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A place-based approach to strengthening the EU chemicals industry in regions and cities

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QG-01-26-004-EN-N; ISBN: 978-92-895-4018-6; doi: 10.2863/0619354

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Acronym

AEQT	Chemical Business Association of Tarragona
AI	Artificial Intelligence
APT	Applied Polymer Technologies
BASF	Badische Anilin- Und Soda-Fabrik
BTX	Benzene, Toluene, And Xylene
CAPEX	Capital Expenditure
CBAM	Carbon Border Adjustment Mechanism
CCA	Cumulative Cost Assessment
CCS	Carbon Capture Storage
CCU	Carbon Capture and Utilisation
CEFIC	European Chemical Industry Council
CINEA	European Climate, Infrastructure and Environment Executive Agency
CISAF	Clean Industrial Deal State Aid Framework
CMR	Carcinogenic, Mutagenic and Reprotoxic
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
DAC	Direct Air Capture
DG	Directorate-General
DPP	Digital Product Passport
ECHA	European Chemicals Agency
ECRN	European Chemical Regions Network
EEA	European Environment Agency
ERDF	European Regional Development Fund
ESF	European Social Fund
EIB	European Investment Bank
ESPR	Ecodesign For Sustainable Products Regulation
ETS	Emissions Trading System
EU	European Union
FTE	Full-Time Equivalent
GDP	Gross Domestic Product
GHG	Greenhouse Gas
LGCA	Lombardy Green Chemistry Association
LRA	Local and Regional Authority
PCT	Patent Cooperation Treaty
PFAS	Per- And Polyfluoroalkyl Substances
PVC	Polyvinyl Chloride

R&D	Research and Development
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RIS3	Research and Innovation Strategies for Smart Specialisation
S3	Smart Specialisation Strategy
SME	Small and Medium-Sized Enterprise
STEM	Science, Technology, Engineering and Mathematics
TEN-T	Trans-European Transport Network
TFA	Trifluoroacetic Acid
VAT	Value Added Tax

Executive summary

The chemical industry is a large and strategically important sector for the EU economy, but unprecedented challenges are severely impacting its resilience. Overall, the EU chemical sector remains technologically advanced and environmentally progressive. However, a declining global market share, increasing import dependence, workforce constraints, and the massive capital requirements associated with the transition to a low-carbon economy represent pressing issues likely to shape the sector's present and future competitiveness and sustainability.

Characterised by a highly fragmented business structure, with microenterprises and SMEs accounting for more than 97% of the companies, the sector is facing increasing global competitive pressure. In recent years, its value added growth has been slower than that in the USA and China, and the divergence has widened, with some EU Member States recording a shrinkage. As a result, the **EU's share of global chemical value added has significantly declined**, and current estimates forecast a further contraction in production, accompanied by persistently low-capacity utilisation. This decline is mainly driven by higher production costs in the EU compared to its competitors, particularly for energy, labour, regulatory compliance, and logistics.

From an employment perspective, the sector continues to play a vital economic role. However, while overall employment levels have remained relatively stable over the past two decades, **several Member States and key chemical regions have recently experienced job losses**. Moreover, although **labour productivity** in the sector remains relatively high compared with manufacturing averages, it **has declined from historical levels, with this decrease accelerating in recent years**.

Trade performance presents mixed trends. Although the EU chemicals sector continues to maintain a surplus in the EU trade balance, upstream chemical segments are increasingly losing competitiveness. Over time, **the EU's share of global chemical exports has declined, while Chinese exports have expanded rapidly**. Simultaneously, **EU dependence on imports from non-EU countries has grown substantially,** with imports rising to nearly one third of total consumption in recent years. China has emerged as the EU's largest extra-EU import partner, reflecting a significant shift in global supply chains and raising concerns about strategic dependencies.

Investment patterns show both strengths and emerging challenges. Capital expenditure in the EU chemicals sector, measured relative to value added, broadly aligns with global trends and has recovered above pre-pandemic levels, although it remains below Chinese investment rates. **The sector continues to perform strongly in research and innovation**, investing a higher share of value added in

R&D than its main competitors and maintaining a leading global position in chemical patent activity. However, maintaining this technological leadership will require sustained investment to better deploy R&D in innovative market products. This is particularly critical in light of the sector's ongoing transformation toward sustainability and the costs of complying with EU regulations, which, in terms of value added, are nearly double investment in R&D.

Environmental performance represents one of the sector's most significant achievements, but also one of its greatest future challenges. Greenhouse gas emissions from the EU chemical industry have fallen by almost half since 1990, largely due to improvements in energy efficiency and EU regulatory frameworks. Additionally, the production and use of several harmful chemicals have declined. Nevertheless, serious environmental and health risks persist. Exposure to PFAS continues to generate significant annual health costs. Meanwhile, remediating thousands of contaminated sites identified across Europe requires substantial financial resources, in addition to the considerable investments needed to transition the EU chemicals industry toward net-zero emissions.

To limit the negative impact of these challenges, which affected around 20,000 direct and 89,000 indirect jobs and 9% of European chemical production capacity between 2022 and 2025, **the European Chemicals Industry Action Plan aims to address the competitiveness, sustainability, and resilience** of the EU chemicals sector. Built around four pillars, and closely aligned with broader EU strategies, the plan combines short-term measures—such as reducing cost pressures and administrative burdens—with long-term structural reforms, including revisions to the REACH Regulation and initiatives to support investment certainty and low-carbon technologies. The Plan is implemented with the support of the newly founded Critical Chemicals Alliance, which focuses on identifying strategic production sites and molecules, addressing trade distortions, modernising infrastructure, and stimulating demand for cleaner chemical products. The effectiveness of the Plan depends on coordinated action among EU institutions, Member States, local and regional authorities (LRAs), industry, and other stakeholders.

However, **several challenges remain insufficiently addressed by the Action Plan**. The needs for reskilling/upskilling are only partially addressed through an implicit reference to the Pact for Skills; the impacts of demographic change on the labour force and the challenge of ensuring sufficient skills in the medium to long term are not addressed; the current approach of the Critical Chemical Alliance working group does not sufficiently address trade disadvantages arising from imports that do not comply with EU rules; while simplification is one of the four pillars of the Action Plan and certain activities are underway to streamline the regulatory frameworks, strategic and systematic rationalisation remains undefined. Moreover, simplification does not fall under the mandate of either of the working groups established under the Critical Chemical Alliance. Other challenges stem from fragmentation between EU Member States and regions, including a lack of consistency between national interventions and regional policies for competitiveness and the twin green and digital transitions; decarbonisation challenges resulting from insufficient grid and storage development; and insufficient investment and cooperation in place-based innovation strategies, to enable strategic collaboration between regional chemical sites and innovation clusters.

LRAs play a central role in strengthening the competitiveness and resilience of the EU chemicals sector by supporting industrial transformation, innovation, and workforce development. LRAs are well placed to support cluster development, foster regional value chains, and promote collaboration within and across territories. Overall, the experiences analysed in this report demonstrate that successful LRA strategies are centred on establishing strong multi-level governance, supporting place-based innovation ecosystems, and enhancing long-term cooperation among public authorities, industry, and research organisations to support sustainable industrial competitiveness. **Effective coordination between public authorities, research institutions, and industry stakeholders ensures long-term planning, stable investment, and industrial development**. Moreover, successful place-based industrial strategies leverage local territorial strengths by supporting shared infrastructure – such as logistics systems, research facilities and collaborative workspaces – to reduce costs, encourage industrial cooperation and lower barriers for new businesses. Rather than relying on top-down control, these strategies succeed through facilitation, coordination platforms, and partnerships that align priorities and mobilise resources efficiently. **A territorially anchored, long-term approach strengthens industrial competitiveness, supports green and digital transitions, and improves regional innovation systems**.

Together with the Action Plan, existing EU funding instruments, strategic frameworks and networks to share best practices, coordinate policy responses, and improve access to funding and partnerships provide valuable resources for LRAs to support research, decarbonisation, and technological deployment. Overall, the future of the EU chemical industry regions – whether mature or emerging – will depend on **balancing sustainability, competitiveness, innovation and regional development, while supporting businesses and workers during the transition.** However, the foresight exercise conducted for this report, reveals that the EU chemicals industry stands at a critical turning point, facing three possible scenarios likely to shape the future of LRA policy: regulations may advance faster than industry and regional capacities, potentially increasing costs and fragmentation; strong environmental progress may be achieved through decarbonisation and circularity, but continued high energy and feedstock costs could weaken competitiveness; and EU strategic autonomy may be strengthened by measures addressing costs and competitiveness while also reshoring production, investing in skills, and building internal value chains.

To mitigate the identified risks, enhance the Action Plan implementation and ensure effective and efficient policy interventions at the LRA level, this study offers the following **forward-looking recommendations**:

Multi-level initiatives from the EU

• Establish a **dedicated public–private initiative under the ECF**'s Clean Transition and Industrial Decarbonisation window.

• Establish **regional platforms** systematically and strategically, including one that is equipped to support the **development of regional roadmaps**.

EU level

• In **implementing the Action Plan**, establish a **strong partnership with LRAs**, encourage the development of regional **quadruple helix approaches** for the chemicals sector, and explore joint initiatives to develop **lead markets**.

• **Reinforce the Critical Chemicals Alliance** by extending the mandate of the **trade defence** working group to evaluate how imports and broader trade policies impact sustainability; establishing a dedicated working group on **simplification**; creating a specific working group on **human capital and skills**; actively supporting **exchange on different approaches** in the chemical regions in order to channel funding better and enhance learning.

