



EU SYMBIOS PROJECT

Project no. 2024-1-PT01-KA220-VET-000253813

SPIN 360 – TASK WP 2.5

Needs Analysis Report

Leather Sector – Surveys & Interviews

June, 2026

Prepared by: SPIN360 srl

Table of Contents

Table of Contents.....	2
1. Introduction: Objectives and Scope of the Needs Analysis.....	3
2. Methodology.....	4
2.1 Overall Approach.....	4
2.2 Survey Design and Administration.....	4
2.3 Interview Design and Administration.....	4
2.4 Rationale for Methodological Choices.....	5
3. Survey and Interviews Analysis.....	6
3.1 Company Profiles and Geographies.....	6
3.2 Waste Management and Monitoring.....	12
3.3 Industrial Symbiosis Partnerships.....	13
3.4 Occupational Safety and Health (OSH) Constraints.....	18
3.5 Regulatory Barriers.....	19
3.6 Skills and Training.....	21
3.7 Interview Findings.....	24
3.7.1 Waste Streams and By-Product Characteristics.....	25
3.7.2 Internal Circular Practices.....	25
3.7.3 External Pressures.....	25
3.7.4 Competence Levels.....	26
4.1 Company Profiles and Geographic Concentration.....	27
4.2 Waste Monitoring: Strength to Build Upon.....	27
4.3 Industrial Symbiosis Partnerships: Informal Strength, Formal Gap.....	27
4.4 Regulatory Barriers: The Dominant Structural Constraint.....	28
4.5 Skills Gaps: A Dual Technical-Regulatory Deficit.....	28
4.6 External Pressures: An Accelerating Trend.....	29
4.7 Key Strategic Priorities.....	29
5. Conclusions.....	31
6. Annexes.....	33
7. Literature Review.....	33

1. Introduction: Objectives and Scope of the Needs Analysis

This report presents the findings of the surveys and interviews conducted in the leather sector. The aim was to identify the current state of circular economy and industrial symbiosis (IS) practices, barriers, competence gaps, and enabling conditions within the industry.

The primary objectives of this needs analysis are:

- To map **existing waste streams and by-product flows** within leather tanneries and related stakeholders;
- To identify **technical, regulatory, and economic barriers** to the adoption of circular economy and industrial symbiosis practices;
- To **assess the skills and competences** available and lacking within companies and academic/scientific communities;
- To **understand external pressures** and enabling conditions that could accelerate the transition towards industrial symbiosis;
- To gather **examples of good practices** in industrial symbiosis already in place within the sector.

The scope of the analysis covers the leather sector across multiple European and international geographies, with particular focus on tanneries, leather companies, academics, and scientific experts. Data was collected through structured **surveys (30 out of 30 completed)** and **in-depth interviews (9 out of 9 conducted)**.

The findings will inform the design of training tools, competence frameworks, and policy recommendations developed in subsequent project phases, contributing to the SYMBIOS project's overarching goal of fostering industrial symbiosis networks in the leather and related sectors.

2. Methodology

2.1 Overall Approach

The needs analysis was conducted using a mixed-methods approach, combining quantitative data collection via structured **surveys** with qualitative insights gathered through semi-structured **interviews**. This dual approach ensures both breadth of coverage across stakeholder groups and depth of understanding of the specific challenges and opportunities facing the leather sector.

2.2 Survey Design and Administration

A structured online survey was developed and distributed to leather sector stakeholders across Europe and beyond. The survey was organised into five thematic sections aligned with the key research objectives:

- Production processes of the company
- Waste management and circular practices
- Industrial symbiosis practices
- Barriers to industrial symbiosis
- Skills and training needs

A total of 30 surveys were completed, representing a range of company sizes (micro, small, medium, large, big, and average), geographies (Italy, Portugal, Germany, France, Spain, Brazil, Argentina, Uruguay, Vietnam, the Netherlands, Turkey, and the USA), and roles within the value chain (leather companies, tanneries, academics, and scientific experts).

2.3 Interview Design and Administration



Nine semi-structured interviews were conducted with key stakeholders, including representatives from leather companies, tanneries, academic institutions, and scientific experts. The interviews explored the following main topics:

- Examples of industrial symbiosis in the company
- Waste streams produced and their critical aspects
- Main contextual barriers (regulatory, economic, external pressure, etc.)
- Lack of skills and competences
- Key enabling conditions for scaling industrial symbiosis

Interviews were conducted in person or via video call, recorded with consent, and subsequently analysed through thematic coding to identify recurring patterns and key insights.

2.4 Rationale for Methodological Choices

The combination of surveys and interviews was chosen to ensure triangulation of data: the surveys provide quantifiable trends across a larger sample, while the interviews offer contextual depth and nuanced understanding that purely quantitative tools cannot capture. The thematic structure of both instruments was designed to be consistent, enabling direct comparison between survey results and interview insights in the analysis phase.

The selection of stakeholders encompassed both supply-chain actors (tanneries, leather companies) and knowledge actors (academics, scientific experts) to ensure that findings reflect both practical operational realities and broader theoretical and regulatory contexts.

3. Survey and Interviews Analysis

This chapter presents the statistical and qualitative analysis of data collected through the 30 surveys and 9 interviews conducted with leather sector stakeholders. Results are organised by thematic section, reflecting the structure of the data collection instruments.

3.1 Company Profiles and Geographies

The survey respondents represent a diverse cross-section of the global leather sector. Table 1 below summarises the distribution of respondents by country and company size.

Country	Average	Big	Large	Medium	Micro	Small	Total
Argentina	1						1
Brazil						1	1
France				1		1	2
Germany			1	1		1	3
Italy	4		1	1	1	2	9
Portugal	5	1	1		3	6	13
Spain						1	1
Netherlands			1				1
Turkey			1				1
USA			1				1
Uruguay			1				1
Vietnam			1				1

Worldwide			1				1
TOTAL	5	1	7	5	3	9	30

Table 1: Distribution of survey respondents by country and company size

Portugal (13 respondents, 43%) and Italy (9 respondents, 30%) together account for nearly three-quarters of the sample, reflecting the concentration of European tannery activity in these countries. The sample includes a wide range of company sizes, with small companies (n=9) and average-sized firms (n=5) being most represented among the European contingent.

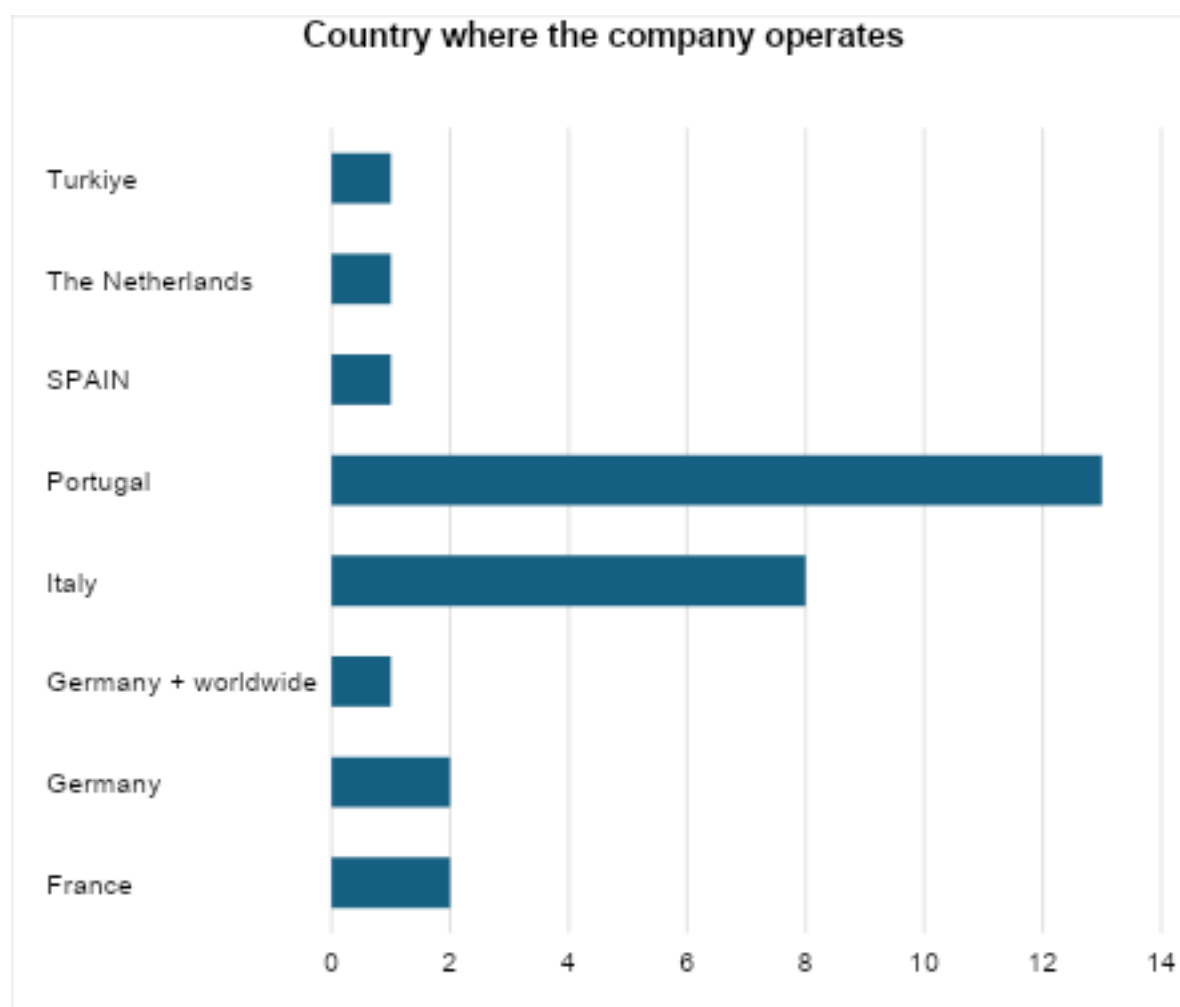


Figure 1



Respondents were asked to identify which **production processes** are currently carried out in their leather-related operations. Dyeing and finishing is the most commonly reported activity (29%), followed by tanning (21%). Beamhouse operations and cutting and manufacturing each account for 9%, while raw hide preservation and preparation represents 4%. The remaining share is distributed across chemical treatment processes, waste management, thermobaric and enzymatic hydrolysis, full-process operations from salted or fresh hide to finished product, and Ribeira processing.

