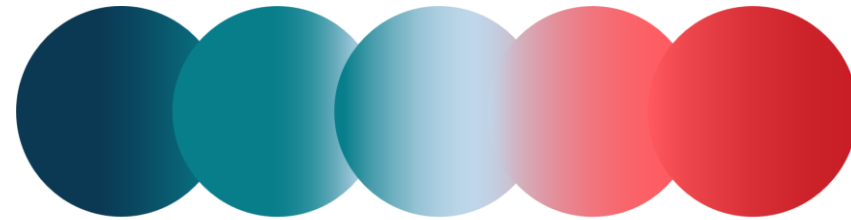# INTEGRANO

MULTIDIMENSIONAL INTEGRATED QUANTITATIVE APPROACH TO ASSESS SAFETY AND SUSTAINABILITY OF NANOMATERIALS IN REAL CASE LIFE CYCLE SCENARIOS USING NANOSPECIFIC IMPACT CATEGORIES

WP1

Definition of case studies, data management and digital DST

3rd Executive Committee meeting
11th September

WP1

Definition of case studies, data management and digital DST

Objectives

- To set robust data management plan to enable all project activities for data generation, curation and analysis [T1.1]
- To implement Define phase in DMADV, set the specific project plan to implement the INTEGRANO IMM [T1.2]
- To provide a suitable digital based decision support toolbox (DST) enabling SSbD [T1.3]

Tasks

Task 1.1	**Data generation and management plan for impact assessment** Leader: CNR; Partners: UNIMIB, ARCHE, CENTI, PRJ, DRT.	**M1-M18**
Task 1.2	**Addressing case studies specific goal and scope** Leader: CNR; Partners: UNIMIB, ARCHE, CENTI.	**M1-M18**
Task 1.3	**Dedicated Algorithms and digital Decision Support Toolbox implementation for NMs** Leader: PRJ; Partners: CNR, UNIMIB, ARCHE, CENTI, DRT	**M1-M36**

Gantt

WP1			Year 1				Year 2				Year 3				Year 4			
Task	**Title**	**Leader**	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1.1	Data generation and management plan for impact assessment	CNR	D 1.1					D 1.4										
1.2	Addressing case studies specific goal and scope	CNR						D 1.2										
1.3	Dedicated Algorithms and digital Decision Support Toolbox implementation for NMs	PRJ								D 1.3				MS 1				

Deliverables

| Del.	Title	Lead Beneficiary	Diss. Level	Due Month	Date	
D1.1	First data management plan	CNR	PU	3	March 2024	✔
D1.2	Report on the goal and scope of addressed case studies, including KDFs and KPIs definition	PRJ	SEN	18	June 2025	
D1.3	Digital Decision Support Toolbox for quantitative based integrated impact assessment towards SSbD solutions	PRJ	SEN	24	December 2025	
D1.4	Final data management Plan	CNR	PU	18	June 2025	

Task 1.1

Data generation and management plan for impact assessment

Preliminary DMP encompasses a significant part of the life cycle of the data produced within INTEGRANO. (D1.1, Month 3)
Expected final DMP at Month 18 (D1.4)

D1.1	First data management plan		CNR	PU	3	March 2024

D1.4	Final data management Plan		CNR	PU	18	June 2025

Link to T2.2 **Data mining** and T2.3 **NMs Characterisation program for selected NMs: size, morphology, p-chem properties** (D2.2, Month 36).
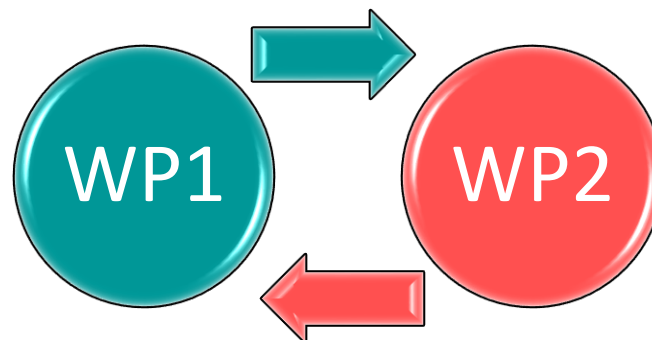
Task 1.2 Addressing case studies specific goal and scope

D1.2	Report on the goal and scope of addressed case studies, including KDFs and KPIs definition	PRJ	SEN	18	June 2025

CS N. 1 (CNR-ISSMC)

	NMs	Synthesis/Extraction	Incorporation technology	Functionality (Abatement of biological contaminants)
1.1	Ag – SiO_2 / Bio-SiO_2 – TiO_2 – Egyptian Blue based materials	Sol-gel	Spray-coating	Antimicrobial
1.2	CuO/ZnO	Sonochemical synthesis	Ultrasound / Spray-coating	Antimicrobial

