

Focus Groups on Leather Industrial Symbiosis

Final Report

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1. Introduction

1.1 Project Overview

SYMBIOS (Digital Platform for Industrial Symbiosis & Circular Economy) is a new Erasmus+ project (Erasmus+ Project Num. 2024-1-PT01-KA220-VET-000253813) focused on exploring the industrial symbiosis in the **agrifood and leather sectors**. The project analyses existing practices, regulatory frameworks, and future opportunities to design a replicable model that supports Europe's ecological transition and strengthens the circular economy. Special attention is given to agrifood and leather, being them two synergic industries that are crucial for the European economy. A major outcome of the project will be a digital platform dedicated to industrial symbiosis and aimed at becoming a tool for information, awareness, training, learning and support professional development in the Green & Circular Economy, while also connecting companies to foster collaboration through symbiotic practices.

Project Start: 31 August 2025

Project Duration: 30 months (29-Feb-2028)

Consortium:

- Universidade Portucalense Infante D. Henrique (UPT) - Portugal,
- IATA – CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS - Spain,
- COTANCE - France/Belgium,
- Cisita Parma scarl - Italy,
- SPIN360 SRL - Italy,
- GOSPODARSKA ZBORNICA SLOVENIJE – Slovenia

Granting Authority: The Portuguese Erasmus+ National Agency under the Erasmus+ Programme, Key Action 220: Partnerships for Cooperation.

Document objective: This document aims to consolidate the outcomes of the two focus groups focused on the leather sector and industrial symbiosis. The findings will serve as a basis for identifying the key areas of investigation to be addressed in the subsequent needs analysis survey.

2. Methodology

2.1 Focus groups design

The focus groups design was developed in accordance with the quantitative and qualitative Key Performance Indicators (KPIs) defined in the EU project Grant Agreement. From a quantitative perspective, the requirements were as follows:

- A minimum of two focus groups organised for the leather sector;
- The involvement of at least six participants per session.

From a qualitative perspective:

- Each focus group was composed to ensure a diverse range of stakeholders, including entrepreneurs, managers, academic researchers, and technical experts, in order to capture complementary perspectives across the value chain.

The two focus groups were held online to accommodate the needs of international participants. Each session was organised with a diversified pool of participants, and the project partners successfully ensured the participation of at least six attendees per session.

In preparation for the focus groups, a literature review was conducted to assess the state of the art of industrial symbiosis in the leather sector. The insights gathered informed the development of a structured set of questions designed to guide the discussions and ensure consistency and comparability across sessions.

Here follows the list of the questions divided into the following topics:

- **State of the art:** current industrial symbiosis practices in the leather sector (tanning, processing, reuse, etc.)
- **Challenges:** the regulatory framework that enables or hinders such practices
- **Possible solutions:** future opportunities and the conditions necessary to replicate virtuous models; the needs of industrial, technical, and research actors

TOPIC 1: KNOWLEDGE AND PERCEPTION OF INDUSTRIAL SYMBIOSIS-STATE OF THE ART

- Do you know what industrial symbiosis is? Have you heard of it before?
- Have you already heard of industrial symbiosis between the leather and food industries (we are tackling the industrial symbiosis in the production phase of the leather)?

- What are the main by-products of the leather industry? (e.g., tanning waste, collagen, animal fats, processing water, etc.) *(a by-product is a secondary product derived from a production process, manufacturing process, or chemical reaction; it is not the primary product or service being produced)*
- Do you know what the relevant by-products of the food industry are? (bones, blood, fats, slaughterhouse waste, vegetable waste, etc.)
- How much do you know about the by-products you generate?
- Do you know if they are being put to good use?
- What is your current waste management strategy?
- How can by-products become inputs for other processes?

Existing practices

- Do you have any industrial symbiosis practices in your context? Which ones (e.g., waste recovery, resource sharing, by-products, energy, joint waste treatment)
- What is the current state of collaboration between the leather industry and the agrifood sector?
- Who do you collaborate with most frequently? e.g., other industrial sectors, public bodies, partners, consortia
- What advantages have you observed (economic, environmental, logistical)?

