

ARTICLE #5 – JULY 2026

SYMBIOS PROJECT

Needs Analysis for the Leather and Agrifood Sectors

Survey and interview results confirm strong potential and clear barriers for industrial symbiosis across Europe

The SYMBIOS project has successfully completed an important milestone: the Needs Analysis for the Leather and Agrifood sectors. Through structured surveys and in-depth interviews with companies, researchers and industry experts across Europe, the project has gathered valuable evidence on the current state of Industrial Symbiosis (IS), identifying both existing good practices and the main challenges that still hinder the transition towards more circular production systems.

Altogether, the analysis combined 30 completed surveys and 9 in-depth interviews in the leather sector, and an equally structured evidence base in the agrifood sector: 30 survey responses collected in Spain, Italy and Slovenia, plus 6 company interviews and 5 academic interviews across the same three countries. Respondents covered stakeholders in Italy, Portugal, Spain, Germany, France, Slovenia, Brazil, Argentina, Uruguay, Vietnam, the Netherlands, Turkey and the USA. By combining quantitative surveys with qualitative interviews, the study provides a comprehensive, evidence-based picture of how industrial symbiosis is currently understood and implemented in the two sectors.

30 / 30 Leather sector surveys completed	30 / 30 Agrifood sector surveys completed
9 Leather sector in-depth interviews	11 Agrifood sector interviews

Industrial Symbiosis: from concept to practice

The findings reveal that both sectors are already taking important steps towards circularity. In the leather sector, two-thirds of surveyed companies (20 out of 30) report advanced, quantitative monitoring of their waste and by-product flows, showing that the sector's foundations, data availability in particular, are already solid. Even more strikingly, 70% of respondents (21 out of 30) already have some form of partnership for by-product valorisation, and 10 companies report stable, long-term symbiotic arrangements, most of them still informal rather than fully structured.

The most commonly reported leather by-products are scraps and trimmings (25% of responses), chemical residues and sludge (19%), packaging waste (16%) and wastewater and treatment sludge (13%). Recycling is the most common destination declared for these by-products (25%), but disposal still accounts for 18% of flows, a clear signal of the untapped valorisation potential that industrial symbiosis could unlock.

The agrifood sector shows a very similar picture, now backed by its own dedicated survey of 30 companies in Spain, Italy and Slovenia. About 70% of respondents already reuse by-products, energy or wastewater internally between departments, and only 17% of by-products still end up in disposal, most are recycled, recovered for energy, or reused internally. Companies interviewed in the same three countries confirmed this trend qualitatively: packaging optimisation, water and energy recovery, and valorisation of by-products (for example whey reused in sweet cream production, or spills supplied to farmers as animal feed) are already common inside individual companies. However, industrial symbiosis initiatives that cross company boundaries, connecting food businesses with other sectors, remain less developed: only 9% of surveyed companies report a stable, long-term valorisation partnership, even though 37% have formal agreements with selected partners and a further 30% collaborate informally or occasionally. These figures confirm that industrial symbiosis is no longer a theoretical concept in either sector, but an emerging reality that can generate both environmental and economic benefits, even if inter-company collaboration still has considerable room to mature.

Survey results at a glance

Leather sector: strong data foundations, informal partnerships

Survey respondents represented a broad cross-section of the sector: Portugal (13 respondents, 43%) and Italy (9 respondents, 30%) together accounted for nearly three-quarters of the sample, alongside companies from Germany, France, Spain, the Netherlands, Turkey, the USA, Brazil, Uruguay, Argentina and Vietnam, and company sizes ranging from micro-enterprises to large multinationals.