• Establish a dedicated **one-stop shop for R&I funding** that streamlines access for industry and LRAs to strengthen innovation capacity in the EU chemicals sector. This should be underpinned by a unified, cross-programme **definition of place-based innovation**.

• Include the EIB in mobilising finance for the greening of the chemical industry through **dedicated financial instruments** within the existing portfolio of funds, leveraging private resources (including **venture capital**), providing **seed funding** for scaling up innovations, and exploring innovative financing solutions such as **green impact investments**.

• Building on **the experience of REACT-EU,** envisage **a funding mechanism** within the next MFF designed for **targeted investments** to bridge gaps between TRL levels. This mechanism should offer high **flexibility** and reduced co-financing requirements for Member States and LRAs.

• Ensure that **EU funding** for projects supporting the decarbonisation of chemical production processes is **more easily accessible to LRAs that have established a clear roadmap for greening their (chemical) economy**.

• **Refine the EU industrial policy** (including but not limited to the chemicals sector), **taking into account the diverse territorial needs of regions**.

• Establish effective and diversified **global trade agreements** in order to explore new markets beyond China and the USA.

• Accompany urgency measures under the anticipated Industrial Accelerator Act that directly affect Single Market rules **with robust and effective territorial impact assessments.**

• Strengthen the EU's strategic autonomy in **critical raw materials** by accelerating the implementation of the RESourceEU Action Plan and the Critical Raw Materials (CRM) Act.

• **Streamline and review state aid regulations,** including the Clean Industrial Deal State Aid Framework and ETS State Aid guidelines, to also allow for temporary (yet reliable) price support mechanisms **to create lead markets for green chemical products**.

• **Revise the ETS Directive** to consider the possibility of redirecting ETS revenues **to finance** verifiable corporate environmental and climate projects, and **to support LRAs in making targeted, place-based investments in the green transition**.

• Create a streamlined and predictable regulatory framework through **the simplification of REACH rules** and faster permitting procedures.

• Ensure that EU social and environmental standards are, as far as possible, upheld through the **extension of the CBAM to chemical products**, even for transition periods, without hampering the availability of key inputs for industrial production.

• Together with Member States, **adopt policies to reduce energy prices**, and, in parallel, **strengthen investments in grids and cross-border interconnections for energy infrastructure**.

Member State level

• Promote **effective multi-level governance** and strengthen **regional strategic networks** to accelerate the development of resilient and secure critical raw material supply chains in more regions.

• Integrate targeted measures within **National Recovery and Resilience Plans** to accelerate the green and digital transformation of the chemicals industry.

• Enhance harmonisation among Member States through **stronger cooperation and coordination in the transposition and implementation of EU legislation** in areas such as permitting, environmental compliance, the circular economy and the reuse of waste materials.

• **Simplify and accelerate permitting procedures** for new chemicals and sustainable materials to boost R&D investment.

• Cooperate with other Member States to **propose and develop new IPCEI projects** in the chemical industry, ensuring the active involvement of LRAs.

• Explore the establishment of **zone-based policies** as tools for regional development.

<u>LRA level</u>

• Develop a **place-based and holistic approach** to the chemical industry by setting up **strategic plans and using existing regional innovation strategies (e.g. S3)** that enable the simultaneous transformation of energy supply.

• **Establish interregional alliances and develop interregional projects** to strengthen strategic regional networks linking major chemical sites.

• Strengthen **territorial coordination and governance** by establishing or institutionalising regional associations – or leveraging existing entities.

• **Enhance the use of existing EU funds under shared management** to support the green and digital transition and complete a **robust ex ante assessment** to inform future regional actions.

• Invest in **shared transport and logistics networks** at the cluster level.

• **Invest in and support shared infrastructure and collaborative spaces** to enhance cooperation between industry, R&D centres and institutions.

• Foster **close industrial partnerships with educational institutions and research centres** to ensure the supply and training of skilled labour.

1 Introduction

Defined as "the industry of industries" by the European Commission, **the chemicals sector represents a key pillar of the European economy.** As of 2024, it accounts for approximately 6% of the value added and 4% of total employment in the EU manufacturing sector. It comprises around 31,400 enterprises across the EU, directly employing about 1.24 million people and indirectly supporting several million more. Moreover, despite a reduction in international trade over the years, the sector has maintained a positive trade balance, ranking fourth in the overall EU manufacturing trade balances.

However, the sector faces significant challenges. The **EU's global market share** in terms of nominal sales, value added, and exports **declined significantly** between 2004 and 2024. **Extra-EU imports**, especially from China, **rose sharply** from 18,2% of total consumption in 2004 to nearly 31% in 2024. Furthermore, the industry faces **higher production costs**, primarily driven by energy prices, compared to competitors in the USA and China. While **the number of direct jobs** in the sector has remained relatively stable over the past two decades, it has **declined in several Member States and key chemical regions in recent years. Announced closures between 2022 and 2025** reduced production capacity by 9%, **affecting around 20,000 direct and 89,000 indirect jobs.** With further closures announced at the beginning of 2026, up to 350 sites in Europe could be at risk within the next three to five years, potentially resulting in the loss of up to 200,000 direct jobs.

Compliance with EU regulations further increases production costs. Estimates indicate that overall regulatory compliance costs reached around 13% of the value added of the EU chemical industry in 2023, up from 4% in 2004— a share that is nearly double the proportion the sector dedicates to R&D. Finally, the EU chemicals sector achieved a landmark reduction in GHG emissions in 2023, with figures cut by almost half since 1990. Additionally, the production and consumption of various chemicals harmful to human health in the EU have decreased over time. However, supporting the final **transition to net-zero emissions in the EU chemicals industry requires substantial new investments**. Estimates indicate that approximately 53% of primary chemical production capacity will require reinvestment by 2030, amounting to more than EUR 1 trillion by 2050, while the cost of cleaning up 23,000 PFAS-contaminated sites across Europe will reach up to EUR 2 trillion over the next two decades.

To mitigate the adverse effects of these challenges, the European Commission published the European Chemicals Industry Action Plan (Action Plan) in July 2025[1], marking an important and timely first step towards boosting the competitiveness and resilience of the EU chemicals industry. The Action Plan

[1] European Commission (2025*a*), COM(2025)530.

combines immediate actions with long-term structural activities to address both cost pressures and regulatory challenges, such as updating the state aid guidelines for ETS, reducing administrative burdens, and revising REACH and the new ECHA basic regulation to improve investment certainty. Among the immediate actions, the establishment of the Critical Chemical Alliance is intended to enhance the strategic resilience of the industry by mapping the risks of site closures and identifying harmful trade impacts. Furthermore, the Action Plan is a core sectoral component of a broader industrial and economic strategy designed to restore European competitiveness. Overall, the strategic coherence between the Action Plan and other relevant legislation and strategies (such as the Clean Industrial Deal, the Steel and Metals Action Plan, the Action Plan for Affordable Energy, the Single Market Strategy, the Critical Raw Materials Act, and the Union of Skills) is high or even very high.

The Plan is also expected to impact on local and regional economies where the chemical industry is a major driver of economic growth and employment. Overall, **it includes several opportunities for Local and Regional Authorities (LRAs) to support the chemical industries in their regions**. LRAs are, in fact, key to understanding regional particularities and challenges, as well as the needs of their companies. They are therefore central for implementing strategies and interventions to enhance the competitiveness and resilience of the local chemicals industry, and to improve the Action Plan's efficiency and effectiveness. Moreover, they can also draw on various EU funding sources and strategic frameworks to further support chemical companies.

To provide data and evidence to support the European Committee of the Regions' political work and to underpin the formulation of policy recommendations, this study contributes to a better understanding of the current trends, challenges, and opportunities in the EU chemicals sector. It also explores the modalities for establishing a place-based approach to implementing industrial policy across European regions. The study methodology is based on a mixed-methods approach, drawing on both primary and secondary sources, including:

- desk research and data analysis;
- six case studies;
- interviews with key representatives of the chemicals industry at both EU level and national/regional level;
- a survey;
- a foresight exercise.

The study is structured as follows:

- **Chapter 2** provides a detailed analysis of the market in terms of production, employment, labour productivity and trade, as well as capital and R&D expenditure, environmental sustainability and remediation costs.

It also identifies the main challenges and barriers limiting resilience and competitiveness in the EU chemicals industry. Finally, it reviews the Action Plan, assesses its coherence with other EU legislation and evaluates the extent to which the Plan is capable of addressing the identified sectoral challenges and barriers.

- **Chapter 3** discusses the opportunities available to LRAs to develop the chemicals industry in their regions. It presents a synthesis of the key findings from the six case studies. Moreover, it provides a brief analysis of additional experiences from LRAs across the EU, focusing on place-based approaches to support the sector's competitiveness and resilience.
- **Chapter 4** discusses the key trends and developments expected to impact the future of the chemicals industry, including potential implications for LRAs. Moreover, it identifies three distinct future pathways designed as policy-relevant exploratory tools to support strategic reflection on the future of the EU chemicals industry.
- **Chapter 5** provides key recommendations tailored to the EU, Member State, and LRA levels.
- **Annex I** includes the six case studies: ChemCologne, Cologne, North Rhine-Westphalia (Germany); Lyon Vallée de la Chimie, Métropole de Lyon (France); Trilateral Chemical Region (the Netherlands/Belgium/Germany); Espoo Innovation Garden and Green Chemistry Park, Espoo (Finland); Lombardy Green Chemistry Association (LGCA), Lombardy (Italy); ChemMed, Tarragona (Spain).
- **Annex II** presents the key survey results;
- **Annex III** lists the references;
- **Annex IV** includes a summary presentation of the main findings and recommendations;
- **Annex V** contains the social media sharables and visuals.