TOPIC 2: BENEFITS AND CHALLENGES

- What opportunities do you see in the cross-promotion of by-products?
- What do you think are the main barriers preventing the synergies between the leather and agrifood industries? (logistical, regulatory, cultural, technological)
- Are companies in both sectors fully aware of the potential benefits of these collaborations?
- What role do you play as public bodies or consortia?

Regulatory framework and governance

- Do current regulations (local, national, European) promote or hinder industrial symbiosis in the leather sector? How? And technology?
- Do you have experience with complex authorization procedures (e.g., end-of-waste, by-products, waste transport between companies)?
- Are there any examples of effective public policies or incentives that you know of or would like to see implemented?

TOPIC 3: INNOVATION AND FUTURE OPPORTUNITIES

- In which innovations are you most interested in? (new materials, energy, water treatment, etc.)
- Are there already active collaborations between you and companies in the food industry?
- What emerging technologies or innovative models could enable new forms of industrial symbiosis in your sector? (e.g., bio-based materials, AI to optimize exchanges, blockchain for flow traceability)
- What would be needed to make an industrial symbiosis model replicable and scalable? (e.g., standardization, matchmaking platforms, ad hoc regulatory tools)
- Which actors or sectors should be more involved in the future?
- What kind of support from research projects, policy makers, or other stakeholders would be useful to you?
- Which raw materials do you currently purchase that could instead come from local waste?
- Do you know any food companies you could collaborate with?
- Are you interested in co-designing solutions with other industries?

Participants were selected according to the criteria described in the following paragraph, in line with the project objectives and stakeholder engagement strategy. The guiding questions were shared with participants in advance.

The focus groups were held on November 17th and November 26th, 2025 and followed the structure outlined below:

- brief presentation of the SYMBIOS project;
- participant introductions;
- overview of theoretical concepts related to industrial symbiosis;
- focus group discussion.

The focus groups were conducted over two sessions of 1.5 hours each, supported by a PowerPoint presentation and interactive tools to stimulate participation and engagement.

2.2 Participant recruitment and profiles

The focus group participants were selected through a structured and targeted process. First, COTANCE & SPIN360 jointly mapped key stakeholders across the European and global leather value chain whose expertise was directly relevant to the objectives of the SYMBIOS project. Based on this

mapping exercise, 15 leather-sector stakeholders were identified (see Annex at the end of the document for the detailed list).

The selected participants represent internationally recognised expertise across academia, research, industry, and interlinked value chains. They included academics specialising in leather technology and innovation (University of Lleida, ITECH Lyon), researchers from leading leather research centres such as SSIP – the Italian Leather Research Institute, CTIC – Leather Technology Centre (Portugal), and CTC Ars Tinctoria (Italy), as well as independent scientists from Authenticae (UK).

The group also comprised representatives of leather clusters actively engaged in industrial symbiosis (ResoCuir France), European tanneries with direct operational integration with the meat sector (Scan-Hide Denmark, Vitelco Netherlands), and international industry associations such as the Leather and Hide Council of America (LHCA), which represents the US leather and hides industry and maintains close & remarkable cooperation with the meat sector. In addition, participants included partners from previous COTANCE projects ([SELAMBO](#) – University of Zaragoza, Spain), renowned tanners, senior leather experts with hands-on experience in industrial symbiosis, and representatives of the meat sector itself - International Meat Secretariat & Beef & Lamb New Zealand & Australia.

Once the relevant stakeholders had been mapped and selected, they were approached during the Lineapelle International Leather Fair held from 23rd to 25th September 2025 in Milan. The majority were met in person on the sidelines of the fair for one-to-one meetings, during which the COTANCE Project Manager briefly presented the SYMBIOS project, gathered initial feedback, and assessed interest in participating in the focus group exercise. All stakeholders expressed interest in the initiative and were provided with a one-page project information leaflet. Stakeholders who could not be met at Lineapelle were contacted via an introductory email inviting them to participate.