Topic	Key survey result
Waste monitoring	67% of companies (20/30) already apply advanced, quantitative monitoring of waste and by-products
IS partnerships	70% of companies (21/30) have some form of partnership for by-product valorisation; only 10 are stable, long-term arrangements
No partnership	30% of companies (9/30) report no by-product valorisation partnership at all
Main regulatory barrier	Administrative burden, permits and authorisations (18 mentions), followed by compliance costs and legal uncertainty (11 mentions each)
Main skills gaps	Technical skills (15 mentions) and regulatory/compliance skills (14 mentions)
Structured training	Only 13% of companies (4/30) invest in regular, structured training on circular economy / industrial symbiosis
Standards adopted	ISO 14001 is the most widespread certification (22%); 20% of respondents hold no environmental standard at all

Interviews with 9 sector stakeholders reinforced these figures: wet-blue shavings emerged as the highest-volume and most economically critical by-product, with valorisation pathways (fertilisers, protein hydrolysates) constrained mainly by the regulatory classification of chromium-containing waste. Chrome-free tanning processes were consistently identified as best positioned for circularity, and district-based models, such as the consortium water-treatment systems already operating in Tuscany, were highlighted as replicable templates for connecting isolated companies into functioning symbiosis networks.

Agrifood sector: solid foundations, still-informal partnerships

A dedicated online survey, run in parallel with the leather sector questionnaire, collected 30 valid responses evenly split across Spain, Italy and Slovenia (10 per country), covering large (47%), medium (33%) and small (20%) companies active in beverages, dairy, meat and fish, cereals and bakery, fruit and vegetables, and other agrifood subsectors.

Topic	Key survey result
Production process	51% secondary processing, 43% primary processing, 7% mixed processes
Main by-products	Organic waste (39%), packaging waste (29%) and wastewater (24%) dominate the by-product profile
Internal IS practices	~70% of companies already reuse by-products, energy or wastewater internally between departments
By-product destination	Only 17% of by-products are sent to disposal; most are recycled, recovered or reused internally
IS partnerships	37% have formal agreements with selected partners, 30% collaborate informally, but only 9% report a stable, long-term partnership
Waste monitoring	53% apply advanced, systematic monitoring; 40% basic/partial monitoring; 7% digitally supported systems
Main regulatory areas	Environmental regulations (33%) and food safety regulations (32%) are the most cited
Main regulatory barrier	Administrative burden (permits, authorisations) and compliance costs, most frequently cited by respondents
OSH constraints	Only 10% report that health & safety requirements significantly limit by-product reuse or exchange
Structured training	Only 7% of companies invest in regular, structured training; 60% train occasionally; 33% do not train at all
Main skills gaps	Technical skills and regulatory/compliance expertise are the most frequently cited gaps
Weakest competences	Energy management (ISO 50001) and Environmental Product Declarations / LCA score lowest; regulatory knowledge and lean management score highest

Qualitative interviews with 6 companies and 5 academic experts in Slovenia, Italy and Spain confirmed and enriched these figures. Food-specific constraints, perishability, shelf life, contamination risk and strict sanitary rules (HACCP, hygiene protocols, traceability), were consistently identified as the strongest limits on by-product reuse. Economic barriers were repeated across all interviews: collection, transformation, transport, storage, testing and certification costs are often too high relative to the small quantities of by-products generated, and several promising initiatives (such as a project to reuse carbohydrate-enriched waste whey) were discontinued when public funding was not secured.

- External pressure from customers, supply chains and ESG requirements was viewed positively by companies and is increasingly pushing them to improve environmental reporting and sustainability practices, even where regulatory expectations remain unclear or in flux.

- Companies reported that basic technical knowledge is generally already in-house; what is missing is time, dedicated resources and specialised competences to scale circular initiatives, along with reliable partners able to receive or process specific by-products, consistent with the survey finding that only 9% have a stable valorisation partnership.
- Academic experts from Spain, Slovenia and Italy converged on the need for practical implementation frameworks, advanced extraction and resource-recovery technologies, and applied research and pilot projects capable of turning food-sector residues into replicable waste-to-value models.