2 State of play and barriers to growth for the chemicals industry in EU regions

This chapter analyses the current state of play and the key barriers facing the EU chemicals industry. It is divided into three main sections:

- Section 2.1 provides a **market and economic analysis** of the sector across the EU and, where data are available, at Member State level.
- Section 2.2 identifies the **main challenges and barriers** faced by the EU chemicals sector.
- Section 2.3 discusses the **main pillars of the Action Plan** and its strategic coherence with other EU legislation; it also assesses the potential effectiveness of the policy actions committed to under the Action Plan.

2.1 Market and economic analysis of the chemicals industry in the EU

This section describes:

- key sectoral trends in **production**, considering the evolution in the number and type of enterprises operating in the EU chemical sector, as well as trends in the value added generated;
- dynamics in **employment** and **labour productivity**;
- the evolution of **trade**, considering both major export destinations and primary import sources;
- **capital** expenditure and investment in research and development (**R&D**); and
- the **sustainability** of the EU chemical sector, considering the evolution of **GHG emissions** and the **production of hazardous chemicals**, as well as the potential costs and related technologies to **remediate pollution**.

Key data and information in this section (and the following) are derived from CEFIC[2] and Eurostat (see the box 1 below for details).

Key findings include:

Trends in production
• The chemical sector in the EU comprised **31,427 enterprises**, and **150 chemical parks** in 2024; the vast majority of these were micro and SMEs enterprises (97.2%).

[2] CEFIC, *2025 Facts & Figures of the European Chemical Industry– Industry Data,* online.

• The EU chemicals industry accounted for **EUR 140.7 billion** in added value in 2024 (most of which was generated by Germany and France). However, its **average annual growth lags behind the global average and that of the USA and China**.

• **In recent years, the gap between value-added growth in the EU and that of its main competitors has widened further**, with some Member States experiencing negative growth**.** As a result, **the share of global value added generated by the EU chemicals sector has declined significantly**.

• Recent estimates for 2025 indicate a **further contraction in EU chemical output compared to 2024**, affecting key Member States specialised in chemicals. Moreover, **capacity utilisation in 2025 remained persistently well below the EU long-term average**.

Employment and labour productivity

• As of 2024, **the chemical sector employed 1,236,000 people directly across the EU**, generating between three and five additional indirect jobs for every direct job.

• **The number of direct jobs** in the EU chemical sector has remained relatively stable over the past two decades, despite a **decline in several Member States and key chemicals regions in recent years.**

• The sector still demonstrates a **high level of labour productivity** compared to the manufacturing average. **However, this was lower in 2024 than in 2004, and a steeper decline has been observed in recent years**.

• The decline in labour productivity can be explained by **the ageing workforce**, **labour shortages**, the **limited capacity of SMEs to upskill and reskill their workforce, as well as high labour costs**.

Trade

• The chemical sector remains a **key contributor to the EU trade balance**, although upstream chemicals are currently facing a deteriorating trade position.

• **The EU share of global chemical exports has declined steadily**, while Chinese exports have surged. Simultaneously, **the geographical composition of extra-EU export destinations has shifted significantly**.

• **EU imports from non-EU countries, as a share of total consumption, have increased significantly**, rising from 18.2% in 2004 to nearly 31% in 2024.

• The composition of extra-EU imports has changed significantly over time, **with China becoming the EU's main extra-EU import partner in 2024.**

Capital and R&D spending

• The EU's investment intensity—measured as **capital spending relative to value added—remains aligned with the global investment rate, higher than**

that of the USA but below China's. The level recorded in 2024 surpassed pre-pandemic benchmarks.

• The **EU chemical sector shows a higher R&D intensity—defined as R&D expenditure relative to value added—than its key competitors**.

• The **EU remains a leading region** in chemical innovation, as reflected **in its share of chemical patent applications and grants.**

Environmental sustainability and remediation costs

• **GHG emissions from the EU chemical sector in 2023 were nearly 50% lower than in 1990,** with the rate of reduction accelerating further in recent years.

• A primary driver of the reductions in GHG emissions has **been sustained improvements in energy efficiency across the energy-intensive chemical sector.**

• The **production and consumption of several chemicals harmful to human health in the EU have declined over time.**

• Despite notable progress, **there is still significant production and consumption of hazardous chemicals known to be harmful to human health:**

- **human exposure to PFAS** is estimated to account for annual health **costs of EUR 52-84 billion;**
- There are **around 23,000 PFAS-contaminated sites in Europe**, of which approximately 2,300 are identified as high-pollution "hotspots".

• Moreover:

- The **transition to net-zero emissions** in the EU chemicals industry is estimated to require investments exceeding **EUR 1 trillion by 2050**;
- **The remediation of PFAS-contaminated sites** in the EU-27 is expected to cost nearly **EUR 86 billion per year over the next two decades**.

Box 1: Notes on data

The analysis in this section is primarily based on NACE 2-digit C20 'Manufacture of chemicals and chemical products'. This sector division comprises six distinct groups (NACE 3-digit): 20.1 - Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms; 20.2 - Manufacture of pesticides, disinfectants and other agrochemical products; 20.3 - Manufacture of paints, varnishes and similar coatings, printing ink and mastics; 20.4 - Manufacture of washing, cleaning and polishing preparations; 20.5 - Manufacture of other chemical products; 20.6 - Manufacture of man-made fibres.

Consequently, this disaggregation excludes pharmaceutical and medicinal products (C21) and the rubber and plastics sectors (C22), which may, however, be included in some national statistics[3]. Focusing on C20 ensures alignment with the figures used by the European Commission in the Action Plan,[4] as well as those published by Eurostat[5] and CEFIC[6].

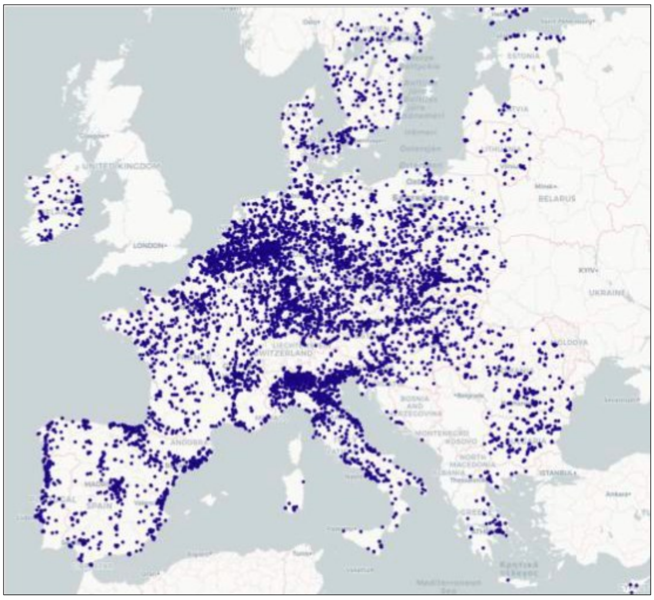
In terms of data coverage, due to gaps in data availability, the statistics for Malta, Cyprus and Luxembourg are not reported. However, the size of the chemical sector in these Member States is marginal. Conversely, regarding GHG emissions, the data from Germany (the largest chemical producer in the EU) are not available. Data are mainly available at the national level, as only a few statistics are provided at the NUTS2 level in Eurostat (specifically on the number of local units in C20, the number of persons employed in them, and labour costs).

2.1.1 Trends in production

2.1.1.a Enterprises

In 2024, **the chemical sector in the EU comprised 31,427 enterprises, concentrated in five Member States**, which together accounted for 59% of the EU total: France (14%), Italy (12.5%), Germany (11.5%), Spain (11.2%) and Poland (9.8%). Over the period 2010–2024[7], the average annual growth rate in the number of enterprises at EU level increased 1.3%, showing a rising trend across five-year periods (0.2% between 2010 and 2014, 1.4% between 2015 and 2020, and 2.2% between 2021 and 2024). However, growth slowed in the

Figure 1: Distribution of European chemical sites tracked by the EEA



Source: reproduced from CEFIC (2025a), p.26.

[3] CEFIC specifies that "in some countries, the scope of the chemicals industry is strictly limited to chemicals, under NACE 20 of the Statistical Classification of Economic Activities in the European Union. In other countries, the scope of the chemicals industry also includes the pharmaceutical sector and the rubber & plastics sectors, i.e., NACE 21 and NACE 22, respectively. See CEFIC, *Landscape of the European Chemicals industry– Industry Data,* online.

[4] See European Commission, *Plan for stronger EU chemical industry*, online.

[5] See Eurostat, *Chemicals production and consumption statistics*, online.

[6] CEFIC, *2025 Facts & Figures of the European Chemical Industry– Industry Data,* online.

[7] Data prior to 2008 are not available, and data for France in 2009 are not reported.

following two years (0.9% in 2023 compared to the previous year and only 0.1% in 2024).

There are also 150 chemical parks in Europe that serve as relays for regional dynamism[8].

