

# Fact Sheet

## Current Landscape of R&I Activities for Industrial Symbiosis Standardisation

### Introduction

A central objective of RISERS is to accelerate the uptake of R&I results in IS standardisation. To achieve this, the project identifies demand-driven priorities, as well as the barriers and enablers that influence the market entry of innovative IS solutions.

This fact sheet provides a comprehensive overview of the European research and innovation (R&I) projects relevant to Industrial Symbiosis (IS) and standardisation performed under the RISERS project. The mapping exercise has been done with an aim to get a comprehensive picture of:

- The areas, topics and activities addressed by the current EU R&I which contribute to IS standardisation,
- Outputs emerging from the R&I projects that may serve as inputs for IS standardisation in terms of pre-normative evidence, technical solutions, and policy recommendations.

The results of the mapping summarised in this fact sheet aim to facilitate the alignment between R&I results and IS standardisation pathways in the RISERS IS Standardisation Roadmap and inform:

- Standardisation bodies and experts about the sources of information and existing scientific evidence delivered by R&I which can be used to drive the IS normative efforts,
- Policymakers and public authorities about the needs indicated in R&I to be addressed in policies to enable IS,
- Industry stakeholders and intermediaries about the emerging technical and operational solutions supporting IS based collaborations,
- R&I community and R&D funders about research areas, project consortia, available results and directions covered by R&I as a basis for building synergies, collaborations and capitalising on existing knowledge for future projects and R&I programming in support of IS standardisation.

### Scope & methodology of the mapping

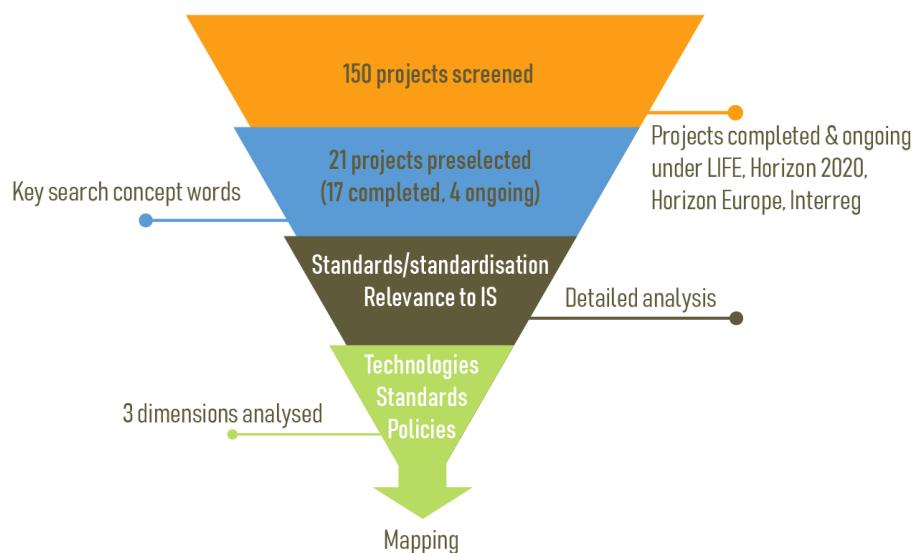


Figure 1. Scope and methodology of IS relevant projects mapping



The mapping covers over 150 EU-funded projects implemented in the years 2015-2027 under the European funded programmes including: Horizon 2020, Horizon Europe, Interreg, and LIFE. The objective of the mapping exercise was not to provide an exhaustive mapping of all reviewed 150 projects but to provide a detailed account of those initiatives identified as most promising in terms of their contributions to IS standardisation. Purposefully, the mapping did not focus on specific sectors. The objective was to offer a detailed overview of the initiatives considered promising in terms of contributions to IS standardisation. Instead, the projects were scanned first on their explicit connection to "standards" and "standardisation" and secondly their relevance to IS practices (Fig. 1).

Eventually 21 projects were identified as highly relevant to IS standardisation: 17 finalised and 4 ongoing (Tab.1)



Each of the selected project was assessed across three dimensions:

1. Standards (direct standardisation outputs, links to standards bodies, standardisation needs)
2. Technologies (IS-enabling tools and technical solutions with potential to inform standards)
3. Policies (regulatory context, policy barriers, recommendations supporting IS uptake)

The sources of information were public deliverables for finalised projects; for selected ongoing projects, RISERS also used direct coordinator input when public material was limited.



### What the mapped project landscape shows ?

#### Types of R&I projects with relevant IS standardisation contributions

The 21 projects identified as most relevant for industrial symbiosis (IS) standardisation span three distinct types of initiatives: research and innovation actions (RIA), innovation actions (IA), coordination and support actions (CSA) implemented under Horizon 2020 and Horizon Europe programmes and a transnational cooperation project implemented under INTERREG programme (Fig. 2).