Key barriers to wider adoption

Despite this encouraging progress, the Needs Analysis highlights several common obstacles that continue to slow down the wider implementation of industrial symbiosis in both sectors:

- Complex regulatory frameworks and administrative procedures that make by-product exchange difficult, the single most cited barrier in the leather survey (18 mentions for administrative burden alone), and the top two regulatory areas in the agrifood survey too, where environmental regulations (33%) and food safety regulations (32%) were most frequently flagged, alongside administrative burden and compliance costs as the leading barrier types.
- High implementation costs, particularly for SMEs, including investments in technologies, logistics, testing and compliance, flagged by 11 leather respondents on compliance costs, and confirmed by agrifood interviews as the key reason valorisation projects are discontinued without external funding.
- High costs and difficulties in sourcing extraction plant for each individual type of food waste (the extraction process differs for each type of waste and requires different machinery and plant); furthermore, the drying process is very energy-intensive.
- Limited cross-sector collaboration: 30% of leather companies report no valorisation partnership at all, while in the agrifood sector only 9% of surveyed companies (out of 30) have a stable, long-term partnership, and both sectors describe difficulty identifying reliable partners able to receive or process specific by-products.
- Skills gaps, especially in regulatory compliance and industrial symbiosis management: in the leather sector, technical skills (15 mentions) and regulatory/compliance skills (14 mentions) are the two most cited gaps, with only 13% of companies investing in structured training; the agrifood survey shows an almost identical pattern, with technical and regulatory skills as the top gaps and only 7% of companies training regularly (60% only occasionally, 33% not at all).
- Limited access to structured information and digital tools that could facilitate matchmaking between companies, a need voiced independently by leather interviewees and by agrifood academics, and reflected in the agrifood survey's low self-assessed competence in digital tools for monitoring and matching resources.

The agrifood sector faces additional, sector-specific challenges related to food safety regulations, traceability requirements and the perishability of by-products, confirmed by the survey, where food safety and environmental regulations together account for nearly two-thirds of the regulatory areas cited, while in the leather sector regulatory uncertainty surrounding specific waste streams, particularly chromium-containing materials, remains the single largest technical and regulatory constraint to scaling industrial symbiosis.

Strong foundations for future collaboration

While barriers remain, the research also identified several factors that can accelerate the transition towards industrial symbiosis, consistently echoed across both sectors and by academic experts:

- Stronger collaboration between industries, building on the fact that 70% of leather companies already have some form of by-product exchange in place, and 70% of agrifood companies already reuse resources internally between departments, solid ground on which to build more structured, cross-company partnerships.
- Clearer and more harmonised regulations, particularly on by-product versus waste classification, cited as a priority in both the leather regulatory-barriers data and the agrifood survey, where environmental and food-safety regulations together dominate the barriers reported.
- Digital platforms to facilitate partner matching and standardised technical data sheets for by-products, requested by leather interviewees and agrifood academics alike, and consistent with the low self-assessed competence in digital monitoring and matching tools reported by agrifood companies.
- Targeted training programmes to close the technical and regulatory skills gaps confirmed by the leather survey (15 and 14 mentions respectively) and by the agrifood survey, where only 7% of companies train regularly and competence in energy management (ISO 50001) and LCA/EPD is particularly low.
- Closer cooperation between businesses, research organisations and public authorities, reflected in the district-based consortium models already operating in the leather sector and the applied-research pilot projects highlighted by agrifood academics in Italy, Spain and Slovenia.

The interviews with academic experts in both sectors further confirmed that successful industrial symbiosis depends not only on technological innovation, but also on governance, trust, information sharing and long-term partnerships capable of connecting different industrial sectors.

Building the next phase of SYMBIOS

The results of the Needs Analysis will directly support the next stage of the project. Based on the evidence collected, including the quantitative survey data from the leather sector and the qualitative insights gathered across the agrifood sector, the SYMBIOS partnership will now develop two Industrial Symbiosis Models: one specifically designed for the Leather sector and one for the Agrifood sector. These models will translate the project's research into practical frameworks that help companies identify collaboration opportunities, improve resource efficiency and create new value from industrial by-products.

The models will also support the development of training materials, digital tools and recommendations aimed at making industrial symbiosis more accessible, scalable and replicable across Europe, directly responding to the training gaps, digital matchmaking needs and regulatory-clarity requests that emerged so clearly from the surveys and interviews.

As the project moves into its next phase, SYMBIOS will continue working with businesses, researchers and policymakers to promote innovative approaches that transform waste into resources and strengthen circular economy practices across the Leather and Agrifood sectors.

We invite all interested stakeholders to follow the next developments of the SYMBIOS project on its social media and website: [LinkedIn](#), [IG](#), [Website](#).