Box 2: Role of chemical parks

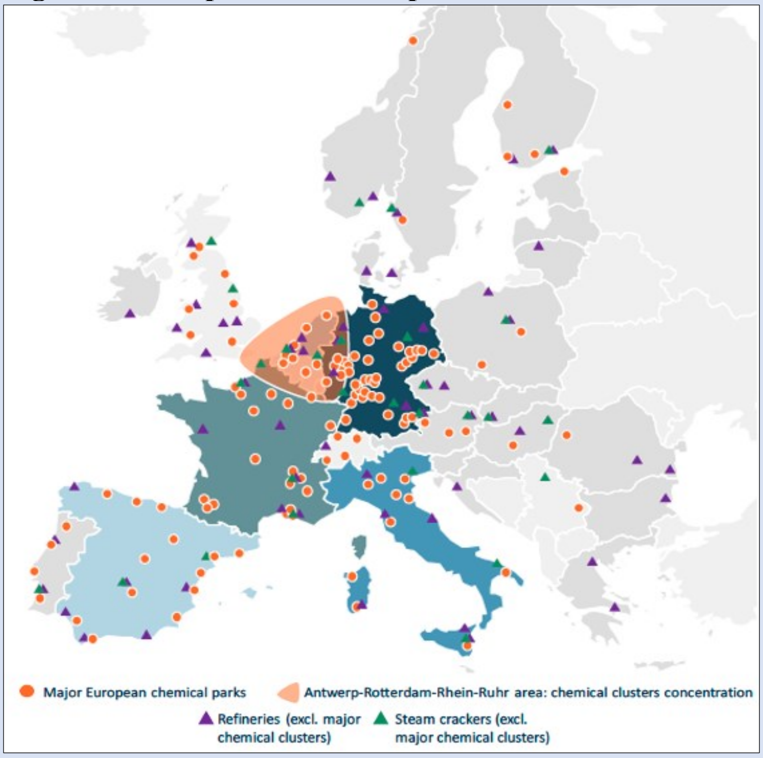
A **chemical park** is a purpose-built industrial cluster where multiple chemical companies are co-located to share common infrastructure, services, utilities, and logistics. These managed sites provide specialised facilities, centralised utilities (energy, water, waste management), logistics and transport links, and technical support. This allows companies to focus on their core production and development activities rather than on auxiliary services.

Chemical parks integrate players across the value chain, acting as hubs for employment (both direct and indirect) and knowledge transfer, while also providing opportunities for growth and cost reduction.

The modern chemical park concept, defined as an intentionally managed industrial cluster with shared services, was developed in Germany in the early 1990s. These parks were established to drive efficiency through the centralised use of shared infrastructure and services, increase the attractiveness of locations for investors by providing a stable framework and enhance synergies and collaboration.

Compared to other European countries, Germany has a particularly large number of chemical parks, many of which are integrated sites, interconnected via pipelines and transport networks, partially covering large geographic areas.

Figure 2: European chemical parks



Source: reproduced from CEFIC (2025a), p.26.

Source: own elaboration based on [*https://chemicalparks.com/chemical-parks*](https://chemicalparks.com/chemical-parks)

Among the five Member States with the highest concentration of chemical enterprises, the trend over the 2010–2024 period was positive in France (3.5% per

[8] CEFIC (2025*a*), p.26.

annum), Poland (2.5%) and Germany (1.1%), while contracting in Italy (–1.0%) and Spain (–0.2%). However, when comparing growth in 2024 with 2023, there is a significant reversal in some of these dynamics: growth turned negative in France (–4.0%) and Poland (–0.8%), and remained negative in Spain (–0.9%). Conversely, it remained positive in Germany (1.2%) and turned positive in Italy (0.8%).

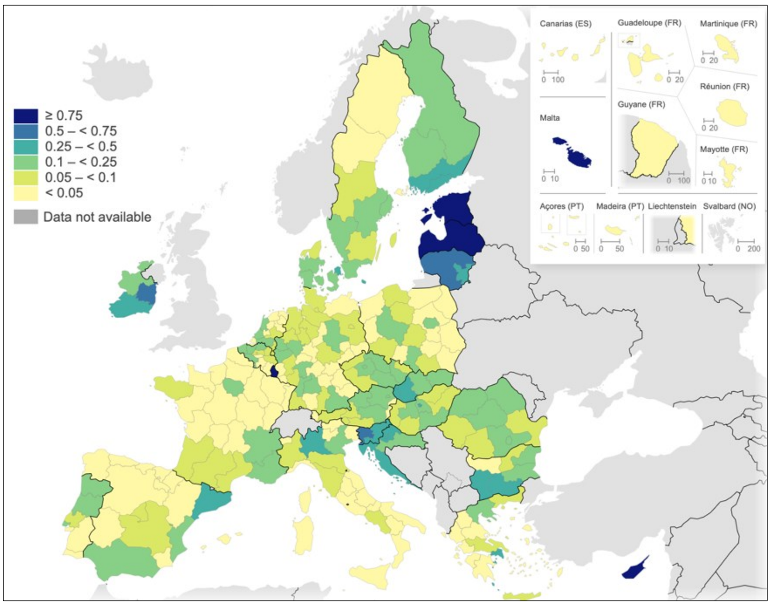
Table 1: Number of enterprises in 2024 by Member State and average growth 2010-2024

Member State	2024		Average growth			
	Number	As % of total EU	2010-2024	*2010-2014*	*2015-2019*	*2020-2024*
Austria	692	2.2%	5.6%	2.4%	2.1%	12.3%
Belgium	712	2.3%	1.1%	0.3%	5.2%	-2.3%
Bulgaria	712	2.3%	1.8%	1.5%	3.0%	1.1%
Croatia	378	1.2%	0.2%	-2.6%	3.9%	-0.6%
Cyprus	65	0.2%	1.4%	0.5%	2.2%	1.7%
Czech Rep.	1,810	5.8%	1.2%	2.9%	0.3%	0.3%
Denmark	271	0.9%	0.7%	-1.4%	4.8%	-1.4%
Estonia	157	0.5%	5.7%	6.6%	5.1%	5.4%
Finland	436	1.4%	2.9%	-0.5%	0.8%	8.3%
France	4,414	14.0%	3.5%	0.5%	2.5%	7.5%
Germany	3,616	11.5%	1.1%	0.4%	0.7%	2.1%
Greece	1,016	3.2%	1.7%	5.1%	-1.2%	1.2%
Hungary	674	2.1%	1.2%	1.4%	1.5%	0.6%
Ireland*	468	1.5%	n.a.	-0.1%	n.a.	2.7%
Italy	3,931	12.5%	-1.0%	-1.0%	-1.0%	-0.9%
Latvia	254	0.8%	5.3%	12.1%	3.2%	0.7%
Lithuania	249	0.8%	7.0%	8.9%	3.1%	9.1%
Luxembourg	21	0.1%	1.6%	0.2%	-2.4%	7.0%
Malta	44	0.1%	0.3%	-0.8%	-2.4%	4.2%
Netherlands	1,422	4.5%	4.3%	2.1%	4.7%	6.2%
Poland	3,065	9.8%	2.5%	0.3%	6.7%	0.3%
Portugal	960	3.1%	1.0%	-1.7%	1.8%	2.8%
Romania	950	3.0%	0.0%	-1.5%	0.2%	1.5%
Slovakia	628	2.0%	13.2%	27.6%	9.7%	2.3%
Slovenia	263	0.8%	3.3%	3.6%	4.2%	2.0%
Spain	3,525	11.2%	-0.2%	-2.5%	1.6%	0.3%
Sweden	694	2.2%	-0.7%	1.2%	-3.2%	0.1%
EU27	**31,427**	**100.0%**	**1.3%**	**0.2%**	**1.4%**	**2.2%**

*Source: own elaboration based on Eurostat [sbs_sc_sca_r2 and sbs_sc_ovw]. Note: * Data not available between 2015 and 2020. Average growth between 2020 and 2024 considers the period 2021-2024.*

At regional level, Eurostat provides data on the number of local units[9] up to 2023[10]. **The leading regions in terms of the number of chemical local units are Lombardia** in Italy (1,683 local units in 2023, corresponding to 4.2% of the EU total), followed by **Cataluña** in Spain (1,175, 3%), **and Ile de France** in France (1,072, 2.7%). When considering the regional share of the national total, and focusing on Member States with more than two NUTS2 regions[11], the highest concentrations are observed in Eastern and Midland in Ireland (260 local units, corresponding to 53.7% of the national total), Attiki in Greece (595; 44.7%), Yugozapaden in Bulgaria (300; 35.3%), Helsinki-Uusimaa in Finland (185; 34.9%), Západné Slovensko in Slovakia (210; 33.7%), and Hovedstaden in Denmark (114; 33.3%). In terms of share of chemical local units over total regional manufacturing local units, the highest values are recorded in Sachsen-Anhalt and Hamburg in Germany (3.8% and 3.5%, respectively), Sydsverige in Sweden (3.5%), Darmstadt in Germany (3.4%), Cataluña in Spain (3.3%), and Eastern and Midland in Ireland (3.0%). Finally, comparing 2023 with 2021, among the 44 key chemical regions across 22 Member States with NUTS2 regions, 15 regions experienced a decrease. The largest declines were recorded in Bucureşti-Ilfov in Romania (-6.3%), Pest in Hungary (-9.3%), Oost-Vlaanderen in Belgium (-11.0%), and Hovedstaden in Denmark (-13.0%). Conversely, the highest increases were reported in Stockholm and Sydsverige in Sweden (+27.2% and +16.5%, respectively), Yuzhen tsentralen in Bulgaria (+13.1%), Bratislavský kraj in Slovakia (+11.5%), and Île-de-France in France (+11.3%).

Figure 3: Share of regional chemical local units over national total (%, 2023)



Source: own elaboration based on Eurostat [sbs_r_nuts2021]

[9] The local unit is an enterprise or part thereof (e.g. a workshop, factory, warehouse, office, mine or depot) situated in a geographically identified place. At or from this place economic activity is carried out for which one or more persons work (even if only part-time) for one and the same enterprise.
[10] Before 2021 there are several missing data.
[11] Estonia, Latvia, Malta, Luxembourg and Cyprus do not have NUTS2 regions. Slovenia and Lithuania have only two NUTS2 regions.

