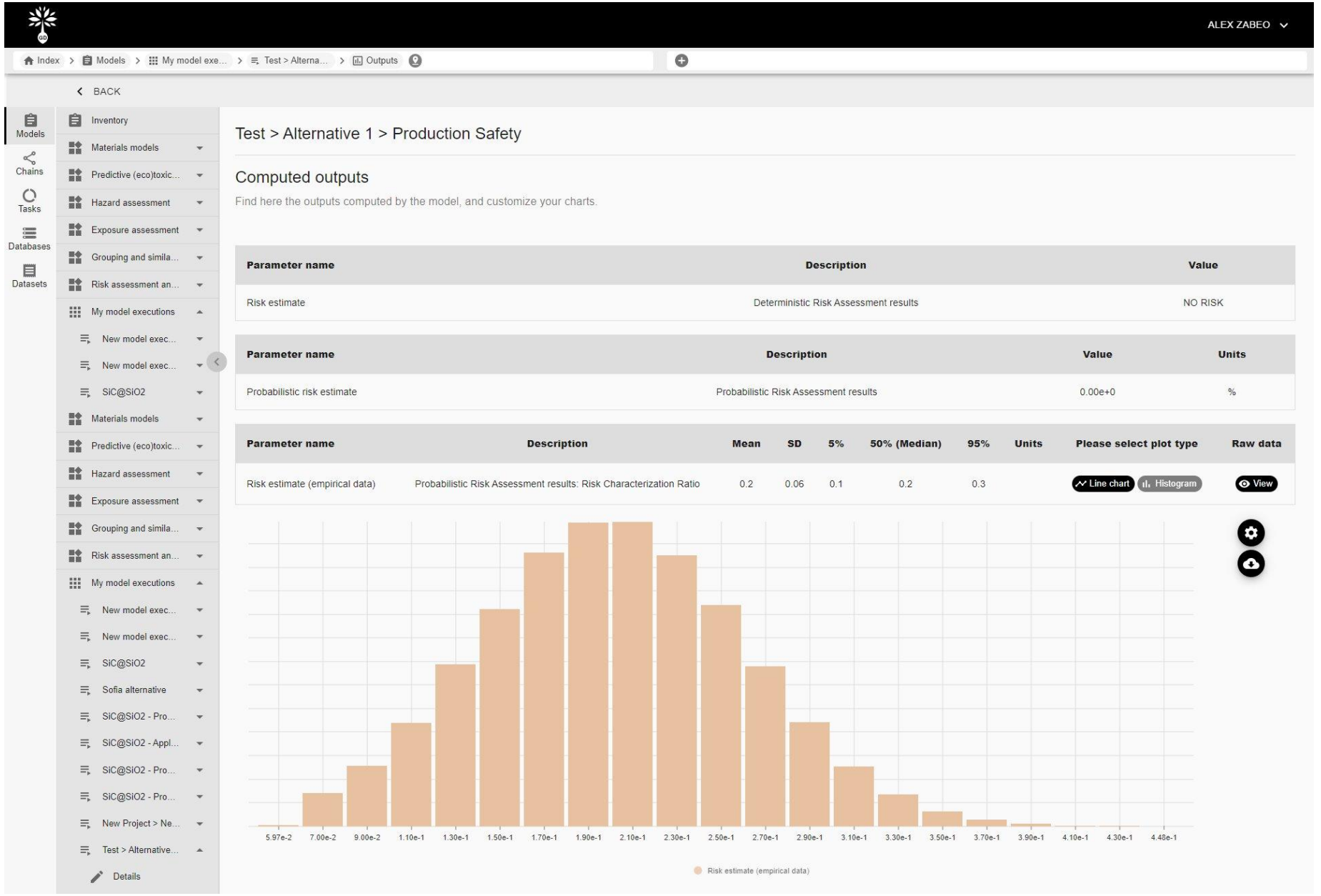
- Flagged for review and eventually reduce toxic effects
- Ensure their safety along the life cycle until less hazardous alternatives are available

Level	Aspects	Total	Percentage	GO	Chitosan	GOx-Chitosan	Evaluation
Most harmful substances	Human health hazard	0	0 %	4	4	4	✓
	Environmental hazards	0	0 %	4	4	4	
Substances of concern	Human health hazard	0	0 %	4	4	4	✓
	Environmental hazards	0	0 %	4	4	4	
Other hazard classes	Human health hazard	3	50 %	2	2	2	
	Environmental hazards	1	100 %	0	4	0	✗
	Physical hazards	0	0 %	4	4	4	