Following this initial expression of interest, COTANCE launched a Doodle poll to identify the most suitable dates and time slots for the focus group meetings. The voting resulted in two preferred sessions: 17 November at 14:00 CET and 26 November at 10:00 CET. COTANCE subsequently informed participants of the selected dates and shared the list of guiding questions to be discussed during the focus groups (see Annex).

As a result, two leather-specific focus group sessions were held, with a total of 12 participants from the identified stakeholder list, with six participants attending each focus group (see the Annex at the end of the document).

2.3 Tools and materials used

Both focus groups were conducted online via Zoom to accommodate the geographical dispersion of project partners and participants. The sessions took place on November 17th and November 26th, with the dates agreed jointly by the partners and confirmed by participants through a poll. Each focus group had a duration of approximately 1.5 hours.

The discussions were facilitated through the use of real-time surveys and a PowerPoint presentation. These tools supported engagement and interaction introduced the concept of industrial symbiosis as well as the project and project team, and helped structure the conversation by presenting key questions and discussion topics.

3. Findings

3.1 Thematic analysis for focus group 1

STATE OF THE ART

Valorisation of By-Products

The leather sector, itself being a by-product (hides and skins) from the meat and dairy industries, also generates a wide array of secondary by-products such as hair, fleshings, fats, collagen-rich materials, shavings, and trimmings. Many of these already have established outlets (fertilisers, cosmetics, gelatine, collagen). Industrial-scale technologies capable of further valorisation are well developed; early examples, such as the [German government-funded project](#) that regenerated retanning agents from leather shavings, show the sector's long-standing innovation capacity.

A significant share of residues originates in the beamhouse stage, where hides undergo cleaning and unhairing. Hides and skins initially resemble waste and only obtain material value once cleaned, meaning that by-product generation is intrinsic to the early part of the process.

CURRENT STATE OF COLLABORATIONS

Starting from a Mentimeter, (Figure 1) participants were asked to write down whether they already had symbiosis practices in their context.

Do you have any industrial **symbiosis practices** in your context? Which ones?

I think many.

No

Tanning is taking the byproducts of meat and milk production

Split Whole hides for gelatin Trimmings WB shavings

Head masks for gelatin

Agroindustry waste as tannin

Hides and skins from the meat sector to the leather sector although low prices v collection costs are problematic

Head mask for human consumption

Figure 1, Current symbiosis practices

Because leather production begins with a by-product, industrial symbiosis is intrinsic to the sector:

In the dairy-veal-leather chain (as described by Vitelco), calves are themselves a by-product of milk production; veal feed is largely made from by-products of human food processing; and hides/skins are one of many outputs handled by slaughterhouses.

Slaughterhouses today valorise a much larger share of the animal than in the past, including blood for pharmaceutical applications.

Collaboration models such as geometrised hides in Brazil demonstrate upstream pre-processing to remove hair and cut the hide in the way that only the relevant hide components go to tanneries.

SLAUGHTERHAUSES -TANNERIES COOPERATION BENEFITS

- Since leather *starts* as a by-product, the point at which residues are removed, cleaned, and classified fundamentally shapes all downstream valorisation options, including the quality and quantity of the leather itself.
- Better alignment between slaughterhouses and tanneries enables:
- Earlier separation of usable by-products, increasing volume and improving quality.
- Higher Blößenrendement (clean usable hide yield), reducing waste and improving material efficiency.

- More predictable, higher-quality inputs for both leather and secondary industries (collagen, fertilisers, technical composites).
- Greater circularity, as collaboration ensures that each component of the animal is directed to its highest-value use.
- Stronger cooperation at this critical upstream junction therefore amplifies the economic, environmental, and circular value of the entire leather value chain.