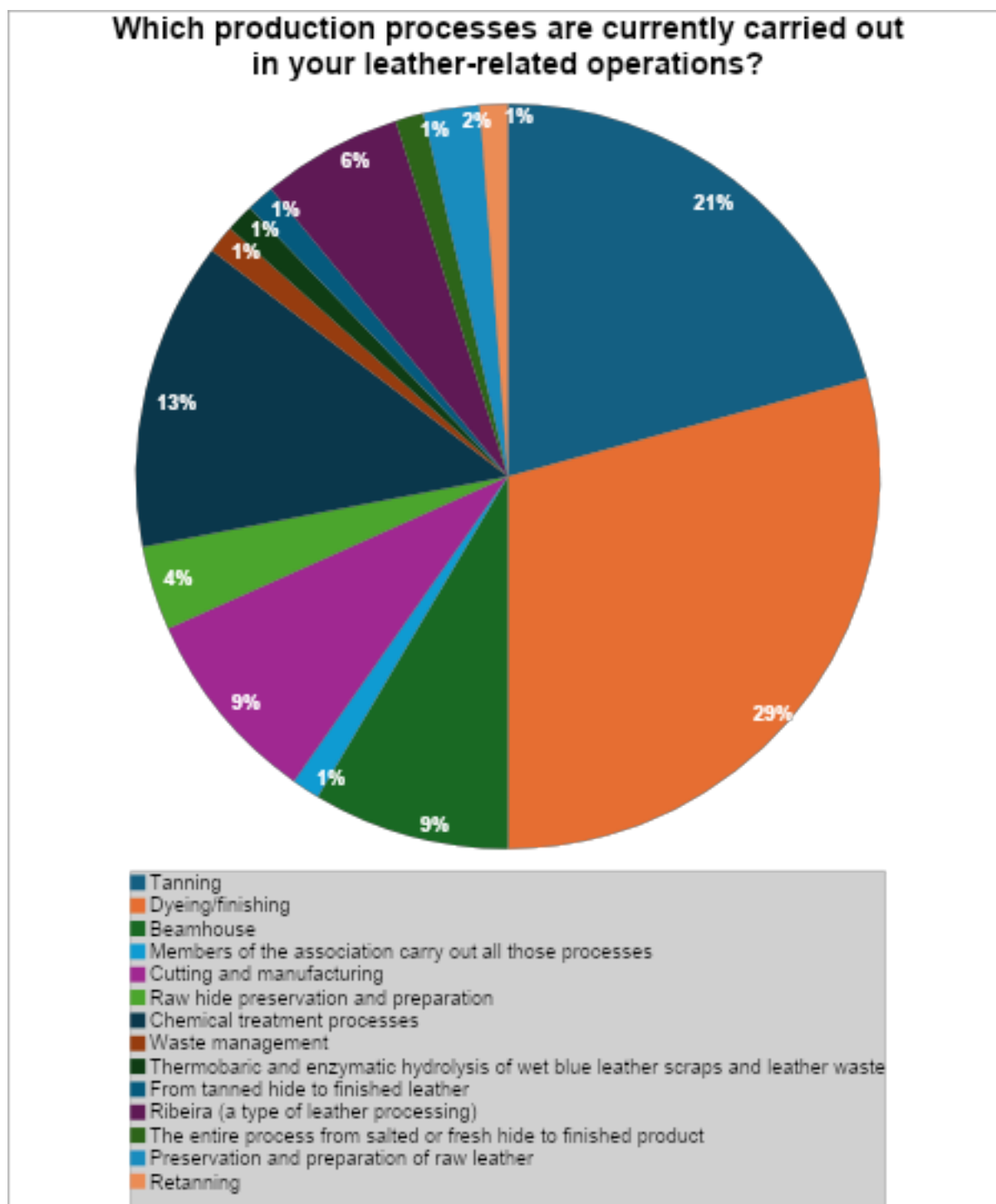
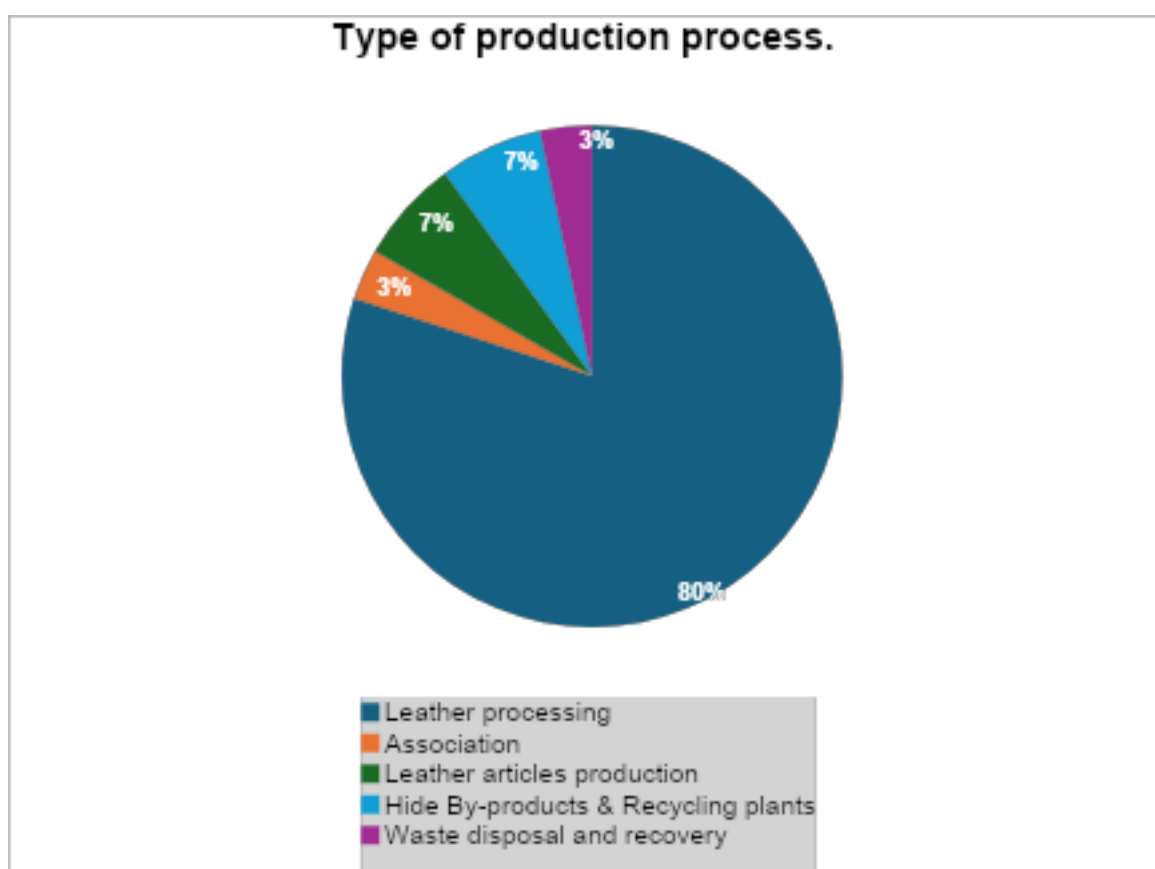


Figure 2

Regarding the type of **production activity** within the ecosystem, the large majority of respondents (77%) are engaged in leather processing, while 18% are involved in leather articles production. The remaining respondents represent associations, hide by-products and recycling plants, and waste disposal and recovery operations (approximately 1–4% each).



In terms of **market orientation**, the majority of respondents serve EU/EEA markets (42%), followed by national markets (32%) and the rest of the world (20%). Local and regional markets are marginal, accounting for 3% each. This indicates that the sector operates predominantly within a European and global commercial context, with limited local market focus.