Table 2: Top NUTS2 regions within each Member State in terms of number of chemical local units as a share of the national total in 2023, including their contribution to the EU total and to regional manufacturing, and growth compared to 2021

Member State	NUTS code	Name of the region	Local units				
			Number	% of EU total	% of national total	% of regional manufact.	2023 vs 2021
Austria	AT12	Niederösterreich	194	0.5%	21.9%	2.6%	-1.0%
	AT31	Oberösterreich	145	0.4%	16.4%	1.8%	8.2%
Belgium	BE21	Prov. Antwerpen	176	0.4%	21.0%	2.2%	-1.7%
	BE23	Prov. Oost-Vlaanderen	145	0.4%	17.3%	1.9%	-11.0%
Bulgaria	BG41	Yugozapaden	300	0.8%	35.3%	2.9%	1.4%
	BG42	Yuzhen tsentralen	224	0.6%	26.4%	2.9%	13.1%
Croatia	HR05	Grad Zagreb	129	0.3%	30.6%	2.4%	-3.0%
	HR03	Jadranska Hrvatska	117	0.3%	27.8%	1.4%	-4.1%
Czech Republic	CZ01	Praha	409	1.0%	19.3%	1.2%	9.7%
	CZ06	Jihovýchod	318	0.8%	15.0%	0.9%	-2.8%
Denmark	DK01	Hovedstaden	114	0.3%	33.3%	2.5%	-13.0%
	DK03	Syddanmark	85	0.2%	24.9%	1.9%	0.0%
Finland	FI1B	Helsinki-Uusimaa	185	0.5%	34.9%	2.7%	0.5%
	FI1C	Etelä-Suomi	133	0.3%	25.1%	1.8%	4.7%
France	FR10	Ile de France	1,072	2.7%	17.3%	2.8%	11.3%
	FRL0	Provence-Alpes-Côte d'Azur	727	1.8%	11.7%	2.7%	7.9%
Germany	DEA1	Düsseldorf	345	0.9%	20.2%	2.8%	-2.3%
	DE21	Oberbayern	297	0.7%	17.4%	2.1%	-1.3%
Greece	EL30	Attiki	595	1.5%	44.7%	2.7%	6.1%
	EL52	Kentriki Makedonia	285	0.7%	21.4%	2.3%	9.2%
Hungary	HU11	Budapest	216	0.5%	28.1%	1.9%	-0.9%
	HU12	Pest	127	0.3%	16.5%	1.3%	-9.3%
Ireland	IE06	Eastern and Midland	260	0.7%	53.7%	3.0%	3.2%
	IE05	Southern	144	0.4%	29.8%	2.1%	2.9%
Italy	ITC4	Lombardia	1,683	4.2%	30.5%	2.1%	-0.1%
	ITH3	Veneto	615	1.5%	11.2%	1.3%	0.8%
Lithuania	LT02	Vidurio ir vakarų Lietuvos	194	0.5%	66.0%	1.0%	6.0%
	LT01	Sostinės regionas	100	0.3%	34.0%	1.2%	7.5%
The Netherlands	NL32	Noord-Holland	282	0.7%	15.0%	1.9%	8.9%
	NL36	Zuid-Holland	252	0.6%	13.4%	1.4%	2.4%
Poland	PL91	Warszawski stołeczny	558	1.4%	16.9%	2.6%	-4.9%
	PL22	Śląskie	400	1.0%	12.1%	1.4%	0.5%
Portugal	PT11	Norte	352	0.9%	20.0%	1.0%	3.2%
	PT16	Centro	305	0.8%	17.3%	1.8%	0.0%
Romania	RO32	București-Ilfov	192	0.5%	21.1%	2.2%	-6.3%
	RO11	Nord-Vest	136	0.3%	14.9%	1.3%	-3.5%
Slovakia	SK02	Západné Slovensko	210	0.5%	33.7%	0.7%	9.9%
	SK01	Bratislavský kraj	175	0.4%	28.1%	1.5%	11.5%
Slovenia	SI04	Zahodna Slovenija	170	0.4%	61.6%	1.7%	5.6%
	SI03	Vzhodna Slovenija	106	0.3%	38.4%	0.9%	9.3%
Spain	ES51	Cataluña	1,175	3.0%	27.0%	3.3%	5.4%
	ES52	Comunitat Valenciana	703	1.8%	16.1%	2.9%	1.7%
Sweden	SE11	Stockholm	309	0.8%	21.6%	2.7%	27.2%
	SE22	Sydsverige	317	0.8%	22.1%	3.5%	16.5%

Source: own elaboration based on Eurostat [sbs_r_nuts2021]

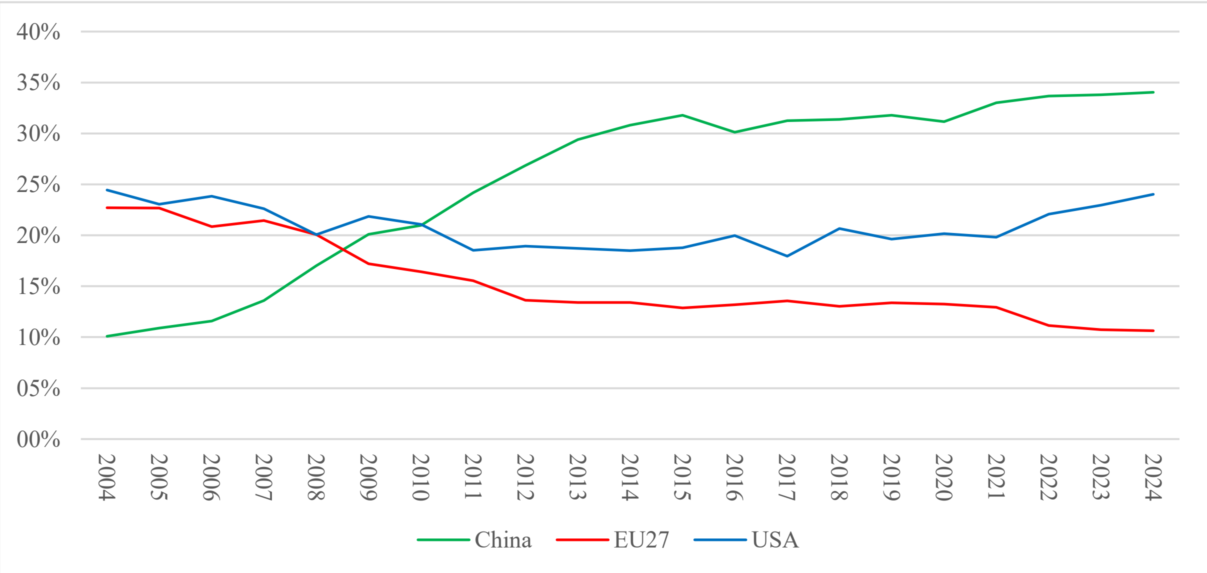
The vast majority of enterprises operating in the EU chemical sector are micro and SMEs, accounting for 97.2% of the total in 2024, a share that has remained constant since 2010. Micro-enterprises account for 72% of all firms, up from 65.7% in 2010 to 70.2% in 2020. Among the more specialised Member States, the highest proportions of large enterprises are found in Germany (6.9%) and Belgium (5.3%), both unchanged from 2010, the Netherlands (3.5%, down from 5.8%), France (2.8%, down from 4.2%), Spain (2.5%, up from 1.5%), and Italy (2.0%, up from 1.5% in 2010).

2.1.1.b Value added

At the EU level, the value added of the chemicals industry amounted to EUR 140.7 billion in 2024. The majority (53% in 2023[12]) was concentrated in sub-sector C201 (manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms), followed by C204 (manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations) at 19% and C205 (manufacture of other chemical products) at16%.

Overall, **the value added of the EU chemicals industry grew at an average annual rate of 2.6% between 2005 and 2024, lagging behind global growth** (6.6% over the same period), as well as that of **the USA** (6.7%) **and China** (13.5%). **In recent years,** the **gap between the EU and its main competitors has widened further**. Between 2020 and 2024, average growth in the EU was limited to 1.5%, compared to 6.4% worldwide, 8.2% in China and 10.9% in the USA.

Figure 4: Share of value added of the chemicals industry in total global chemicals industry value added in the EU, the USA and China (%, 2004–2024)



Source: own elaboration based on CEFIC, 2025 Facts and Figures.

[12] Data on chemical sub-sector is available only up to 2023 from Eurostat.

The value added of the EU chemicals industry was notably impacted by the COVID-19 pandemic (–4.2% between 2019 and 2020, compared to –0.7% in the USA and –3.4% worldwide, but less severely than China, at –5.3%). Furthermore, the sector was affected by the surge in energy prices following Russia's invasion of Ukraine (–12.3% between 2022 and 2023, compared with –8.9% worldwide, –5.3% in China and –8.5% in the USA). **More recently, in 2024, the EU chemicals sector continued to lag behind its competitors** with value added growth of 0.3% compared with 1.3% worldwide, 2% in the USA and 6% in China.

As a result of these developments, **the share of global value added generated by the EU chemicals sector declined significantly**, from 22.7% in 2004 to 13.4% in 2014 and then further to 10.6% in 2024. By comparison, the Chinese chemical sector now accounts for 34.0% of total global value added, up from 10.1% in 2004. The USA has also regained ground in recent years, increasing its share from 18.5% in 2014 to 24.0% in 2024, almost reaching its 2004 level (24.4%).

Table 3: Value added of the chemicals industry in each Member State, as a share of total EU value added, manufacturing value added within each Member State, worldwide value added, and rate of growth (%, 2004–2024).