Existing Metrics and Practices

The Blößenrendement — the ratio of usable hide surface after trimming, cleaning, and unhairing — is a long-established indicator of material efficiency and symbiosis between slaughterhouses and tanneries. German tanners historically used it to optimise yield (buying by weight but selling by area). Although less used today, Blößenrendement remains relevant for quality-based valorisation choices.

CHALLENGES

Economic Barriers & Market Dependence

A persistent barrier is the economic viability of valorisation routes:

- Many by-products can technically be recovered, but low market prices — particularly for gelatine/collagen splits — make processing unprofitable.
- Producing more refined or pre-processed hides (pre-trimmed or pre-fleshed for higher Blößenrendement) may not be rewarded for slaughterhouses unless price incentives exist.
- Attempts to improve material efficiency (cutting necks and bellies in the tannery to divert them into collagen streams) face consumer price resistance: higher-quality leather should cost more (€80/m² instead of €50/m²), but the market does not always accept this.

Regulatory Barriers

- New EU regulations can impede cross-sector valorisation
- Secondary raw materials such as wet-blue shavings or wet-blue cuttings fall under complex waste classifications, limiting cross-border movement and use.
- Anti-livestock narratives, labelling rules as they are now, and regulatory asymmetries between natural vs synthetic materials disadvantage leather and therefore its own by-products and undermine incentives for circular economy practices.
- Lack of standardisation in upstream practices (trimming and hide preparation) hampers harmonised valorisation.

Technological & Knowledge Barriers

Engineering companies possess advanced waste-to-resource technologies, but are often reluctant to share them due to high development costs and the desire to maintain a competitive market advantage.

The stage at which by-products are removed also has a major impact on their quality. Slaughterhouses are increasingly losing the specialised expertise needed to pull down hides correctly and preserve their quality before they are sent to tanneries. The traditional hide-puller (hide-desalter) profession is now close to disappearing, further threatening the quality of raw materials entering the leather value chain.

Material Efficiency Constraints

Many valorisation markets require critical mass and steady supply, which individual tanneries — especially SMEs — cannot always provide.

Cutting hides too early or without relevant expertise can turn potentially valuable materials into waste.

INNOVATIONS AND FUTURE OPPORTUNITIES

Bio-based Tanning Agents from Agrifood Residues

There is growing potential for vegetable tanning agents sourced from agrifood waste streams:

- Avocado pits and skins, grape pomace (“Grape tannins”), and olive leaf extracts offer viable tannin alternatives.
- Projects in Spain and Italy have technically validated extraction processes, though industrial-scale implementation remains limited.
- Sea buckthorn tannins and other plant-derived polyphenols also show promise as chromium alternatives.
- These innovations align with the updated European Bioeconomy Strategy, which encourages industrial symbiosis, provides funding via Horizon Europe, and may open dedicated budget lines for bio-based materials.

Circular Uses for Chromium-Containing Residues

New possibilities exist for wet-blue shavings containing chromium:

- Pilot projects successfully converted chromium-bearing shavings into biodegradable flowerpots, demonstrating that chromium leather waste can be safely valorised in non-food, fertilising applications.

Improved Material Efficiency Through Symbiosis

Greater cooperation between slaughterhouses and tanneries can:

- Optimise the allocation of hides: high-quality hides to leather; lower grades to gelatine/collagen/fertiliser.
- Enable joint de-hairing and pre-processing, improving Blößenrendement and reducing downstream chemical use.
- Support more precise differentiation between hides for leather vs hides for collagen markets.

Narrative Shift & Regulatory Opportunity

There is strong agreement on the need to:

- Correct misleading narratives around livestock, hides, and leather's environmental profile.
- Promote leather as a natural, renewable, circular material, in contrast to fossil-based synthetics.
- Engage in EU policy processes to ensure fair treatment of natural materials in labelling, product standards, and circular economy legislation.

Industrial Symbiosis Scaling Potential

For industrial symbiosis to become scalable and replicable:

- Economic incentives must align with valorisation costs.
- Regulatory frameworks must facilitate exchange of secondary raw materials.
- Workforce skills must adapt; staff must be trained to understand material flows, regulatory constraints, and valorisation pathways.