OUTPUT

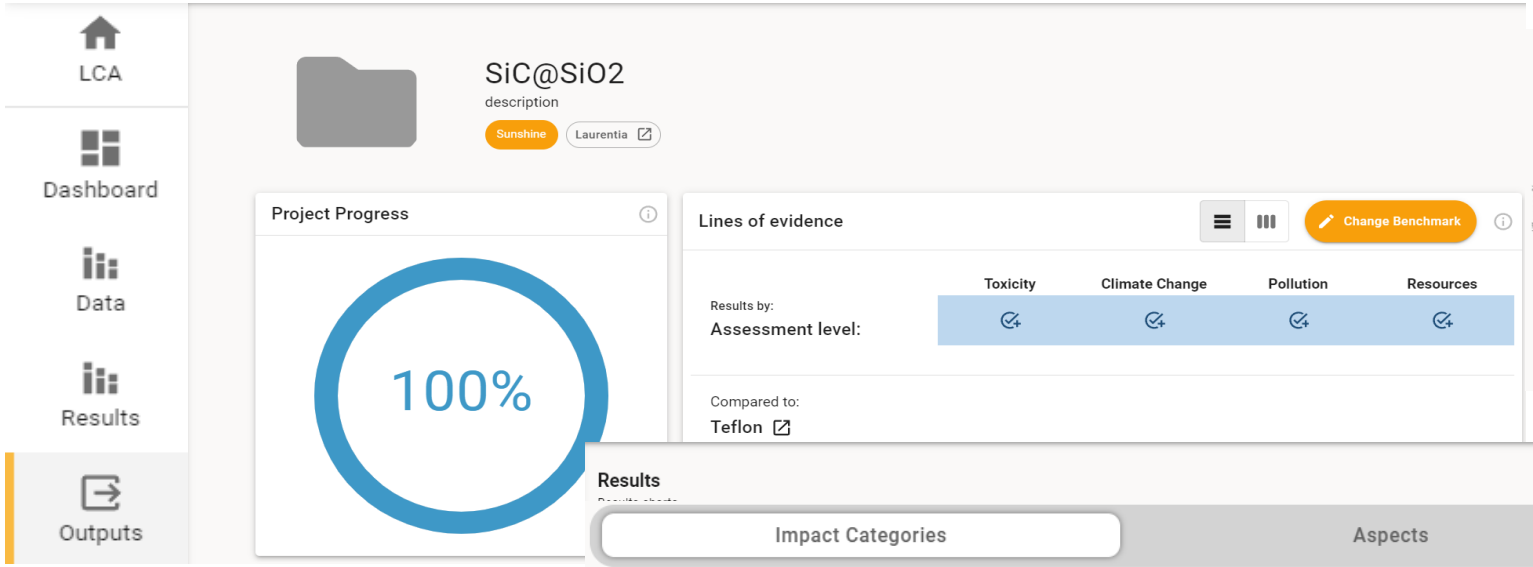
TIER 2 RESULTS

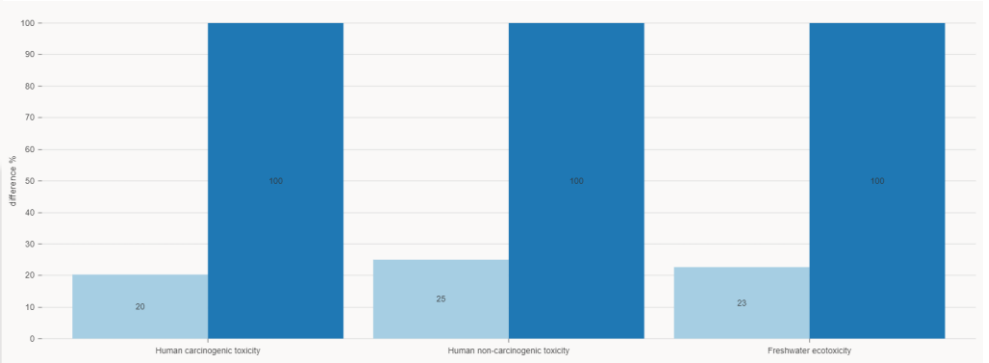
Steps 2 and 3: Risk assessment of the production and application phases