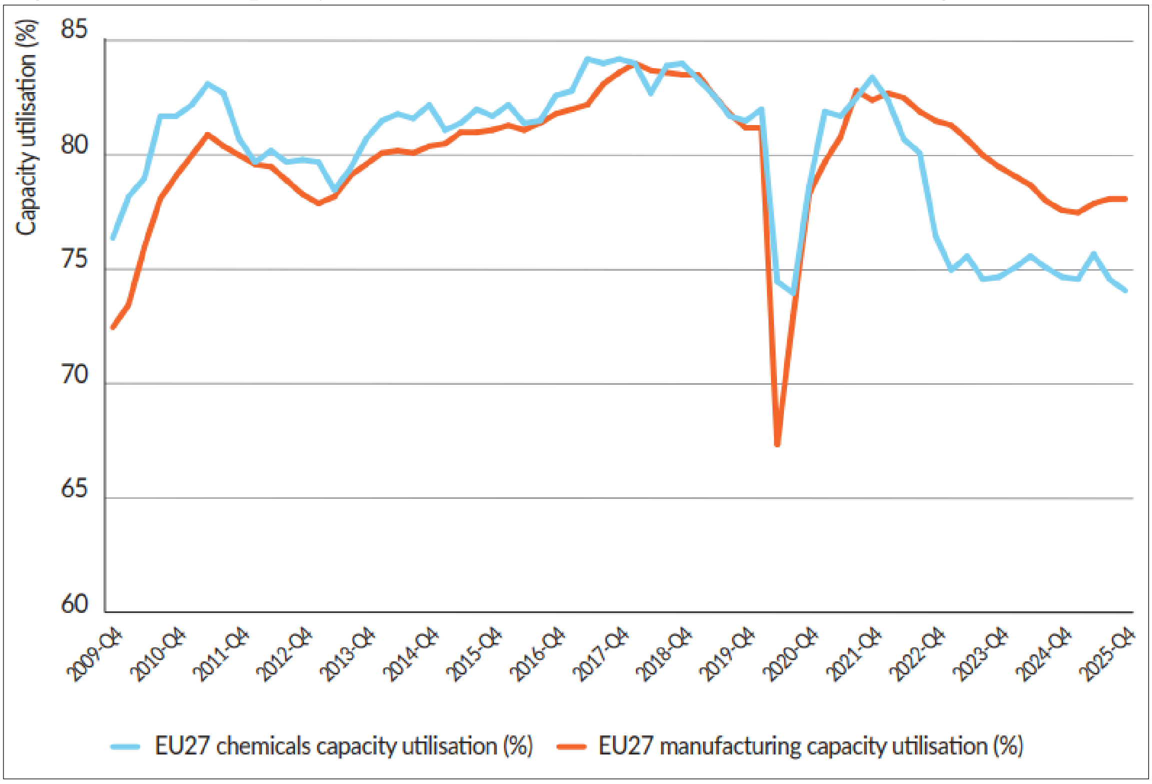
Member State	As share of total EU			As share of manufacturing (2023)*	As share of world (2024)	Average growth			
	2004	2014	2024			2005-2024	*2005-2014*	*2015-2019*	*2020-2024*
Austria	1.7%	2.2%	2.1%	3.7%	0.22%	4.5%	4.6%	4.9%	4.0%
Belgium	6.6%	7.2%	5.2%	11.5%	0.56%	1.5%	2.5%	1.5%	-0.5%
Bulgaria	0.1%	0.3%	0.4%	5.4%	0.05%	10.0%	12.6%	7.6%	7.4%
Croatia	0.1%	0.1%	0.1%	1.8%	0.01%	4.1%	1.9%	17.0%	-4.3%
Czech Rep.	1.0%	1.2%	2.3%	4.8%	0.24%	9.7%	4.6%	8.9%	20.7%
Denmark	1.1%	1.7%	1.6%	4.3%	0.17%	5.2%	6.4%	13.4%	-5.4%
Estonia	0.1%	0.1%	0.1%	2.4%	0.01%	7.9%	13.9%	-0.4%	4.2%
Finland	1.6%	1.6%	1.3%	5.9%	0.14%	1.8%	1.8%	8.2%	-4.7%
France	15.8%	15.0%	20.6%	9.3%	2.19%	4.0%	1.3%	10.0%	3.4%
Germany	33.9%	35.5%	33.1%	6.4%	3.52%	2.5%	2.2%	3.9%	1.5%
Greece	0.7%	0.6%	0.5%	4.3%	0.06%	1.6%	0.9%	1.7%	2.8%
Hungary	0.7%	0.9%	1.0%	3.4%	0.10%	6.4%	6.3%	5.3%	7.7%
Ireland	4.2%	3.0%	2.4%	3.5%	0.25%	6.1%	10.2%	-1.6%	5.7%
Italy	9.5%	9.3%	8.5%	4.4%	0.90%	2.0%	1.5%	5.9%	-0.9%
Latvia	0.0%	0.0%	0.1%	3.2%	0.01%	10.4%	10.6%	12.1%	8.2%
Lithuania	0.1%	0.2%	0.6%	6.8%	0.06%	21.6%	24.7%	25.4%	11.4%
Netherlands	8.7%	7.0%	4.6%	6.6%	0.49%	0.4%	0.2%	6.1%	-5.0%
Poland	2.4%	3.0%	4.9%	4.2%	0.52%	6.8%	4.8%	7.5%	9.9%
Portugal	0.8%	0.6%	0.6%	3.5%	0.06%	2.1%	0.2%	5.7%	2.4%
Romania	0.3%	0.5%	0.5%	2.6%	0.05%	10.9%	6.7%	-9.6%	39.9%
Slovakia	0.2%	0.2%	0.3%	1.6%	0.03%	8.6%	7.6%	12.8%	6.3%
Slovenia	0.3%	0.3%	0.4%	3.2%	0.04%	3.4%	2.8%	1.5%	6.7%
Spain	8.0%	6.8%	6.7%	6.9%	0.71%	1.8%	0.5%	6.2%	0.3%
Sweden	2.1%	2.6%	2.2%	4.3%	0.24%	3.0%	3.8%	4.1%	0.5%
EU27	**100.0%**	**100.0%**	**100.0%**	**5.9%**	**10.63%**	**2.6%**	**1.8%**	**5.4%**	**1.5%**
China					34.0%	13.5%	19.8%	6.3%	8.2%
USA					24.0%	6.7%	4.3%	7.3%	10.9%
World						6.6%	7.2%	5.5%	6.4%

*Source: own elaboration based on CEFIC, 2025 Facts and Figures. Note: *based on Eurostat [sbs_sc_ovw].*

By Member State, most of the EU chemical value added in 2024 came from Germany (33.1%) and France (20.6%), which together account for 53.7% of the total, followed by Italy (8.5%), Spain (6.7%), Belgium (5.2%), Poland (4.9%), and the Netherlands (4.6%). The remaining Member States each contribute less than 2.5% to the total EU chemical value added, with eleven of these accounting for less than 1%. The highest degree of specialisation in the chemical industry, measured as a share of manufacturing value added, is observed in Belgium (11.5%), at nearly twice the EU average (5.9%), followed by France (9.3%), Spain (6.9%), Lithuania (6.8%), the Netherlands (6.6%), and Germany (6.4%).

In terms of growth, the value added generated by the sector has recorded positive average growth across all Member States over the last twenty years, albeit with significant variation. Average annual growth rates ranged from the lowest levels in the Netherlands (0.4%), Belgium (1.5%), Greece (1.6%), Finland (1.8%), and Spain (1.8%), to rates exceeding 10% in Bulgaria, Latvia, Romania, and Lithuania. However, while only a few Member States experienced negative growth between 2015–2019 (Estonia, -0.4%; Ireland, -1.6%; and Romania, -9.6%), **contractions were more widespread in the 2020–2024 period**, affecting six Member States (Belgium, -0.5%; Italy, -0.9%; Croatia, -4.3%; Finland, -4.7%; the Netherlands, -5%; and Denmark, -5.4%). The worst year for the sector was 2023, when 20 Member States experienced a year-on-year decline in value added, ranging from -9.8% in Poland to -35.7% in Lithuania.

Figure 5: EU17 capacity utilisation (%)*, chemicals *vs* manufacturing



*Source: reproduced from Hadhri M. and Tuerlinckx C. (2025). Note: *It measures the ratio of actual output to maximum potential output, expressed as a percentage.*

Finally, **the latest 2025 trends indicate that output is expected to decrease by more than 2%**, down from the 2.4% growth recorded in 2024, and well below the overall average growth expected for manufacturing (1.4%)[13]. This highlights **the highly uncertain economic environment in which the EU chemical sector operates**, a trend that has persisted throughout the past year. During the first nine months of 2025, production declined in the Netherlands (-6.2%), France (-3.9%), Germany (-3.2%), Poland (-2.6%), Italy (-2%) and Spain (-1%). Among Member States specialised in chemicals, output increased only marginally in Belgium (0.2%). **Capacity utilisation also remained persistently low at 74.6%, well below both the EU long-term average (81,4%)** and the USA average since Q3 2022[14]. Overall, in the first half of 2025, the EU chemical sector operated at 9.5% below its pre-crisis capacity (2014–2019).

2.1.2 Employment and labour productivity

2.1.2.a Employment

The chemical sector employs **1 236 000 people directly across the EU (2024),** accounting for around 4.1% of total EU manufacturing employment. Moreover, it generates between three and five additional indirect jobs for every direct job[15].