3.2 Thematic analysis for focus group 2

As part of the main findings of the second focus group, participants were asked first what industrial symbiosis meant for them. Most respondents linked industrial symbiosis with circularity,

bioeconomy, resource efficiency and waste prevention, while others reported it to be linked with cooperation and integration among all stakeholders. Results are shown in figure 2:

Furthermore, participants highlighted that:

Do you know what **industrial symbiosis** is? Have you heard of it before? Are you researching this topic?



- Leather is essentially a waste material until it is transformed and given value by the meat or leather industry.
- In the circular bioeconomy, leather follows two main pathways:
 - It is a **long-lived, highly sustainable material**, superior to alternatives.
 - It can also be part of **industrial symbiosis**, where leather products return to natural recycling cycles at their end of life.
- As some participants highlighted, (established by UNIDO), only **20%–25%** of the mass of cattle hides are converted into leather; **75%–80%** requires alternative valorization pathways
- A **cascading use approach** is essential: materials not converted to leather must be removed and valorized at the correct stage of the process to preserve their native value and avoid wastage of processing resources.

STATE OF THE ART

CURRENT STATE OF COLLABORATIONS

In the first argument talked in the focus group, participants were asked to answer the question through a Mentimeter reported in Figure 3:

Do you have any industrial **symbiosis practices** in your context? Which ones?



Taken together, these comments indicate that most of the participants already identify existing industrial symbiosis practices. The findings highlight two central themes: (1) the close symbiosis linking the alligator and tannery industries, and (2) the integrated relationship between the leather industry and the broader food sector, having regard that leather-making is already a symbiotic relation with the meat sector:

Alligator farming industry and tannery

- There is an active collaboration between the alligator farming industry and the alligator tanneries. They work closely with the watch bracelet manufacturers and the leather goods manufacturers.

Leather industry and food sector

- Bovine hair can be repurposed as a soil conditioner or slow-release fertilizer; flashings and hydrolyzed materials can also be used as fertilizers.
- Some hide splits are sent to the gelatin or collagen industries for human food or cosmetics, while trimmings are used in pet food production.
- Breeders and tanneries used to have closer relationships regarding hide quality with public-funded vaccination campaigns in the context of the eradication of diseases and related hide/skin defects, and tanneries worked closely with abattoirs on slaughter, flaying and hide removal practices.

Today, especially in the UK, the sector is fragmented: many small abattoirs lack structured hide-collection systems, leading to many hides not entering the market.

SLAUGHTERHOUSES -TANNERIES COOPERATION OBSTACLES

Another topic discussed during the session was 'Slaughterhouses and Tanneries cooperation'. A key theme that emerged concerned the obstacles hindering the improvement of industrial symbiosis, as well as the barriers preventing more structured forms of cooperation.

In summary

- If leather is described as a waste or a byproduct, that limits how much effort it can reasonably put into improving it, and it also affects how we can communicate its potential benefits or improvements to others.
- Communication should promote hide quality improvement as farmers won't produce "perfect" hides or drastically modify animal management.
- Strengthened collaboration between tanneries and food producers is needed to ensure hides are efficiently utilized globally, minimizing waste and maximizing value: hides should be increasingly recognised as a valuable resource.
- The supply of hides is entirely **supply-driven**; the leather industry cannot influence upstream production, and demand does not drive supply: leather depends on the business model of the meat value chain, making cooperation essential to add value to an otherwise low-value by-product.
- Market dynamics, especially price, dominate the sector; falling demand for leather has reduced raw material prices and weakened bargaining power.