Differences in the scope, objectives and targeted TRL (Technology Readiness Level) levels translate into a broad range of outputs with different use readiness and complementary pathways towards IS standardisation provided by these projects.

Table 1. List of the 21 projects identified as highly relevant for IS standardisation

Project	Funding type	Funding programme
<b>Completed</b>		
<b>SCALER</b>	CSA	Horizon 2020
<b>SYMBIOPTIMA</b>	RIA	Horizon 2020
<b>REHAP</b>	IA	Horizon 2020
<b>HARMONI</b>	CSA	Horizon 2020
<b>REMADYL</b>	RIA	Horizon 2020
<b>SHAREBOX</b>	RIA	Horizon 2020
<b>CIRCPACK</b>	IA	Horizon 2020
<b>RETROFEED</b>	IA	Horizon 2020
<b>FISSAC</b>	IA	Horizon 2020
<b>MEASURE</b>	CSA	Horizon 2020
<b>CORALIS</b>	IA	Horizon Europe
<b>LIGHTME</b>	IA	Horizon 2020
<b>STAN4SWAP</b>	CSA	Horizon 2020
<b>BIOMAC</b>	IA	Horizon Europe
<b>ECO-BINDER</b>	IA	Horizon 2020
<b>CISUFL0</b>	IA	Horizon Europe
<b>CIRC-UTS</b>	RIA	Horizon 2020
<b>Ongoing</b>		
<b>ICARUS</b>	RIA	Horizon 2020
<b>SYSCHEMIQ</b>	IA	Horizon Europe
<b>REBUILT</b>	-	Interreg
<b>SYMSITES</b>	RIA	Horizon 2020