Compared with the previous two decades, the number of direct jobs in the EU chemical sector remained relatively stable (1,217,000 in 2004). This overall stability is the result of reversing employment trends over time. While between 2004 and 2014 employment in the sector declined significantly, with an average annual decrease of 1.5% across the EU, since 2014 it has increased at an average annual rate of 1.7%. However, **in recent years, this positive momentum has weakened, and in several Member States, employment growth in the sector has turned negative**. Specifically, between 2015 and 2019, the EU recorded an average annual growth rate of 3.1%, with only five Member States experiencing negative growth. By contrast, over the period 2020–2024, the EU average annual growth rate fell sharply to 0.3%, while the number of Member States with negative growth increased to eight. **When focusing exclusively on the most recent two-year period, the slowdown is more pronounced**: the EU average annual growth rate fell to –0.2%, and the number of Member States

[13] CEFIC (2025*b*).
[14] CEFIC (2025*b*).
[15] CEFIC, *Our contribution to EU industry - Facts & Figures of the European Chemical Industry*, on-line.

experiencing negative employment trends increased to fifteen, including France and Germany.

Table 4: Employment in the chemical sector

Member States	Number (2024)		Average growth rate					
	Total	*As % of manufacturing*	2005-2014	2015-2024	*2015-2019*	*2020-2024*	*2023-2024*	2004-2024
Austria	21.553	3,0%	0,4%	2,2%	2,3%	2,1%	1,2%	1,3%
Belgium	42.701	8,4%	-1,9%	0,4%	0,3%	0,5%	-0,9%	-0,8%
Bulgaria	14.859	3,1%	-1,6%	0,8%	1,2%	0,4%	1,3%	-0,4%
Croatia	6.089	2,2%	-2,2%	0,0%	-0,6%	0,5%	-0,3%	-1,1%
Czech Rep.	31.706	2,5%	-1,0%	0,8%	2,0%	-0,4%	-0,8%	-0,1%
Denmark	12.144	3,5%	4,5%	-1,8%	-3,7%	0,2%	-2,5%	1,3%
Estonia	2.292	2,2%	0,0%	-1,0%	-0,9%	-1,0%	-3,2%	-0,5%
Finland	12.508	3,8%	0,1%	-0,3%	0,1%	-0,8%	-0,5%	-0,1%
France	208.861	6,4%	-4,0%	3,9%	7,7%	0,1%	-0,9%	-0,1%
Germany	401.222	5,0%	0,0%	1,8%	3,1%	0,6%	-0,3%	0,9%
Greece	12.468	3,1%	0,3%	0,9%	0,9%	0,8%	0,7%	0,6%
Hungary	15.916	2,1%	-1,4%	1,1%	0,6%	1,5%	-1,3%	-0,2%
Ireland	7.656	2,8%	-2,4%	0,0%	-0,3%	0,2%	-0,4%	-1,2%
Italy	116.283	3,0%	-1,8%	0,9%	2,4%	-0,6%	0,3%	-0,4%
Latvia	3.050	2,6%	1,8%	1,0%	2,7%	-0,6%	-3,8%	1,4%
Lithuania	7.417	3,2%	2,4%	3,4%	3,9%	2,9%	-0,3%	2,9%
Netherlands	46.327	6,2%	-1,4%	0,6%	1,0%	0,1%	0,1%	-0,4%
Poland	99.307	3,5%	0,0%	2,7%	4,0%	1,4%	1,3%	1,4%
Portugal	14.508	1,9%	-2,3%	2,2%	3,1%	1,3%	0,3%	-0,1%
Romania	18.804	1,8%	-5,8%	-3,1%	-3,9%	-2,2%	-3,5%	-4,4%
Slovakia	8.107	1,7%	-1,3%	-1,0%	-1,7%	-0,4%	-0,8%	-1,2%
Slovenia	6.991	3,1%	-2,6%	1,0%	1,1%	0,9%	-0,5%	-0,8%
Spain	104.985	4,8%	-2,0%	2,7%	4,1%	1,3%	0,8%	0,3%
Sweden	20.465	3,3%	-1,0%	0,0%	2,9%	-2,8%	2,0%	-0,5%
EU27	**1.236.032**	**4,1%**	**-1,5%**	**1,7%**	**3,1%**	**0,3%**	**-0,2%**	**0,1%**

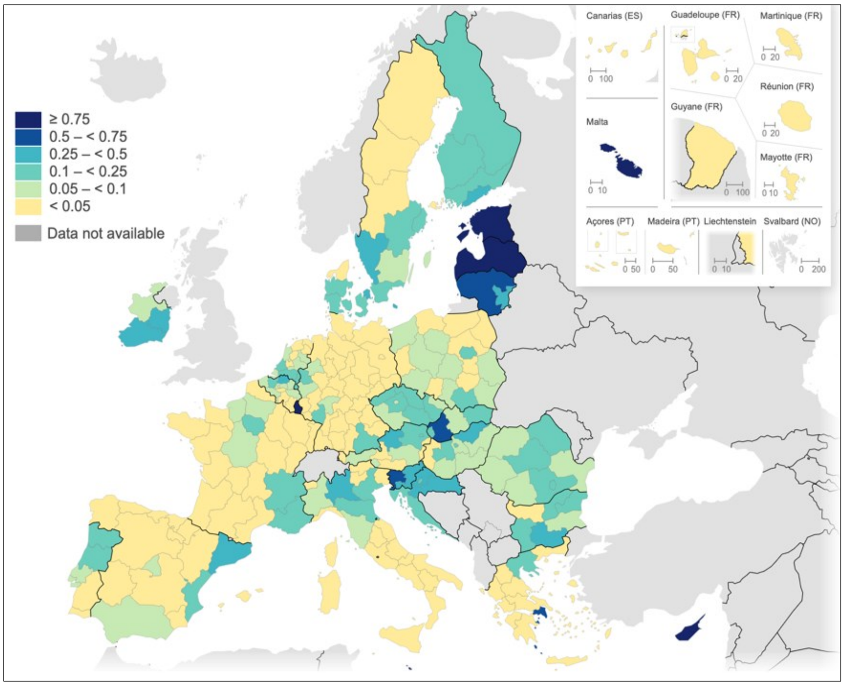
Source: own elaboration based on CEFIC, 2025 Facts and Figures.

By Member State, almost one-third of EU employment in the chemical sector in 2024 is concentrated in Germany, followed by France (16.9%), Italy (9.4%), Spain (8.5%), and Poland (8%). As a share of manufacturing employment in each country, the chemical sector is more pronounced—exceeding the EU average—in Belgium (8.4%), France (6.4%), the Netherlands (6.2%), Germany (5%), and Spain (4.8%). The lowest employment shares within manufacturing are observed in Slovakia (1.7%), Romania (1.8%), and Portugal (1.9%).

In terms of average annual growth over the past two decades, positive employment trends were observed in only eight Member States: Lithuania (2.9%), Latvia (1.4%), Poland (1.4%), Denmark (1.3%), Austria (1.3%), Germany (0.9%), Greece (0.6%), and Spain (0.3%). In all other Member States, employment in the chemical sector declined, with the steepest average annual decreases recorded in Romania (-4.4%), Ireland (-1.2%), Slovakia (-1.2%), Croatia (-1.1%), Slovenia (-0.8%), and Belgium (-0.8%).

At regional level, using Eurostat data up to 2023[16], the leading regions in terms of the number of persons working in chemical local units are Lombardia in Italy (45,886 persons in 2023, corresponding to 3.9% of the EU total), Rheinhessen-Pfalz and Düsseldorf in Germany (45,727; 3.9% and 44,312; 3.8% respectively) and Cataluña in Spain (40,229; 3.4%).

Figure 6: Share of persons employed in regional chemical local units over national total (%, 2023)



Source: own elaboration based on Eurostat [sbs_r_nuts2021].

In terms of persons per local units, the average value across the top regions is 40, ranging from few employees such as in Kentriki Makedonia in Greece and Východné Slovensko in Slovakia (10 and 8 respectively) to more than 100 employees such as in Antwerpen in Belgium (111), and Düsseldorf and Rheinhessen-Pfalz in Germany (128 and 369 respectively). When considering the regional share of the national total, and focusing on Member States with more than two NUTS 2 regions[17], the highest concentrations are observed in Attiki in Greece (9,014 persons, corresponding to 69.7% of the national total), Západné Slovensko in Slovakia (5,360; 65.5%), Hovedstaden in Denmark (6,286; 49.4%), Helsinki-Uusimaa in Finland (6,065; 48.2%) and Eastern and Midland in Ireland (5,108; 45.9%). Looking at the persons employed in chemical local units over total regional manufacturing local units, the highest values are recorded in Rheinhessen-Pfalz in Germany (26.6%), Zeeland in the Netherlands (23.2%), Antwerpen in Belgium (17.3%), and Düsseldorf in Germany (12.6%).

Finally, comparing 2023 with 2021, among the 44 key chemical regions across 22 Member States with NUTS2 regions, 17 regions experienced a decrease. The largest declines were recorded in Southern in Ireland (-13.1%), Oberösterreich in Austria (-13.5%), Východné Slovensko in Slovakia (-14.1%) and Sydsverige in Sweden (-21.6%). Conversely, the highest increases were reported in Małopolskie

[16] Before 2021 there are several missing data.

[17] Estonia, Latvia, Malta, Luxembourg and Cyprus do not have NUTS2 regions. Slovenia and Lithuania have only 2 NUTS2 regions.

in Poland (+15.0%), Ile de France in France (+11.9%), Norte in Portugal (+9.8%), Attiki in Greece (+8.8%), and Oost-Vlaanderen in Belgium (+7.6%).

Table 5: Top NUTS2 regions within each Member State by number of persons employed in chemical local units as a share of the national total in 2023, including number per local unit, their contribution to the EU total and regional manufacturing, and growth compared to 2021.