As far as the barriers are concerned, two main limitations have been addressed, regulatory and logistical barriers. Below the issues of the discussion

Regulatory barriers

- It's essential that the government and the public authorities at EU level take its role seriously in promoting the circular economy and provide funding and incentives.
- The leather industry should collaborate with slaughterhouses, the agri-food sector, and EU authorities to set clear waste-reduction goals and improve hide quality, aiming to reduce the current estimated wastage of hides from 40% to zero at global level. Low-quality hides should be redirected to other growing sectors (such as the gelatine or protein hydrolysate sectors).

However, for being taken up by these other sectors they need to go through a beamhouse process which will bring them to a “clean” stage that allows their further processing.

Logistical barriers

- As slaughtering shifts from large facilities to smaller local slaughter points, collection becomes more complex, transportation costs rise, and achieving sufficient volumes for efficient processing becomes harder. These logistical constraints help explain why, in many developing countries, the agri-food and leather sectors are not well economically integrated.

BENEFITS AND CHALLENGES

The discussion moved then to the benefits and challenges of Industrial Symbiosis. There was a general consensus that consistent allocation rules in LCA are needed and that the leather sector depends on the much larger meat sector. Here are the key highlights of the discussion:

- In LCA,, under attributional approaches, waste-derived materials receive zero allocation, carrying no environmental burden into their next use, Currently hides/skins may inherit part of the previous life cycle’s footprint. Unclear or inconsistent allocation creates major problems, the meat and the leather sectors must define a clear, agreed-upon allocation percentage when allocation is used, while applying zero allocation wherever possible.
- The meat sector remains far larger than the leather goods sector, and its engagement with livestock suppliers especially in regenerative systems, is vital for hides supply and traceability. In the UK, limited tanning capacity, abattoir consolidation, and reduced local slaughter options affect animal welfare (because the animals have to move large distances for slaughter, since large areas where people want to have local slaughter are being pushed out of business and have all either already closed), local production, and hide availability. Hide quality varies within each hide. There are leather value chains requiring blemish-free whole hides (Car or furniture upholstery), while other downstream sectors (footwear, leathergoods,...) can work around the defects. Efficiency improves with reduced cutting waste, as only the highest-quality sections are used for final products. It is also important to avoid unnecessary processing of low-value areas and supporting a more sustainable, selective utilisation model.

INNOVATIONS AND FUTURE OPPORTUNITIES

The last topic debated was ‘Innovations and future opportunities’. Starting from a Mentimeter, (in Figure 4) most answers were related to new chemistries, better waste management, biogas, traceability and compost. A few participants expressed concerns about nature-based marketing,

particularly the clear communication of leather's biogenic origin. Below are the main points of the discussion.

What **emerging technologies** or innovative models could enable new forms of industrial symbiosis in your sector? (e.g bio-based materials etc..)

geometrization - kind I
 new chemistries biogenic materials
 better waste management
 traceability biogas compost
 nature based marketing

- Leather's origin as a biogenic material must be communicated accurately, especially as chemical processing complicates the use of terms like "natural" under forthcoming rules such as the Green Claims Directive. Clearer terminology, and innovation toward more biophilic products will help distinguish leather from emerging biomaterials. At the same time, the sector must address cutting and processing waste through collaboration with agri-food and waste-management partners, developing solutions that support circularity and preparing for upcoming cascading extended producer-responsibility requirements.
- Speaking about hides' quality, since each hide contains both high- and low-quality areas, a suggestion concerned separating out the low-quality sections and directing them into industrial symbiosis pathways, such as agri-food use, instead of tanning a material that will never be used. Only the highest-quality sections would go into final leather products. This would maximise material efficiency, reduce unnecessary processing, and create clear routes for the different parts of the hide.