CS N. 2 (CNR-ISMN)

NMs	Synthesis/Extraction	Incorporation technology	Functionality (Abatement of contaminants of emerging concern)
Perovskite oxide (Sr/Ferrite doped) Filtration process (bio-SiO_2@TiO_2) NANOTHEC-ABA, NANOPERWATER	Solution Combustion Synthesis Citrate-assisted Sol-Gel	Dip-coating (ISMN) Ultrasound (BIU)	Thermocatalysis (membrane support SiC, B4Ceramics)

Task 1.2 Addressing case studies specific goal and scope

CS N. 3 (CNR-IPCB e SCITEC)

NMs	Synthesis/Extraction	Incorporation technology	Functionality (mechanical properties)
Bio-SiO_2 (Functionalisation, SCITEC)	Extraction from rice-husk (CENTI)	Fillers of polymers (foaming, IPCB)	Reinforcement

CS N. 4 (CNR-ISAC)

	NMs	Synthesis/Extraction	Incorporation technology	Functionality (Abatement of particulates, VOCs)
4.1	$CaCuSi_4O_{10}$ (EB) (UNITO)	Solid state synthesis (mechanical mixing, calcination)	Dip/Spray-coating	Air filtration efficiency
4.2	Polymer nano-fibers	Polymerisation	Electrospinning	Air filtration efficiency

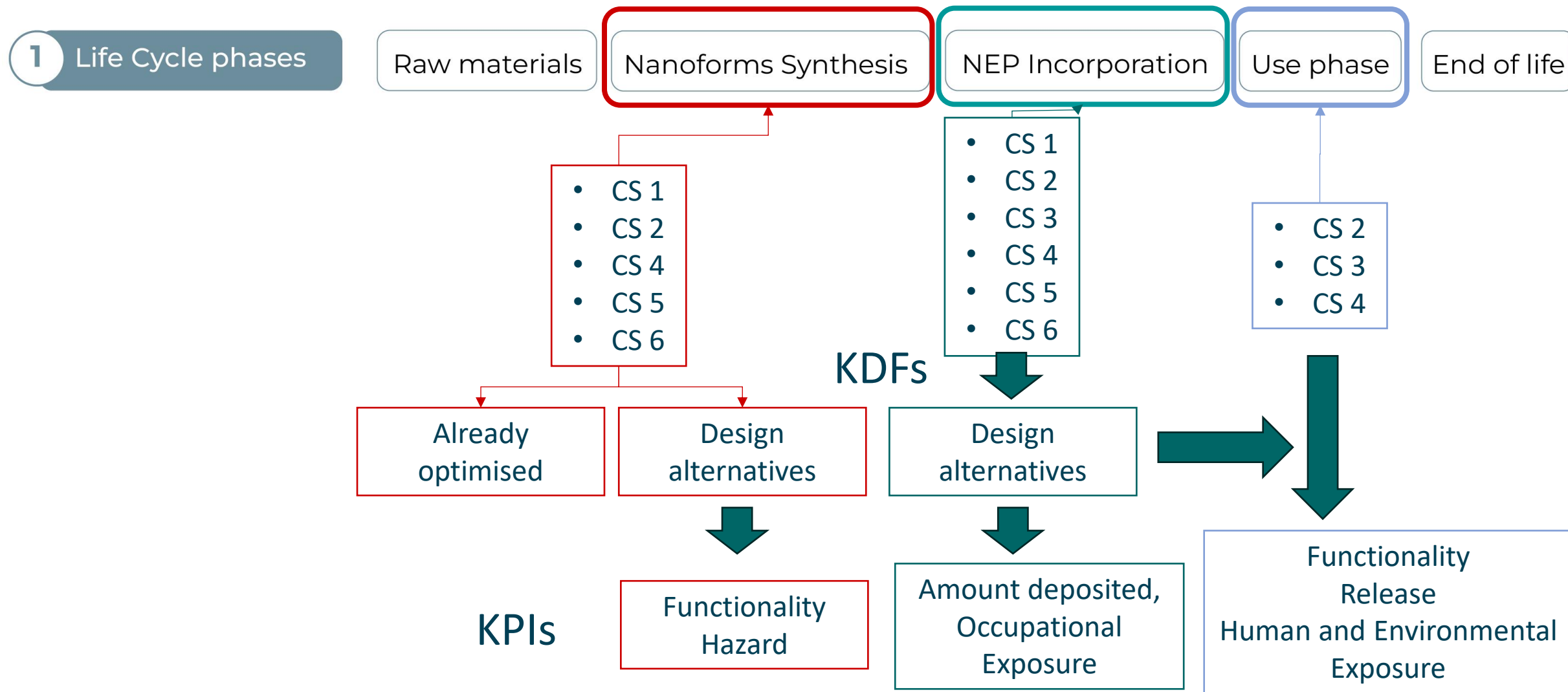# Task 1.2 Addressing case studies specific goal and scope