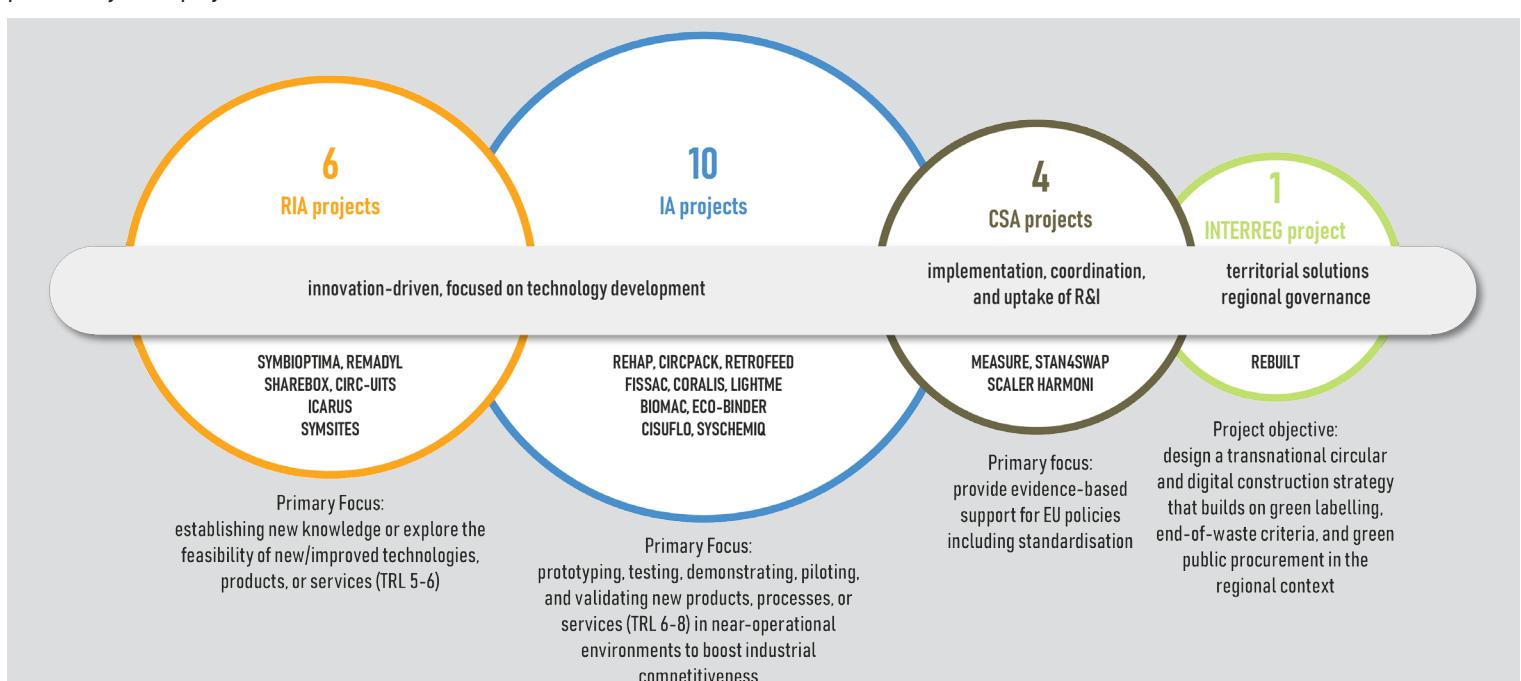


Figure 2. Types of R&I projects with relevant IS standardisation contributions

## Areas & sectors addressed



Figure 3. Mapped projects grouped by category

The analysed 21 projects provided contributions to different sector specific or cross-cutting areas with some tagged to more than one category as presented in Fig 3. The largest share of the analysed projects is linked to construction & building materials, followed by metals and advanced materials as well as plastics and packaging. It highlights strong standardisation needs anchored in the related value chains to improve resource efficiency in terms of innovative materials and enabling technologies performance, quality requirements, and pathways for innovations uptake. Beyond this cluster, several projects addressed ecoindustrial systems and IS, as well as cross-sectors circularity including such industries as chemicals, water and waste. This indicates that IS standardisation work reflected in the projects is not confined to a single sector but is developing in parallel across multiple industrial domains. The

remaining projects and categories e.g. biomass, energy and industrial data or consumer related products point to emerging or more specialised fields where some IS standardisation-relevant evidence exists but is less concentrated.

## Outputs of the analysed R&I projects relevant for IS standardisation

Having different objectives and applications across multiple sectors, the analysed projects provide 3 main types of outputs: standard-oriented, technology-oriented and policy-oriented. High-maturity R&I contributions to IS standardisation by sector

Table 2. Outputs of the analysed R&I projects

### Standards-oriented outputs

Provide the closest-to-adoption building blocks for IS standardisation -and indicate where R&D maturity is sufficient to launch or accelerate standardisation work.

- Direct IS pre-standardisation output: CEN Workshop Agreement (CWA) focused on industrial symbiosis to create a standardized framework for resource sharing. CWA 17354:2018, "Industrial Symbiosis: Core Elements and Implementation, (SHAREBOX project)
- Methods, KPIs and assessment frameworks supporting comparability and verification (e.g. MEASURE harmonised performance indicators and LCA documentation recommendations).
- Sector-linked standardisation inputs translating circular innovations into standardisable requirements (e.g., REHAP, FISSAC, ECO-BINDER, LIGHTME, CISUFO).
- Digital product information and interoperability needs feeding standardisation processes (e.g., REBUILT on Digital Product Passports and data exchange; CORALIS proposals linked to Digital Product Passports).

### Technology oriented outputs

Provide the operational evidence base (performance data and results from demonstration, piloting and validation of IS enabling technical solutions) that standards need to define credible requirements, metrics and verification methods.

- Digital and operational tools and platforms generating evidence for harmonised data needs and interoperability (e.g. CORALIS, SYMBIOPTIMA, REBUILT).
- Pilot-scale symbiosis implementation and replication (materials, water and energy exchanges), providing real-world performance insights (e.g., CORALIS, SYMSITES, SYSCHEMIQ).
- Evidence on secondary material quality and circular products (supporting future requirements and test methods, and indirectly End-of-Waste/by-product discussions), especially in construction and manufacturing value chains (e.g., FISSAC, ECO-BINDER, ICARUS, REHAP, CISUFO, REMADYL).

### Policy-oriented outputs

Include governance models, regulatory frameworks, incentives and policy recommendations for IS implementation. They show where standards can reduce uncertainty and administrative burden, enabling cross-sector and cross-border IS through improved regulatory clarity, consistency and implementability.

- Policy alignment and harmonisation of needs across waste, water and energy frameworks and circular economy strategies (e.g., HARMONI, SCALER).
- Identification of regulatory barriers and permitting challenges, including barriers related to waste regulation and operational bottlenecks (e.g., SYMSITES, RETROFEED).
- Policy contributions linked to specific EU instruments where standards can support implementation (e.g., STAN4SWAP, CIRCUITS).



## High-maturity R&I contributions to IS standardisation by sector

An analysis of project types (IA, RIA, CSA) and targeted TRL levels indicates that the most mature and readily applicable R&I outputs for IS standardisation resulting from these projects are delivered for the following sectors:

### CONSTRUCTION

(incl. cement, ceramics, metals, chemicals, agroforestry residues, flooring covers)

- Standards for bio-based products using agri-waste, including bio-based content declaration, sustainability criteria, and LCA application (REHAP).
- Standards for binary and sulpho-aluminate cements (FISSAC).
- Standards for low CO<sub>2</sub> hydraulic binders and eco-concrete formulas. (relevant for CEN/TC 51 Cement and building limes, ECO-BINDER)
- Collected sector-specific standards (e.g. ISO 45001, EN 197-1) supporting process optimisation and equipment retrofitting in construction-related process industries (RETROFEED)
- Methodologies for end-of-life material identification and secondary raw material quality assessment for floor coverings (CISUFL0)