4. Schematic synthesis of key insights

4.1 Focus group 1

1. Valorisation of by- products is essential to promote Industrial Symbiosis
2. Stronger cooperation between slaughterhouses and tanneries enables the growth of economic, environmental and circular value
3. Industrial symbiosis is the main lever for future sustainability
4. Upstream coordination improves overall yields and reduces chemicals
5. Policy alignment is critical to unlock innovation
6. Narrative change is a strategic necessity
7. Skills and incentives determine scalability

4.2 Focus group 2

1. Leather is a long-lived, sustainable resource and by-product
2. Fragmented but essential collaboration across the value chain
3. Supply-driven nature of hide quality and availability
4. Regulatory, logistical and market barriers limit efficient symbiosis valorization
5. Critical role of LCA allocation in environmental accounting
6. Communication challenges and public misperception of leather
7. Innovation opportunities in biogenic pathways and circularity
8. Cross-sector symbiosis as a strategic priority

5. Conclusions

The focus groups confirm that **industrial symbiosis is structurally embedded in the leather sector**, as leather originates as a by-product of the meat and dairy industries. The sector already relies on complex interconnections with agri-food, slaughterhouses, tanneries, and downstream industries. However, despite the maturity of many valorisation technologies, the **full potential of**

industrial symbiosis remains unrealised due to economic, regulatory, logistical, and narrative barriers.

A central finding is that **upstream coordination—particularly between slaughterhouses and tanneries—represents the most critical leverage point** for improving circularity and material efficiency. Early-stage practices such as hide removal, trimming, and classification directly determine leather quality, usable yields, and downstream valorisation options. Stronger cooperation at this stage increases Blößenrendement- clean usable hide yield -, improves by-product quality, reduces chemical use, and ensures that different parts of the hide are directed to their highest-value applications.

Economic misalignment remains a major constraint. While many symbiotic solutions are technically feasible, **market prices often fail to reward higher-quality hides, upstream pre-processing, or refined valorisation pathways**. As leather supply is entirely supply-driven and dependent on meat and/or milk production, the sector's limited bargaining power reinforces the need for cooperation across value chains rather than isolated optimisation.

Participants consistently highlighted **regulatory and logistical obstacles** as key inhibitors of industrial symbiosis. Complex waste classifications, limited cross-border mobility of secondary raw materials, and regulatory asymmetries between natural and synthetic materials weaken incentives for circular practices. At the same time, increasing fragmentation of slaughtering activities and growing distances between slaughterhouses and tanneries raise logistical costs and limit access to sufficient volumes, particularly for SMEs.

The focus groups also underline the importance of **skills, data, and governance**. The loss of upstream expertise in hide handling negatively affects material quality, while insufficient data sharing limits accurate assessment of waste, yields, and environmental impacts. Clear, fair, agreed and consistent **Life Cycle Assessment (LCA) allocation rules** are essential to ensure credible environmental accounting and avoid misrepresentation of leather's by-product status.

Finally, a **strategic narrative shift** is required. Leather is frequently perceived as unethical rather than as a long-lived, biogenic, and circular material. Correcting this misperception—through transparent communication, aligned policy frameworks, and evidence-based environmental data—is essential to unlock innovation, restore market value, and enable fair regulatory treatment.

Overall, the findings show that **industrial symbiosis must evolve from fragmented practices to a coordinated system**, supported by aligned incentives, enabling regulation, shared metrics, workforce training, and cross-sector collaboration. Under these conditions, industrial symbiosis can become a scalable and replicable pathway for sustainability, resilience, and circular value creation in the leather sector.

6. Annex

The present annex shows the list of participants to the two focus groups .

ASSOCIATION	DATE OF FOCUS GROUP
Authenticae (UK)	2° Focus Group, Nov 26
CTC Ars Tinctoria srl (IT)	2° Focus Group, Nov 26
Leather expert (UK)	2° Focus Group, Nov 26
ResoCuir (FR)	2° Focus Group, Nov 26
Vitelco (NL)	1° Focus Group, Nov 17
LHCA (USA)	1° Focus Group, Nov 17
ITECH (FR)	1° Focus Group, Nov 17
International Meat Secretariat	1° Focus Group, Nov 17
VDL (DE) - 2 participants	1° Focus Group, Nov 17
Independent/Beef&Lamb Australia	2° Focus Group, Nov 26
CTIC (PT)	2° Focus Group, Nov 26