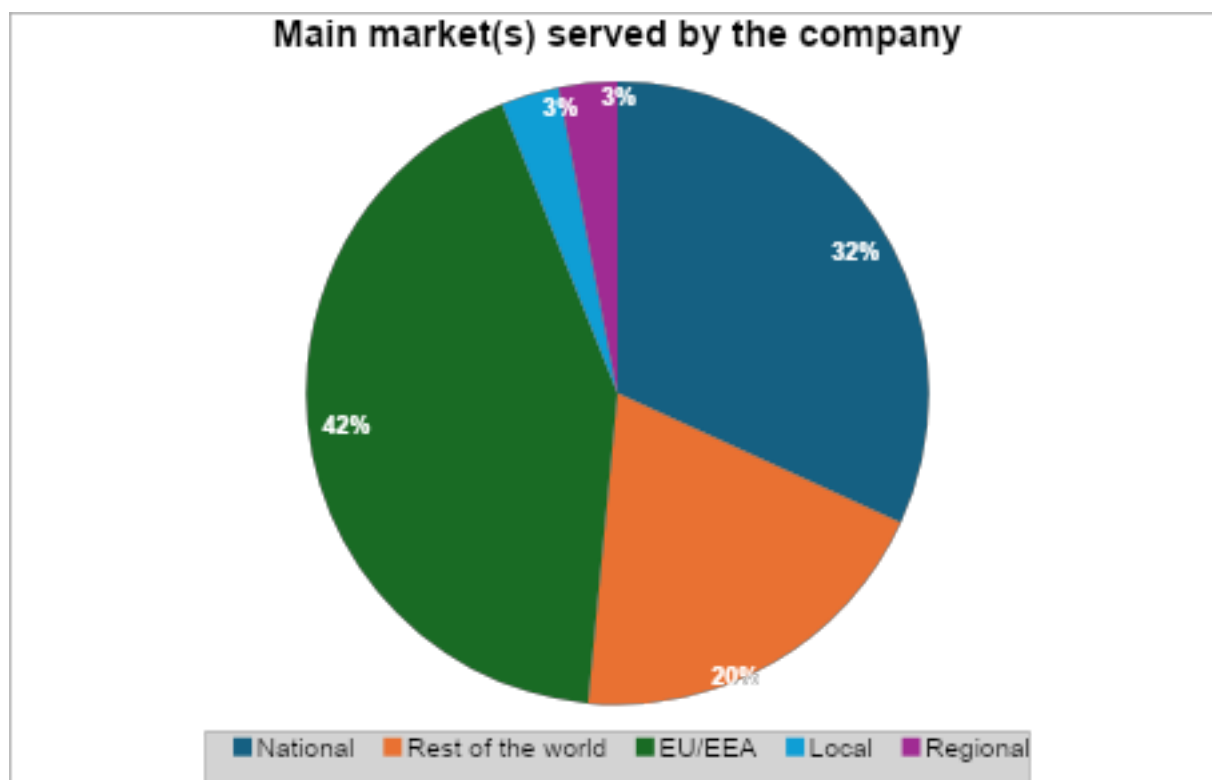
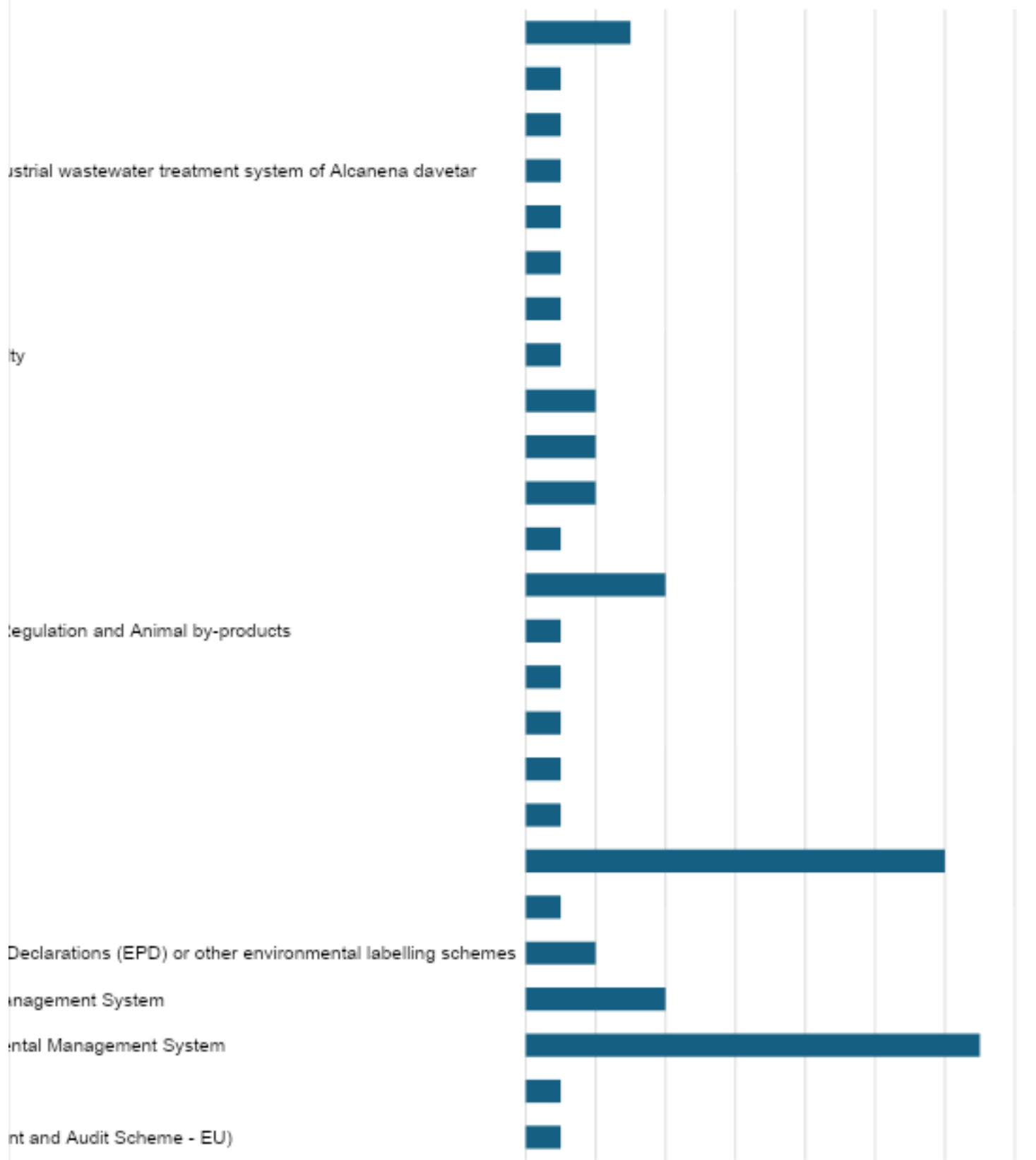


Figure 4

Respondents were also asked to indicate which **standards, management systems, or environmental schemes are implemented in their companies**. ISO 14001 (Environmental Management System) is the most widely adopted standard (22%), followed by the absence of any standard (None, 20%). ISO 50001 (Energy Management System) accounts for 7%, as does LWG (Leather Working Group). Further certifications reported include EPD and other environmental labelling schemes (5%), B-Corp, Higg FSLM, Higg SLCP, Dermatest, USDA BioPreferred, SA 8000, ISO 45001, UNIC social accountability, REACH compliance, LWG Gold, and others, each representing between 2% and 3% of responses. This diversity of certification schemes reflects the heterogeneous regulatory and market demands facing sector actors across different geographies and supply chain positions.

Which of the following standards, management or environmental schemes are implemented in your company?



3.2 Waste Management and Monitoring

Respondents were asked to describe their **level of internal monitoring of waste and by-product** flows. Results indicate a relatively high level of monitoring sophistication within the sample:

Monitoring Level	Number of Respondents
Advanced (quantitative, systematic monitoring)	20
Basic (qualitative or partial data)	8
Digitally supported monitoring systems	2
TOTAL	30

Table 2: Level of internal monitoring of waste and by-product flows

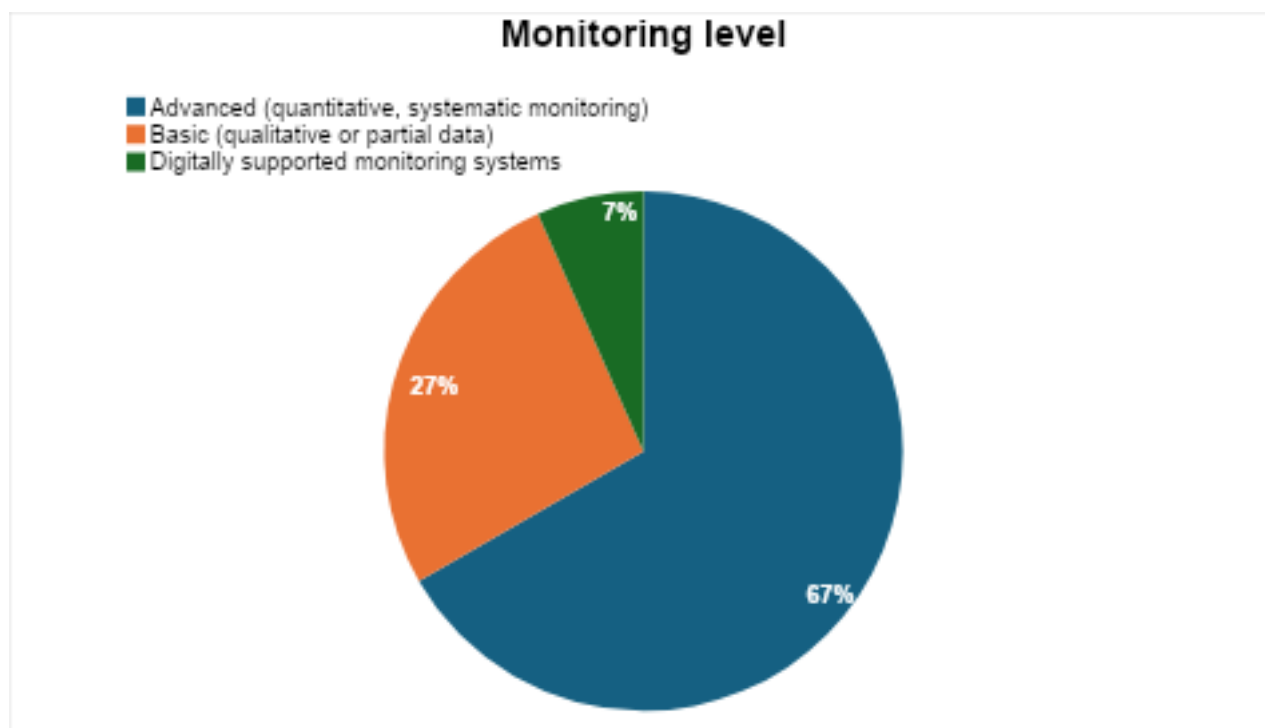


Figure 6

Two-thirds of respondents (20 out of 30) report advanced, quantitative monitoring of waste and by-product flows, suggesting that data availability is not a primary barrier. Only 8 companies rely on basic or partial data, while 2 have implemented digitally supported systems.