### PLASTICS & PACKAGING

- Referenced standards for material characterisation, compostability, and circular economy metrics of plastic packaging (CIRCPACK)
- Recycling quality standards for mixed plastic waste recycling within cross-border value chains (SYSCHEMIQ)

### INDUSTRIAL PARKS / INDUSTRIAL SYMBIOSIS

#### LIGHTWEIGHT METAL ALLOYS

- Needs in inspection and testing standards for manufacturing processes of metal matrix composites and lightweight metal alloys with applications in aeronautics and automotive industries relevant for ISO/TC 261 Additive manufacturing (LIGHTME)

- Expanded ISO 50001 for inter-plant energy exchanges, cross-sectoral, standardised data models, and open protocols needed for Digital Product Passports (DPPs) with applications in energy-intensive process industries chemical/petrochemical, steel, aluminium, cast iron, and minerals (CORALIS)

### BIOBASED PRODUCTS AND MATERIALS

- Standardisation needs for risk governance of nano structured bio-based materials for applications in agriculture, automotive, food packaging, construction, printed electronics (incl. nanomaterial characterisation, occupational exposure, and toxicological screening, BIOMAC)

Figure 4. Contributions to IS standardisation by sector

## Initial alignment between RISERS roadmap IS standardisation areas and evidence generated by mapped R&D projects

The mapping of 21 R&D projects confirms a strong alignment with the RISERS roadmap (Table 3), particularly for the three cross-cutting foundations – harmonised IS concepts, end-of-waste/by-product conditions, and digitalisation – which are addressed by the majority of projects. Sectoral contributions are strongest in construction materials and plastics, where projects deliver mature evidence on quality assurance, testing methods, and regulatory acceptance pathways. Biomass and waste heat are moderately covered, mainly through sustainability assessment, traceability, and cluster-level energy exchange solutions. By contrast, batteries and textiles show more limited and fragmented coverage, with contributions often indirect or exploratory. Overall, the evidence supports the roadmap's conclusion that while sector-specific standardisation is advancing, impact and scalability depend on stronger horizontal frameworks for terminology, data interoperability, and end-of-waste criteria to enable replication across sectors and Member States.

Table 3. Alignment of the 21 mapped R&D projects with the RISERS cross-cutting and sectoral industrial symbiosis (IS) standardisation priority areas.  
(✓ = primary contribution    ○ = secondary / indirect contribution)

RISERS priority area	SCALER	SYBIDP-TIMA	REHAP	HARMON	REMDAY	SHAREBOX	CIRCPACK	RETROFEED	FISSAC	MEASURE MEASURE	CORALIS	LIGHTME	STAN4SWAP	BIOVAC	ECO-BINDER	CISUFLO	CIRC-JUTSa	ICARUS	SYSCHEMIQ	REBUILT	SYMSITES
IS general	✓	✓	○	✓		✓				○	✓								○	○	
End-of-waste / By-product status	○	○	✓	○	✓	○	✓	✓	✓	○	✓	○	○	○	✓	✓	○	○	✓	✓	
Digitalisation & data	○		○		○	✓	○	✓		✓	✓		○			○	✓	✓	✓	○	✓
Construction materials			✓					✓	✓		✓	✓			✓	✓				✓	
Plastics & packaging					✓		✓				○			○				○	✓		
Biomass & bio-based materials			✓				○				○				✓						
Waste heat								✓			✓									✓	
Batteries & critical materials												✓		✓							
Textiles	No "textiles-dedicated" project among the 21 mapped																				
Energy data & grids						○		✓		✓							○			○	

## Next Steps

The next phase will identify research and innovation priorities for IS standardisation. One of the main objectives is to underline areas where standardisation is lacking or insufficient, particularly in cross-sector collaboration, digital tools, and sustainable product standards.

This action will lead to the development of a prioritised list for standardisation needs creating a clear roadmap of critical gaps to guide future research and innovation efforts. In addition, it is expected the formulation of recommendations for R&I funding calls. The objective is to ensure upcoming calls encourage demand-driven innovation and address systemic bottlenecks in IS standardisation.

## About the RISERS project

RISERS is a Horizon Europe project aimed at developing an Industrial Symbiosis Standardisation Roadmap supporting the uptake of high impact synergies and resources considering:

- identification of the needs, gaps and opportunities,
- revision of current standards and standardisation efforts relevant for CE and the priority synergies and resources,
- initiating the process of new standards development (especially for newer technologies and pilot-scale synergies).

The RISERS project was launched in January 2024 with a duration of 3 years.

For more information visit: <https://risers-project.eu>

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