CS N. 5 (BIU)

NMs	Synthesis/Extraction	Incorporation technology	Functionality (Preservation)
C-dots (BIU)	Sol-gel	Ultrasound	Shell-life extension

CS N. 6 (ROV)

NMs	Synthesis/Extraction	Incorporation technology	Functionality (UV shielding)
$SiO_2@TiO_2$ / $SiO_2@TiO_2$ in micropellet (Centi + VERL)	Extraction from rice-husk (CENTI)	Micronization (ROV, VERL)	UV-adsorbent SPF

Task 1.2 Addressing case studies specific goal and scope

1 Life Cycle phases

| Raw materials | Nanoforms Synthesis | NEP Incorporation | Use phase | End of life |

Nanoforms Synthesis:
- CS 1
- CS 2
- CS 4
- CS 5
- CS 6

NEP Incorporation:
- CS 1
- CS 2
- CS 3
- CS 4
- CS 5
- CS 6

Use phase:
- CS 2
- CS 3
- CS 4

KDFs

| Already optimised | Design alternatives | Design alternatives |

KPIs

| Functionality Hazard | Amount deposited, Occupational Exposure | Functionality Release Human and Environmental Exposure |

Dedicated Algorithms and digital Decision Support Toolbox implementation for NMs

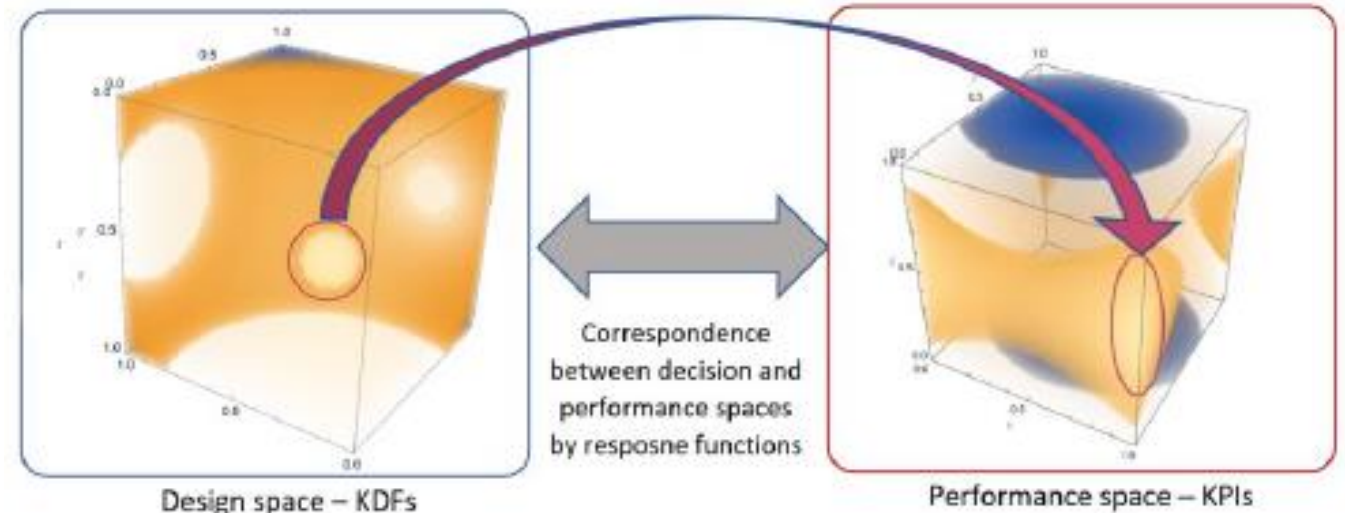| D1.3	Digital Decision Support Toolbox for quantitative based integrated impact assessment towards SSbD solutions	PRJ	SEN	24	December 2025

Task 1.3

Dedicated Algorithms and digital Decision Support Toolbox implementation for NMs

PRJ will design and implement the INTEGRANO digital DST that will implement algorithms for:

- assessing correlation between set KDFs values in the DoE matrices and obtained KPIs values from experimental measurement and computation referred to the 5Ds for each NMs LCS;
- Multi-Objective Optimisation Design (MOOD) to sort among all possible design cases the multi-optimal ones, simultaneously complying with safety, sustainability and functional KPIs requirements.

INTEGRANO will enable integrating the safety and nano-safety dimensions that will be computed exploiting standardized LCA and SCLA frameworks.

Design space – KDFs

Correspondence between decision and performance spaces by resposne functions

Performance space – KPIs

Work planned for the NEXT 6 MONTHS

- Automation tools for samples coding, identification, traceability (PRJ)
- Provide partners' access to data repository (PRJ)