Respondents were also asked to identify the **main types of by-products** generated in their operations. Leather scraps and trimmings are the most frequently reported by-product (25%), followed by chemical residues and sludge (19%), wastewater and treatment sludge (13%), and packaging waste (16%). Fleshings account for 7%, while hair residues represent 9%. The remaining share is distributed across mixed streams, carcasses, and sewage and treatment sludge (approximately 2–8% each). This distribution confirms that solid leather waste and water-intensive process residues dominate the by-product profile of the sector, and that by-product diversity is high, requiring differentiated valorisation strategies.



3.3 Industrial Symbiosis Partnerships

The survey investigated the existence and nature of **partnerships for by-product valorisation**. Results reveal a mixed landscape of formalised and informal arrangements:

Partnership Type	Count
Formal agreements with selected partners	11
Informal or occasional partnership	9
No partnership	9
Stable and long-term symbiotic partnership	10
TOTAL (multiple answers allowed)	39

Table 3: Partnerships for by-product valorisation

Notably, 21 out of 30 respondents (70%) have some form of partnership for by-product valorisation, with 10 reporting stable, long-term symbiotic arrangements. This indicates that industrial symbiosis is already occurring in practice, albeit often informally. Nine companies (30%) report no partnerships at all.

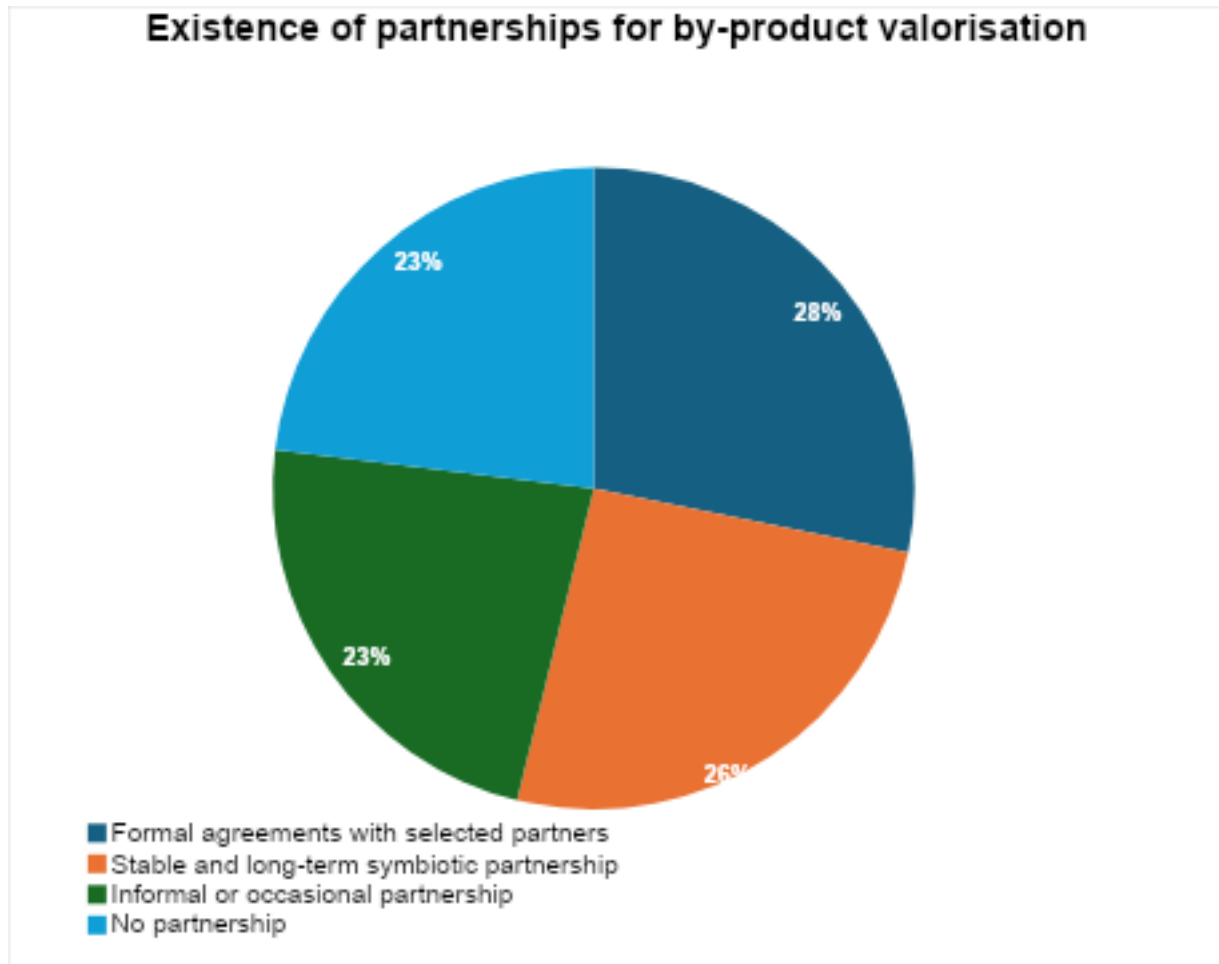


Figure 8

Respondents were further asked whether their **company implements internal Industrial Symbiosis practices between departments or production units**. The largest share (26%) answered No, indicating that internal symbiosis is not yet the norm. Among those with internal practices, the reuse of water or wastewater between departments is the most common form (21%), followed by integrated management of multiple resource flows (energy, materials, water) at 14%, and reuse of materials or by-products between departments (12%). The reuse of energy or heat between departments accounts for 9%. Smaller shares report valorisation of waste by transforming it into a by-product in partnership with another company, manufacture of bio-based chemicals from by-products, by-products as raw materials for the agricultural sector, condensation water recovery, and chromium reuse (each



between 2% and 4%). These results suggest that while external partnerships are relatively widespread, the internalisation of circular flows within individual companies remains limited and unevenly distributed.

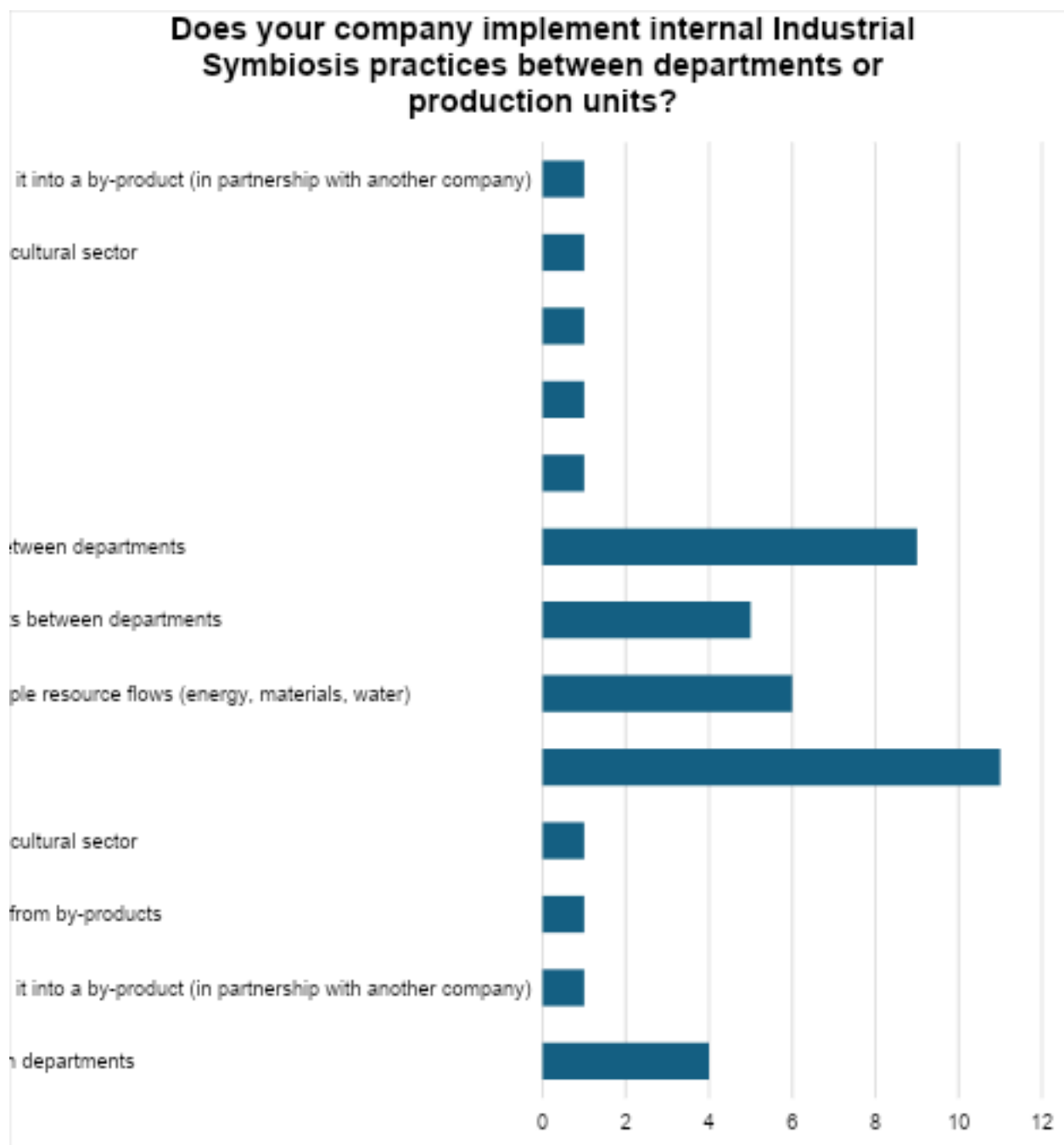


Figure 9

Regarding the current **destination of by-products produced**, recycling is the most reported pathway (25%), followed by disposal (18%), external industrial symbiosis (12%), and energy