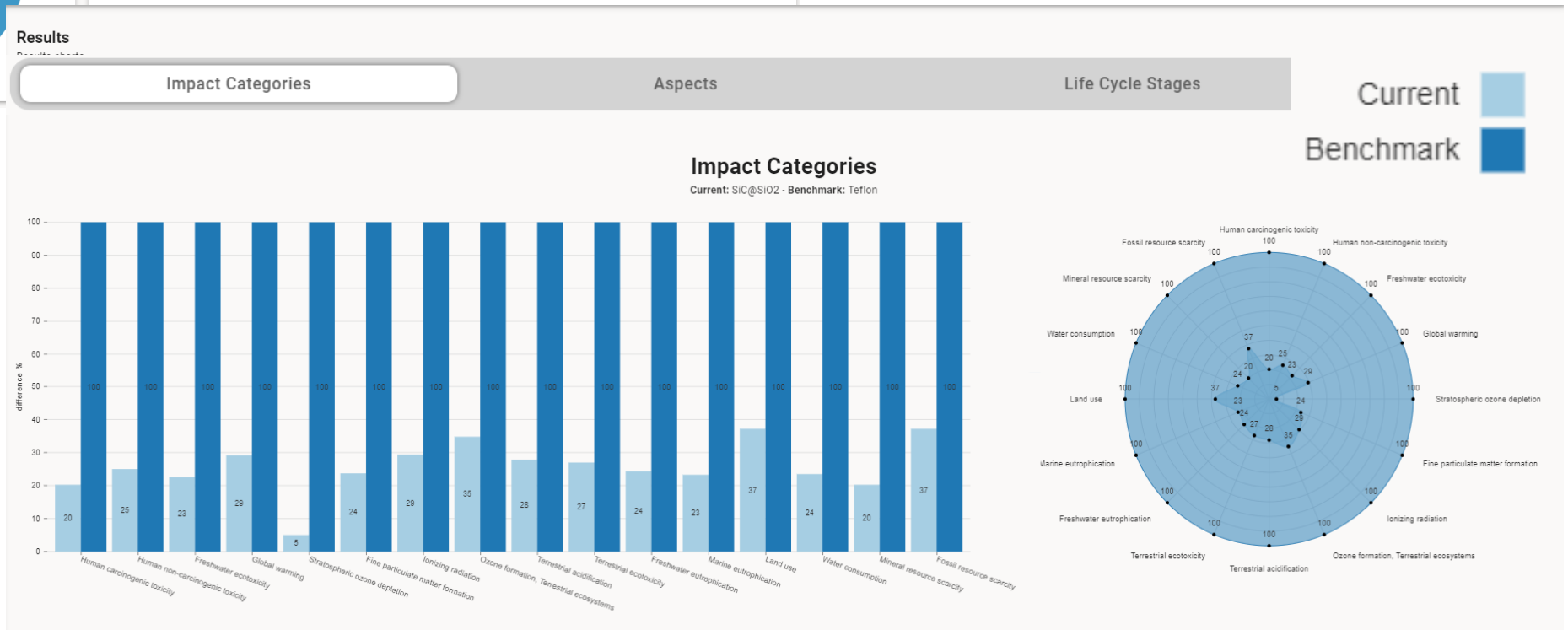


TIER 2 RESULTS

Steps 4 and 5: Environmental, social and economic sustainability







Imports datasets from:

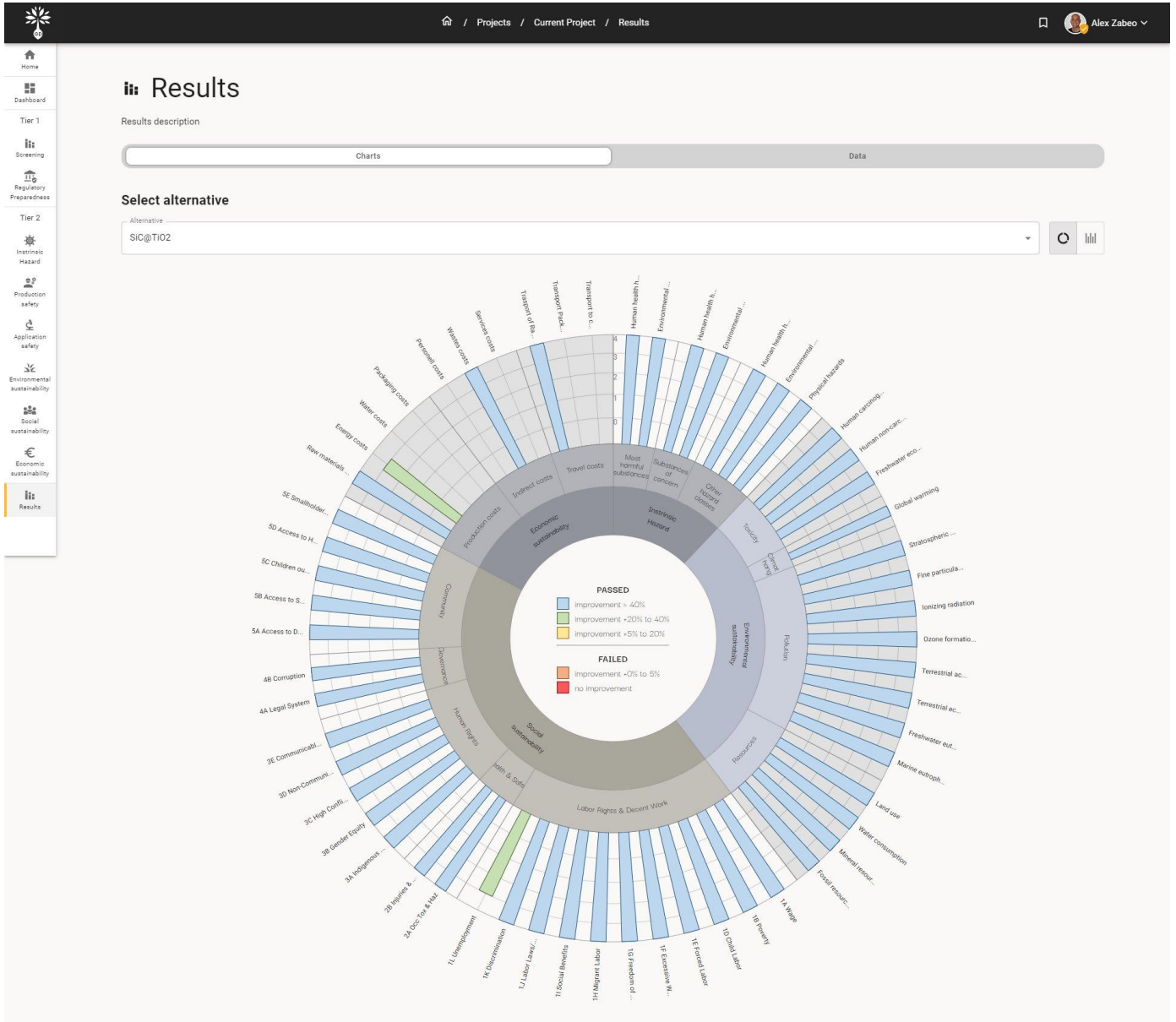
- Ecoinvent
- Sphera (GaBi)
- Social Hotspots database

Comparison to benchmark according to impact categories

TIER 2 RESULTS

Final integration of safety and sustainability assessment results

Improvement in safety and sustainability relative to the benchmark



APPLICATION TO CASE STUDIES - EXAMPLES

SUNSHINE
Safe and Sustainable Design for Advanced Materials

SUNRISE
Safe and Sustainable by Design Advanced Materials

Protective coatings with antimicrobial and antifungal properties

Suncreams increasing UV shielding and photostability

Biosurfactants derived from natural sources and polymeric-based surfactants

ALCHEMISSTS

Bio-based plasticizers will be synthetized from vegetable oils, rosins, and furan derivatives

BIOSAFIRE
Nature's flame-retardant technology upgraded

Biobased flame-retardants for the:

- Railway sector (seat base)
- Marine sector (boat command consol)
- Wood sector (coatings)
- Home appliances (refrigerator chassis, oven display holder)

MEET THE SSbD TEAM

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ALEX ZABEO

DANAIL HRISTOZOV

ELENA SEMENZIN

ELISA GIUBILATO

ARIANNA LIVIERI

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MEET THE SSbD TEAM

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