recovery (9%). Internal reuse and internal symbiosis accounts for 13%, while soil applications and composting (vegetable shavings, hair, uncontaminated carcasses) represent 8%. Smaller shares correspond to elimination, donation of tanned leather shavings to vocational schools, land application and composting of vegetable-tanned trimmings, bio-fertiliser production for organic agriculture, and energy recovery from finished leathers (each between 1% and 4%). This distribution highlights that while recycling is the primary declared destination, a significant share of by-products still ends in disposal, underscoring the untapped potential for valorisation and the need for enabling frameworks.

Current destination of the by-products produced

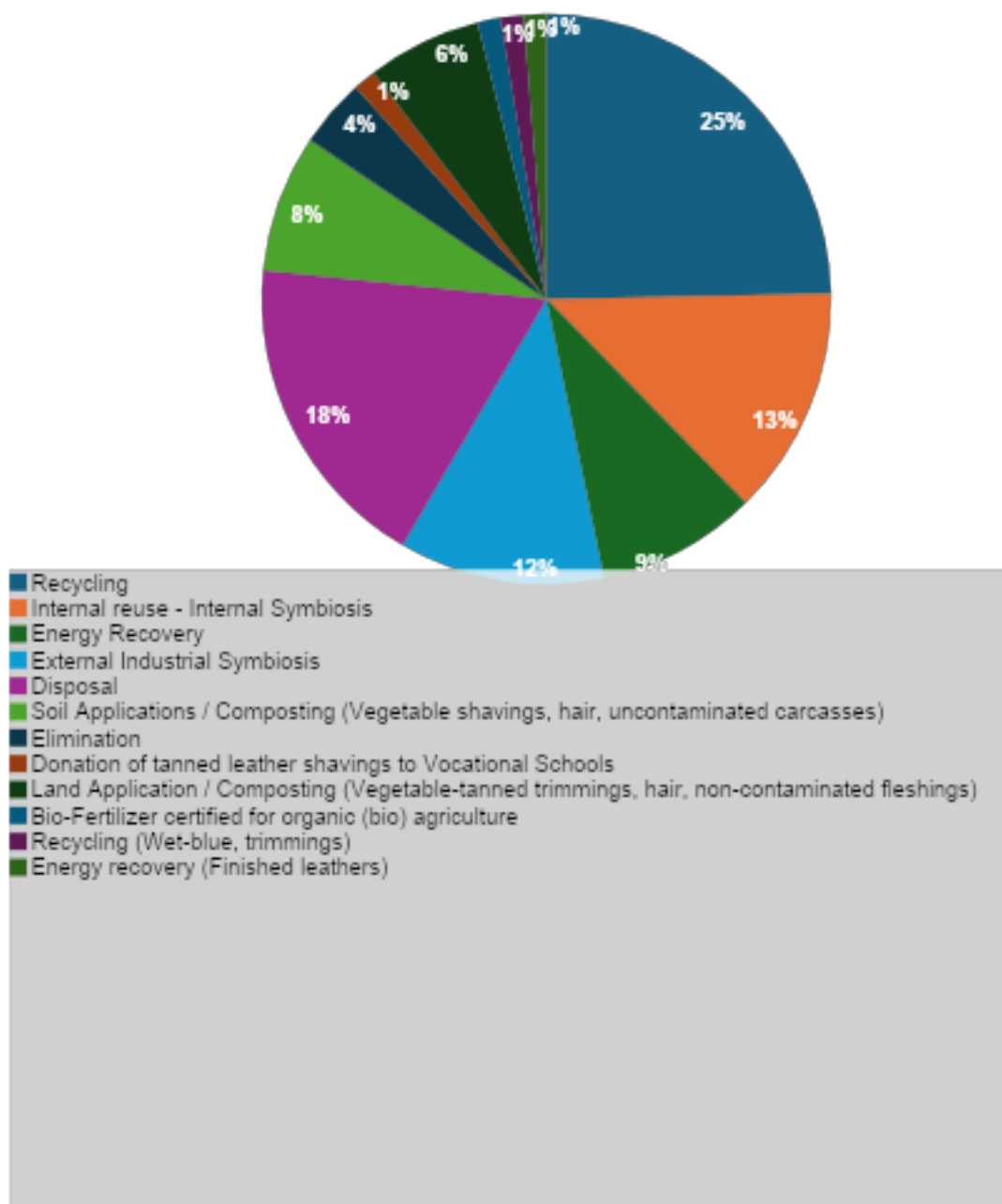


Figure 10

3.4 Occupational Safety and Health (OSH) Constraints

Respondents were asked to what extent **OSH requirements** limit by-product reuse or exchange. Responses vary significantly by country:

OSH Impact Level	Count
Not applicable (no hazardous by-products)	7
Not at all	6
Slightly	9
Moderately	5
Significantly	3
TOTAL	30

Table 4: Extent to which OSH requirements limit by-product reuse or exchange

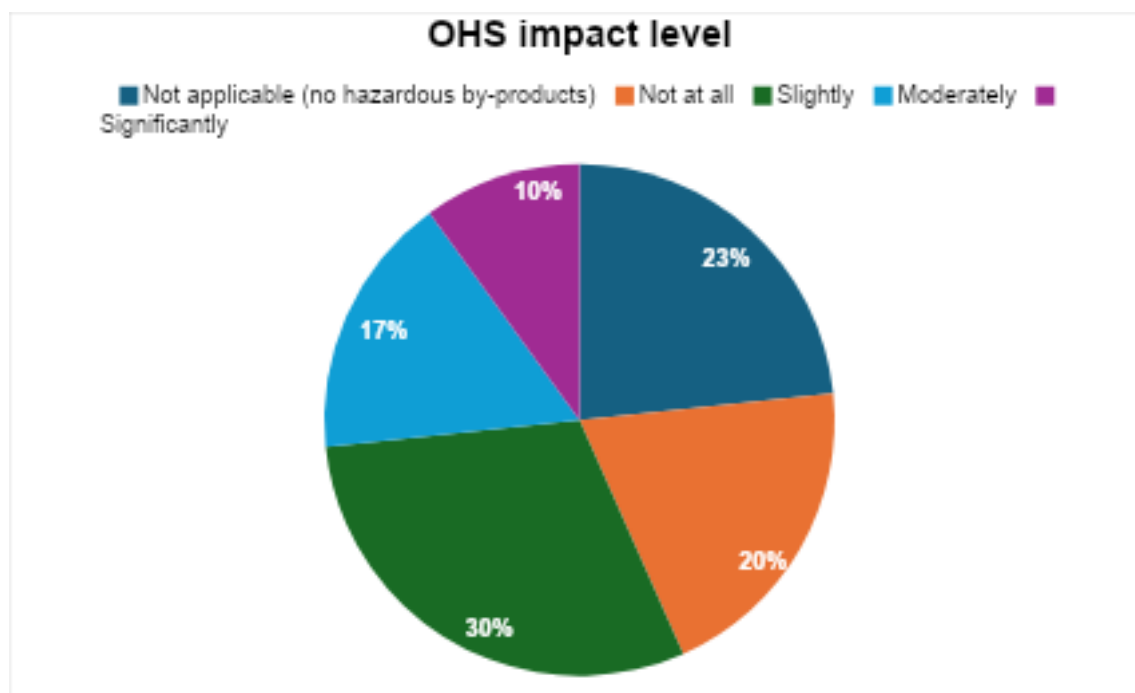


Figure 11

For most respondents, OSH requirements do not represent a significant barrier. However, 8 companies report moderate to significant constraints, indicating that hazardous by-product management remains a concern for a meaningful minority of the sector.

3.5 Regulatory Barriers

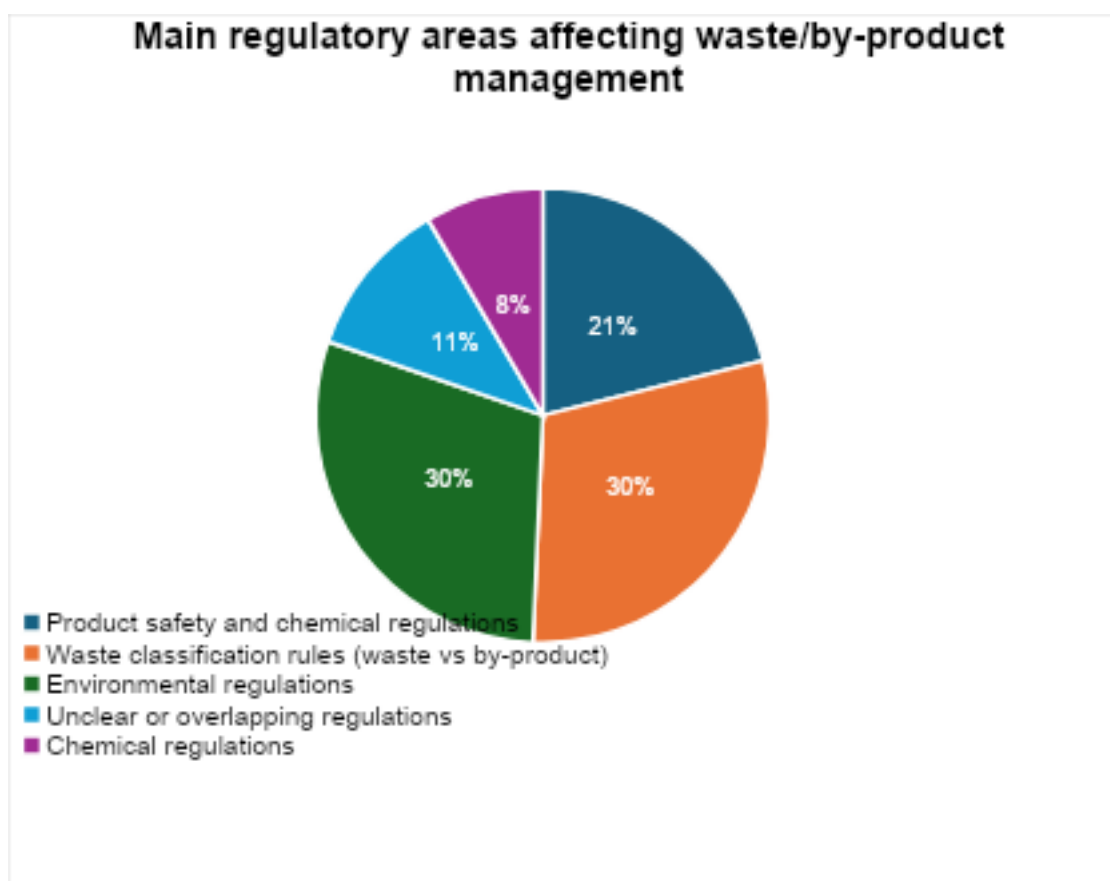
3.5.1 Main Regulatory Areas

The survey identified the regulatory areas most affecting waste and by-product management:

Regulatory Area	Count
Environmental regulations	14
Safety and chemical regulations (REACH etc.)	11

Product safety and chemical regulations	6
Waste classification rules (waste vs by-product)	5
Unclear or overlapping regulations	1
TOTAL (multiple answers allowed)	31

Table 5: Main regulatory areas affecting waste/by-product management



3.5.2 Types of Regulatory Barriers

Beyond the regulatory areas, respondents **identified specific types of regulatory barriers encountered:**

Regulatory Barrier Type	Count
Administrative burden (permits, authorisations)	18
Compliance costs	11
Legal uncertainty or lack of clarity	11
Issues of liability and obligation	7
No significant regulatory barriers	6
TOTAL (multiple answers allowed)	53

Table 6: Main types of regulatory barriers encountered

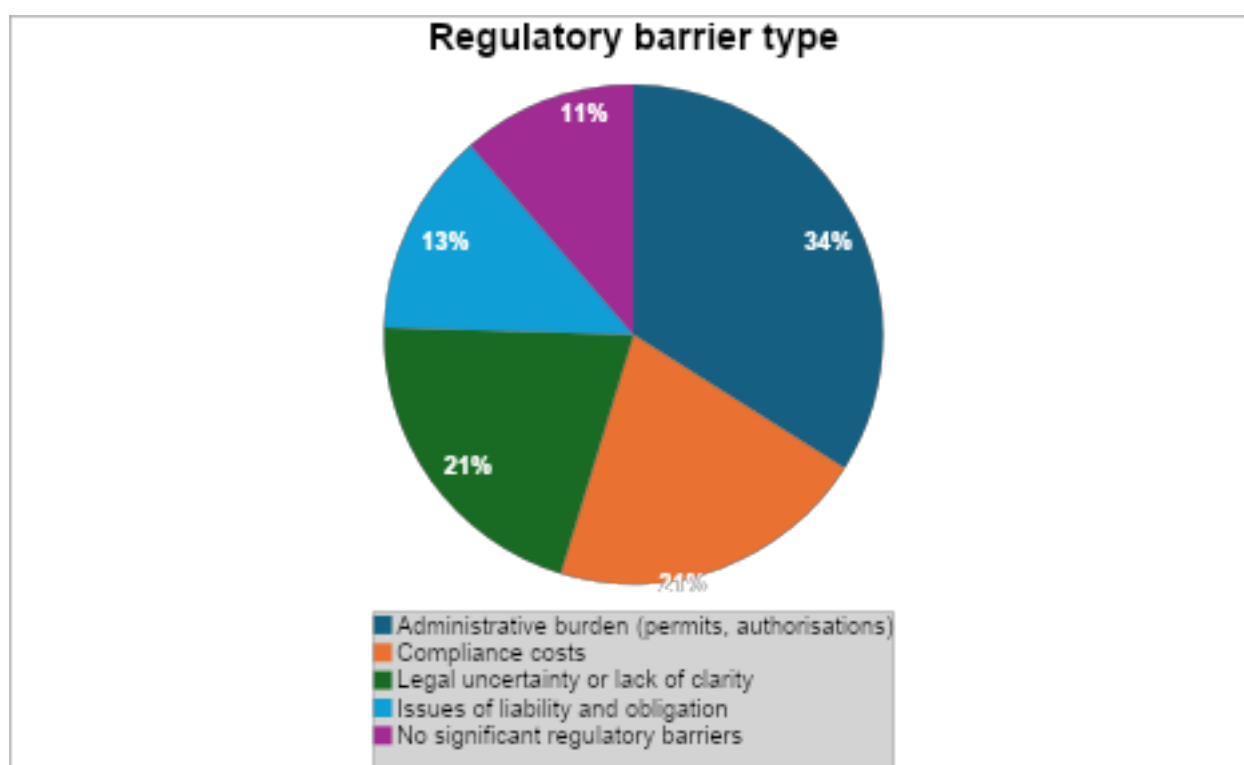


Figure 13

Administrative burden is the most frequently cited barrier (18 responses), followed by compliance costs and legal uncertainty (11 each). These findings are consistent with

interview insights highlighting the misalignment between EU-level regulation and national implementation.

3.6 Skills and Training

3.6.1 Skills Gaps

Respondents were asked to identify the **main skills gaps limiting the implementation of circular or symbiotic practices**:

Skills Gap Category	Count
Technical skills (processes, materials, energy)	15
Regulatory and compliance skills	14
Strategic and managerial skills	5
Digital and management skills	3
Awareness or internal coordination skills	4
Competencies in regulation and compliance	2
Difficulties in traceability	1
Time	1
No significant skills gaps identified	7
TOTAL (multiple answers allowed)	52

Table 7: Main skills gaps limiting circular/symbiotic practice implementation

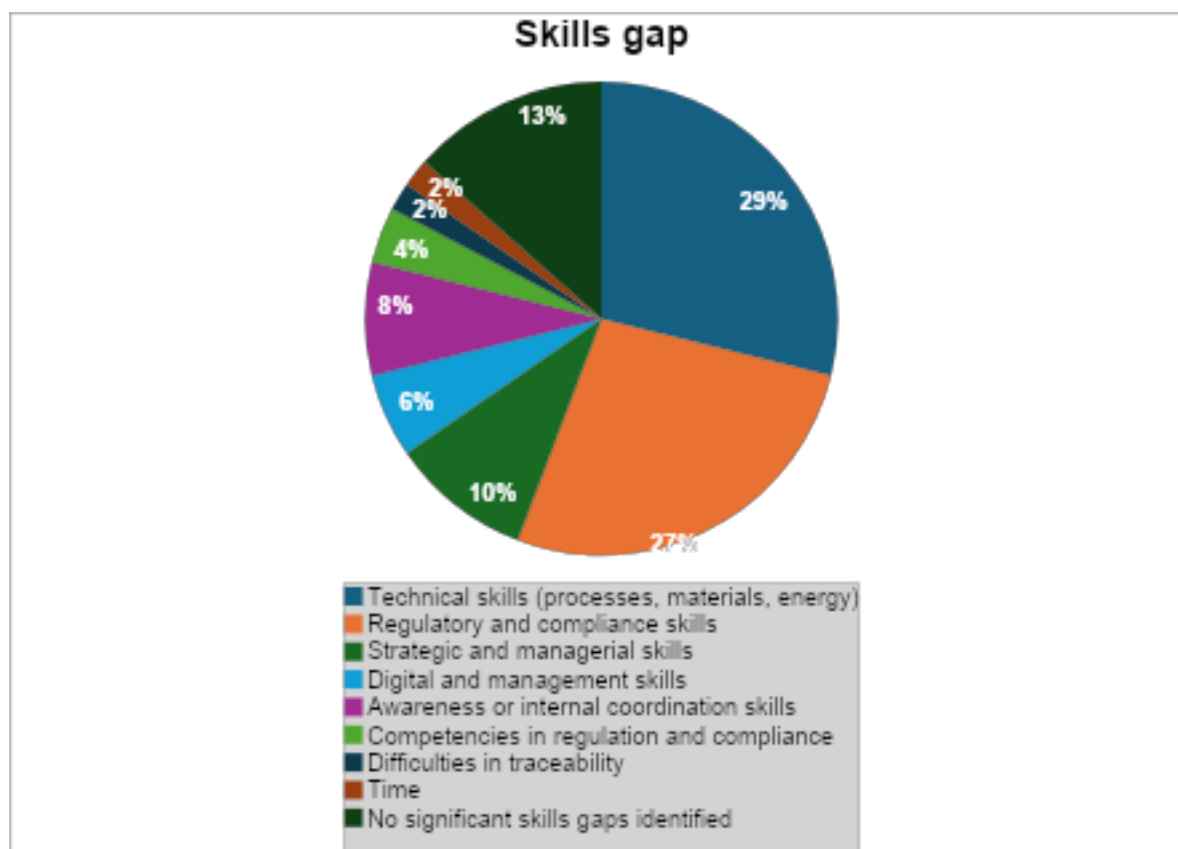


Figure 14

Technical skills (15) and regulatory/compliance competences (14) are the most significant gaps. This dual need — for both practical know-how and regulatory literacy — reflects the complexity of implementing industrial symbiosis within a heavily regulated sector.

3.6.2 Training Investment

Training Status	Small	Average	Medium	Large	Big	Micro	Total
No training	3	2	3	1			9
No specific training	1		1				2
Yes, occasional/ad hoc	3	4	1	1			9

Yes, occasional/specific formations	1	1	1			3	6
Yes, regular and structured	1	2		1			4
TOTAL	9	5	5	7	1	3	30

Table 8: Companies investing in training on Circular Economy and/or Industrial Symbiosis

Only 4 companies (13%) invest in regular, structured training **on circular economy and industrial symbiosis**. The majority either offer occasional or ad hoc training (15 companies) or provide no training at all (11 companies). This represents a significant opportunity for structured capacity building.

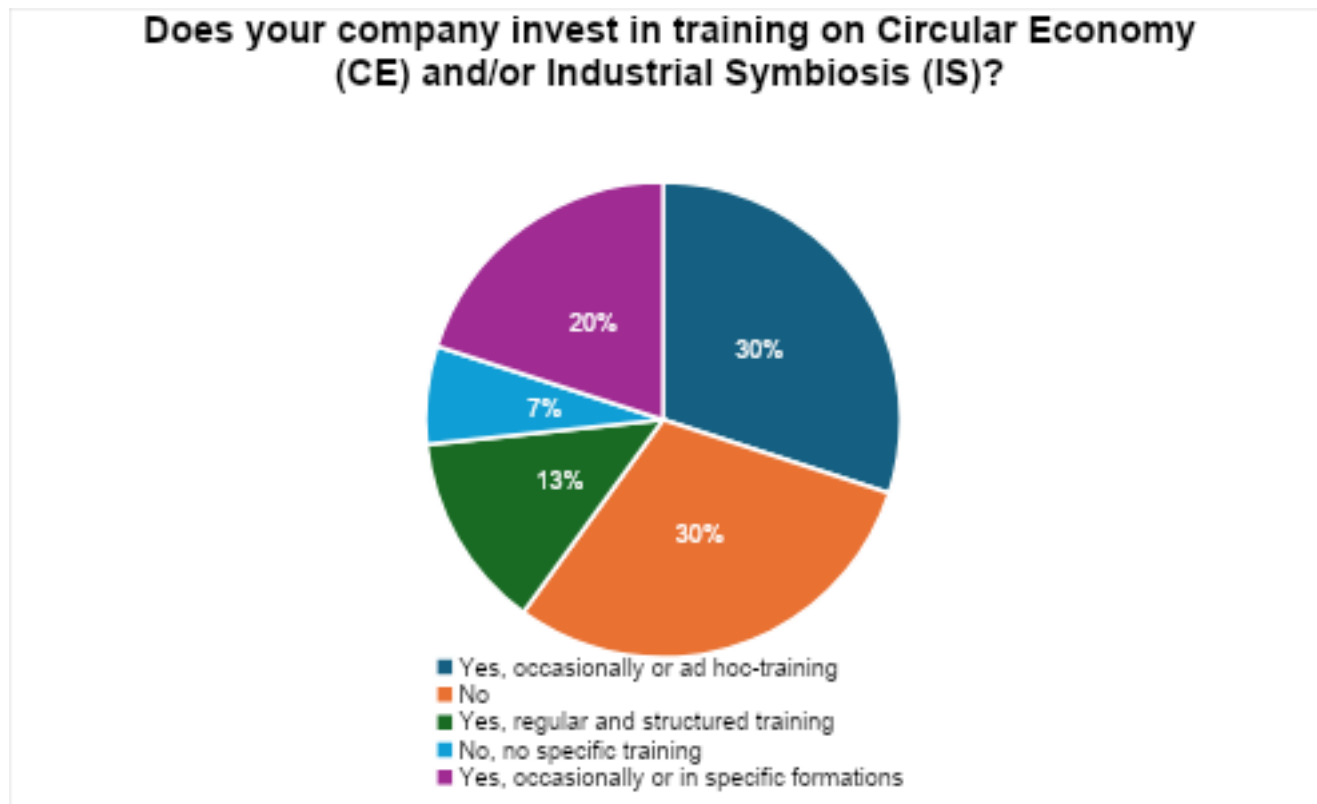


Figure 15



3.6.3 Level of competences

Distribution of respondents' self-assessed **competence levels** in sustainability, resource efficiency, environmental management, and industrial symbiosis-related areas. The results highlight significant variability across topics, with higher competence reported in lean management and environmental management systems and lower competence in LCA, EPD, and industrial symbiosis implementation.

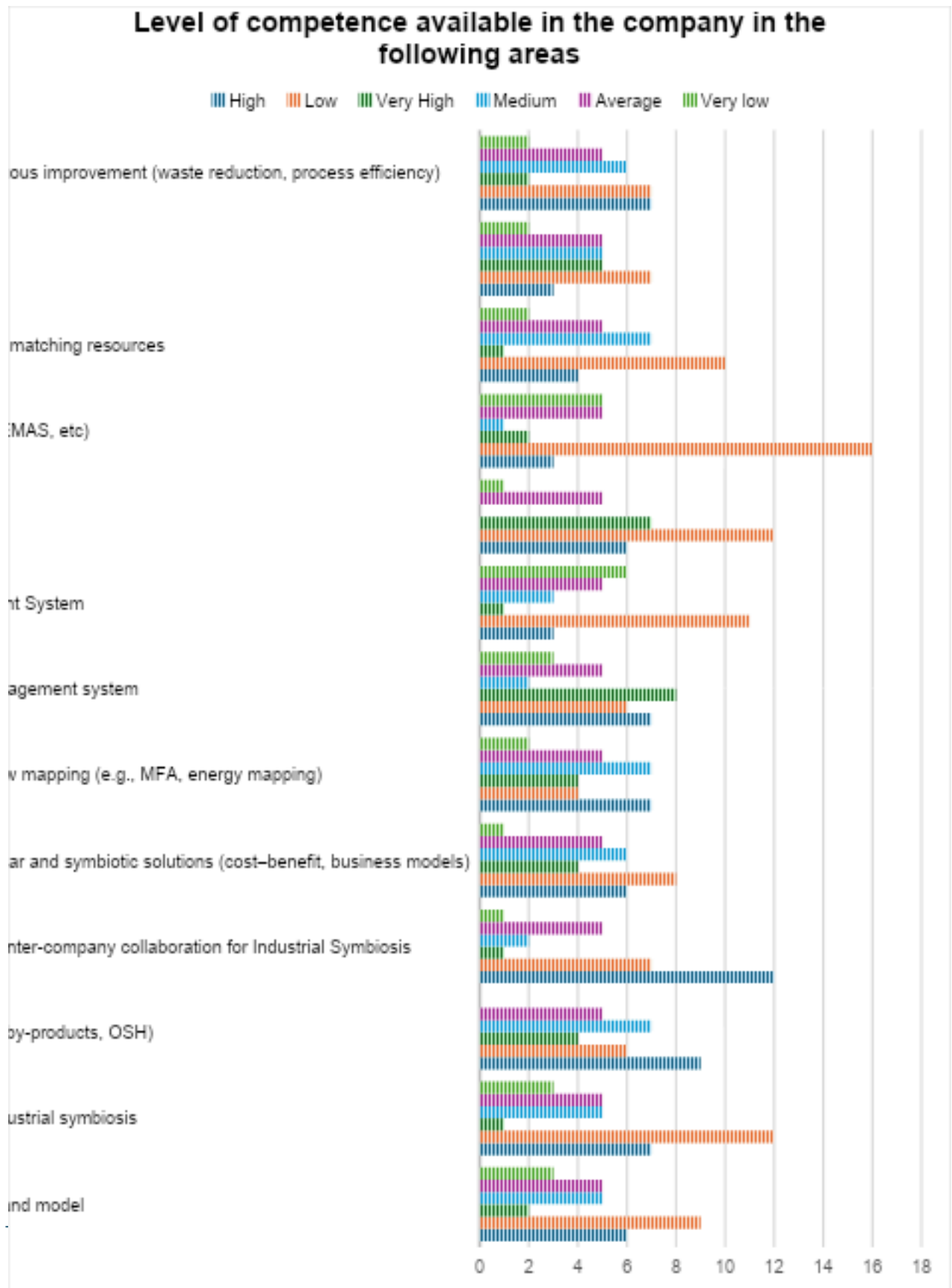


Figure 16

3.7 Interview Findings

The 9 interviews conducted with leather sector stakeholders yielded rich qualitative insights across four thematic areas:

3.7.1 Waste Streams and By-Product Characteristics

The most relevant waste streams identified by interviewees include:

- Leather scraps and waste (limited reuse options with both environmental and economic implications)
- Dust from processing operations
- Sludge from wastewater treatment plants
- Wastewater (technically complex reuse due to chemical concentration build-up)
- Chemical waste and empty packaging (functioning closed-loop model for packaging already documented)

Wet-blue shavings were identified as the highest-volume and most economically critical by-product. Valorisation pathways exist — including fertilisers and protein hydrolysates — but are constrained by regulatory classification issues related to chromium content.

3.7.2 Internal Circular Practices

Several positive examples of internal circular practices were identified, including:

- Photovoltaic panels and rainwater harvesting (achieving 15–25% water reduction)
- Machine wash water reuse in chrome-free operations
- Early-stage fat valorisation for biodiesel production
- By-product sale to food and agricultural industries



- District-based consortium treatment plants in Tuscany (closed-loop water management via vats with regenerated water)

Chromium-free processes (wet-white, vegetable, and olive-based tanning) were consistently identified as best positioned for circularity, as they significantly expand valorisation pathways including composting and fertiliser production.

3.7.3 External Pressures

Interviewees identified several external drivers pushing the sector towards greater circularity:

- **Customer and brand requirements:** Brands increasingly demand environmental and waste management procedures from suppliers, conducting audits and requesting sustainability data
- **CSRD (indirect but growing):** Tanneries are not directly subject to CSRD, but their large clients are beginning to oblige them to report on supply chains
- **ESG criteria and certifications:** Growing demand for recognised standards including ISO 14001, LWG, and RSCI
- **Supply chain transparency:** Clients require traceability, LCA studies, and data-driven environmental performance communication

3.7.4 Competence Levels

The interviews revealed that competence levels across the sector vary significantly. Key areas of deficiency identified include Life Cycle Assessment (LCA) expertise, cross-sector and industrial symbiosis knowledge, environmental and waste management competences, and collaboration and partnership building skills. These findings are consistent with and reinforce the skills gap data from the surveys.

4. Discussion

This chapter interprets the results presented in Chapter 3, highlighting key trends, systemic barriers, and strategic opportunities for the leather sector's transition towards industrial symbiosis. The discussion follows the thematic structure of the analysis chapter.

4.1 Company Profiles and Geographic Concentration

The geographic concentration of respondents in Portugal and Italy reflects the historical importance of these countries as hubs of European tanning production. This also means that findings are most representative of the Iberian and Italian leather industries. The inclusion of respondents from Brazil, Uruguay, Vietnam, and the USA, while limited in number, hints at the global relevance of industrial symbiosis challenges in the leather value chain and the potential for transferable learnings.

The diversity of company sizes, from micro enterprises to large multinationals, is important for contextualising findings. Smaller companies face structural disadvantages in accessing technical expertise and implementing circular solutions, while larger firms have greater resources but also face more complex regulatory compliance demands.

4.2 Waste Monitoring: Strength to Build Upon

The high rate of advanced monitoring (67% of respondents) is a notable strength that differentiates the leather sector from many other industrial sectors. Systematic data availability is a prerequisite for industrial symbiosis — without knowing what waste streams are generated, in what quantities, and with what characteristics, identifying valorisation partners is near impossible. This existing capacity should be leveraged and standardised to facilitate cross-sector by-product exchange, particularly through the development of standardised technical data sheets for by-products (as called for by interviewees).

4.3 Industrial Symbiosis Partnerships: Informal Strength, Formal Gap



The finding that 70% of respondents have some form of IS partnership is encouraging and suggests that the leather sector is already engaged in symbiotic exchange, even if often informally. However, only 10 companies report stable, long-term arrangements. The prevalence of informal partnerships represents both a risk (lack of contractual protection, reliability, and scalability) and an opportunity (existing relationships that could be formalised and scaled).

The 30% of companies with no partnerships at all represent a priority target for outreach and network-building initiatives. District-based industrial symbiosis models — already functioning in Tuscany — offer a replicable template for connecting isolated actors into functional symbiosis networks.

4.4 Regulatory Barriers: The Dominant Structural Constraint

Regulatory barriers emerge as the single most pervasive structural constraint on industrial symbiosis in the leather sector. The combination of environmental regulations, chemical safety requirements (notably REACH), waste classification rules, and administrative burden creates a regulatory environment that systematically disincentivizes circular investment relative to conventional disposal.

Three specific dynamics are particularly problematic:

- **Chromium classification:** The regulatory status of chromium-containing by-products as hazardous waste severely limits valorisation pathways for wet-blue shavings and sludge, which are among the highest-volume streams. This is a technically solvable problem, pathways exist but requires regulatory innovation and clearer classification frameworks.
- **Misalignment between EU and national implementation:** Interviewees consistently noted that EU-level regulation and national-level implementation are frequently misaligned, creating uncertainty and compliance complexity. This is particularly acute for companies operating across multiple jurisdictions.

- **Disposal economics perverse incentive:** As long as disposal costs remain lower than valorisation costs, which is the current situation for most by-product streams, companies face a structural disincentive to invest in circular solutions. Environmental fees and regulatory mechanisms need to be redesigned to close this economic gap.

4.5 Skills Gaps: A Dual Technical-Regulatory Deficit

The co-dominance of technical skills gaps and regulatory/compliance skills gaps (15 and 14 responses respectively) reveals a dual deficit that must be addressed simultaneously. Technical knowledge without regulatory literacy leads to well-intentioned but non-compliant circular initiatives, while regulatory knowledge without technical skills leaves companies unable to operationalise compliance into viable business processes.

The limited prevalence of regular, structured training (only 13% of respondents) suggests that the sector is currently addressing this deficit through ad hoc means, which is inefficient and leaves companies exposed to skills gaps that emerge as new regulatory requirements evolve. A structured, sector-specific training offer, addressing LCA, waste classification, cross-sector symbiosis knowledge, and partnership development, would fill a clear market gap and directly support the SYMBIOS project's objectives.

Interviewees also highlighted the lack of cross-sector knowledge as a particular barrier: tanneries often do not know which industries could absorb their by-products as raw materials, and vice versa. Tools and platforms that bridge this knowledge gap, such as the SYMBIOS project's digital matching tools, are therefore a strategic priority.

4.6 External Pressures: An Accelerating Trend

The growing influence of brand requirements, ESG criteria, and the indirect effects of CSRD represents an important external catalyst for change. While regulatory pressure on tanneries themselves remains limited, the supply chain demands of their major clients are increasingly compelling even SMEs to adopt circular and transparent practices. This "compliance cascade" from large brands to SME suppliers is likely to intensify over the coming years.



The sector should view this trend not only as a compliance burden but as a market opportunity: companies that develop robust circular practices and credible sustainability data will be better positioned to retain and attract premium brand clients, access green finance, and meet evolving market expectations.

4.7 Key Strategic Priorities

In synthesis, the following strategic priorities emerge from the analysis:

- **Regulatory clarity and harmonisation:** Targeted advocacy and engagement with EU and national regulators to improve by-product classification frameworks, reduce administrative burden, and align incentives with circular economy goals.
- **Standardisation of by-product data:** Development and adoption of standardised technical data sheets for leather by-products to facilitate Industrial Symbiosis partnerships.
- **Structured training and capacity building:** Design and delivery of sector-specific training programmes addressing the dual technical-regulatory skills deficit.
- **Network and partnership facilitation:** Creation or strengthening of district-based Industrial Symbiosis networks and digital matching platforms to connect by-product generators with potential receivers.
- **Research and innovation:** Dedicated R&D investment in underdeveloped circular pathways, particularly for chromium-containing streams, wastewater recovery, and emerging recycling technologies.

5. Conclusions

This needs analysis has documented both the genuine potential and the significant structural barriers to industrial symbiosis in the leather sector. The key findings can be summarised as follows:

- The leather sector already has foundations for industrial symbiosis. High rates of waste monitoring, the prevalence of (mostly informal) Industrial Symbiosis partnerships, and documented examples of good practices in chrome-free operations, district-based water management, and cross-sector by-product valorisation demonstrate that the sector is not starting from zero. These existing capacities and practices can and should be built upon.
- Chromium remains the central technical barrier. The regulatory and technical constraints around chromium-containing by-products (particularly wet-blue shavings and sludge) are the single largest obstacle to scaling Industrial Symbiosis in the leather sector. Addressing this requires both regulatory innovation (clearer classification frameworks) and technical innovation (validated valorisation pathways). Chrome-free operators are best positioned for immediate progress.
- Regulatory misalignment and administrative burden are systemic constraints. The combination of EU-national regulatory misalignment, complex waste classification rules, and high administrative burden creates a structural environment that rewards disposal over valorisation. Addressing these issues requires coordinated engagement with regulators at multiple levels.
- Skills gaps are wide and structurally underdressed. The lack of LCA expertise, cross-sector knowledge, and regulatory literacy, combined with very low rates of structured training, leaves the sector poorly equipped to implement the circular transitions demanded by both market forces and future regulation. Structured, accessible, sector-specific training is urgently needed.



- External pressures are accelerating the transition imperative. Brand requirements, ESG standards, and the indirect effects of CSRD are creating an increasingly urgent business case for circular action, particularly for companies in the supply chains of major brands. This external pressure, while challenging, also represents a significant opportunity for companies that move early.

This report findings of the surveys and interviews provide a strong evidence base for the design of targeted interventions, training tools, regulatory guidance, digital matching platforms, and collaborative networks, that can help the leather sector overcome identified barriers and scale industrial symbiosis practices.



6. Annexes

[Surveys and interviews answers](#)

7. Literature Review

[Bibliography](#)