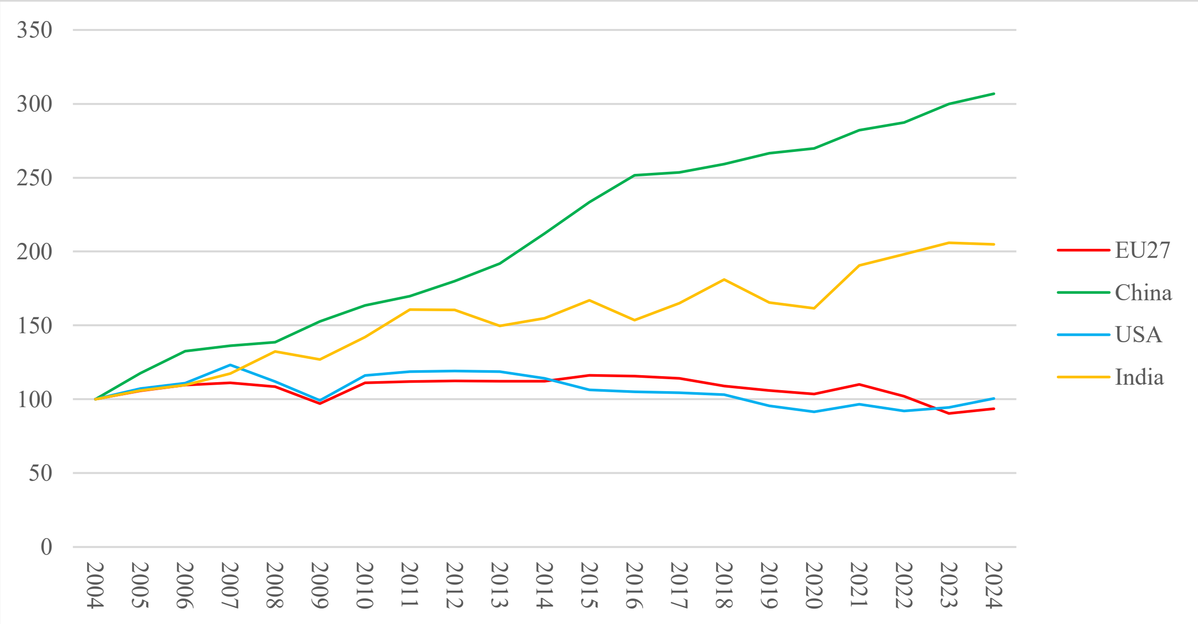
Member State	NUTS code	Name of the region	Persons employed in local units					
			Number	Number per local unit	% of EU total	% of national total	% of regional manufact.	2023 vs 2021
Austria	AT31	Oberösterreich	7,347	51	0.6%	37.9%	3.8%	-13.5%
	AT12	Niederösterreich	4,819	25	0.4%	24.9%	4.2%	6.7%
Belgium	BE21	Prov. Antwerpen	19,487	111	1.7%	43.7%	17.3%	1.4%
	BE23	Prov. Oost-Vlaanderen	6,187	43	0.5%	13.9%	7.1%	7.6%
Bulgaria	BG42	Yuzhen tsentralen	4,583	20	0.4%	30.3%	3.4%	-1.5%
	BG33	Severoiztochen	3,616	35	0.3%	23.9%	7.2%	5.1%
Croatia	HR02	Panonska Hrvatska	2,470	37	0.2%	42.6%	3.6%	-1.3%
	HR06	Sjeverna Hrvatska	1,669	15	0.1%	28.8%	2.0%	5.0%
Czech Republic	CZ04	Severozápad	6,911	35	0.6%	21.7%	6.4%	-4.1%
	CZ07	Střední Morava	5,402	25	0.5%	17.0%	3.1%	-2.3%
Denmark	DK01	Hovedstaden	6,286	55	0.5%	49.4%	7.9%	-6.8%
	DK03	Syddanmark	2,472	29	0.2%	19.4%	2.7%	0.4%
Finland	FI1B	Helsinki-Uusimaa	6,065	33	0.5%	48.2%	7.9%	1.5%
	FI1C	Etelä-Suomi	2,832	21	0.2%	22.5%	3.7%	3.2%
France	FR10	Ile de France	28,632	27	2.4%	18.9%	8.0%	11.9%
	FRK2	Rhône-Alpes	22,766	31	1.9%	15.1%	5.8%	0.3%
Germany	DEB3	Rheinhessen-Pfalz	45,727	369	3.9%	12.1%	26.6%	-0.6%
	DEA1	Düsseldorf	44,312	128	3.8%	11.7%	12.6%	-4.8%
Greece	EL30	Attiki	9,014	15	0.8%	69.7%	5.3%	8.8%
	EL52	Kentriki Makedonia	2,202	8	0.2%	17.0%	2.8%	0.1%
Hungary	HU31	Észak-Magyarország	4,781	66	0.4%	29.7%	5.3%	0.2%
	HU21	Közép-Dunántúl	3,349	38	0.3%	20.8%	2.6%	-8.2%
Ireland	IE06	Eastern and Midland	5,108	20	0.4%	45.9%	4.4%	-0.1%
	IE05	Southern	4,922	34	0.4%	44.2%	4.9%	-13.1%
Italy	ITC4	Lombardia	45,886	27	3.9%	40.5%	5.0%	2.4%
	ITH5	Emilia-Romagna	14,588	27	1.2%	12.9%	3.1%	2.5%
Lithuania	LT02	Vidurio ir vakarų Lietuvos	4,985	26	0.4%	67.2%	2.9%	1.4%
	LT01	Sostinės regionas	2,438	24	0.2%	32.8%	4.2%	-0.4%
The Netherlands	NL36	Zuid-Holland	10,028	40	0.9%	16.8%	9.2%	3.1%
	NL41	Noord-Brabant	8,043	33	0.7%	13.4%	4.4%	6.9%
Poland	PL91	Warszawski stołeczny	11,991	21	1.0%	13.2%	6.3%	2.9%
	PL21	Małopolskie	9,878	31	0.8%	10.8%	4.4%	15.0%
Portugal	PT11	Norte	5,046	14	0.4%	21.4%	1.3%	9.8%
	PT16	Centro	3,706	14	0.3%	15.8%	1.9%	0.0%
Romania	RO32	București-Ilfov	3,699	19	0.3%	20.6%	3.0%	-1.4%
	RO12	Centru	3,161	24	0.3%	17.6%	1.7%	-5.4%
Slovakia	SK02	Západné Slovensko	5,360	26	0.5%	65.5%	2.6%	1.4%
	SK04	Východné Slovensko	1,134	10	0.1%	13.9%	1.1%	-14.1%
Slovenia	SI04	Zahodna Slovenija	3,996	24	0.3%	55.4%	4.2%	4.2%
	SI03	Vzhodna Slovenija	3,220	30	0.3%	44.6%	2.5%	2.2%
Spain	ES51	Cataluña	40,229	34	3.4%	40.4%	8.8%	3.5%
	ES52	Comunitat Valenciana	19,079	27	1.6%	19.2%	7.1%	5.1%
Sweden	SE23	Västsverige	5,031	18	0.4%	25.3%	3.3%	-2.8%
	SE22	Sydsverige	4,268	13	0.4%	21.5%	5.3%	-21.6%

Source: own elaboration based on Eurostat [sbs_r_nuts2021].

2.1.2.b Labour productivity

The EU chemical sector continues to demonstrate **a high level of labour productivity**, at 67% above the manufacturing average[18]. However, **the level recorded in the EU in 2024 is lower than that observed in 2004, reflecting the decline registered in recent years.** Taking 2004 as the base year (2004 = 100), labour productivity decreased to 93.6 in 2024, down from 110 in 2021. While labour productivity in the chemical sector in the USA followed a pattern broadly similar to that observed in the EU, a significant divergence emerges when comparing the EU with China and other competitors, such as India.

Figure 7: Labour productivity (sales/employment, 2004=100)



Source: own elaboration based on CEFIC, 2025 Facts and Figures.

Within the EU, the contraction in labour productivity relative to 2004 is most pronounced in Hungary (75.1 in 2024), Finland (82), Italy (83.4), Belgium (85.4), the Netherlands (87), Spain (87.4), Germany (90.5), and France (93.9). By contrast, labour productivity increased markedly in several eastern Member States, notably Bulgaria (186.3), Slovakia (186.3), Romania (227), Latvia (258.3), and Lithuania (262.1).

Moreover, this downward trend has accelerated in recent years. In 2015, only two Member States (Denmark and Greece) recorded productivity values below their 2004 baseline. However, by 2020, 16 Member States (including Spain, Germany, and France) had values lower than those in 2015. By 2024, this group had increased to 17 (including the Netherlands) when compared to 2020 levels.

[18] European Commission (2023*a*).

Table 6: Labour productivity by Member State (sales/employment, 2004=100)

Member States	Average			2024	Difference		
	2005-2014	2015-2019	2020-2024		2004-2015	2015-2020	2020-2024
Austria	148.5	180.2	142.5	112.6	79.9	-15.4	-51.9
Belgium	100.9	103.9	86.4	85.4	13.3	-20.6	-7.3
Bulgaria	143.0	189.5	184.0	186.3	102.1	-9.1	-6.7
Croatia	110.9	120.0	117.5	115.5	18.0	4.4	-6.9
Czech Rep.	113.5	153.2	168.1	165.4	20.8	41.7	2.9
Denmark	95.2	120.8	129.4	137.3	-9.1	34.9	11.5
Estonia	122.7	143.2	148.2	142.1	28.3	39.8	-26.0
Finland	93.9	120.1	89.2	82.0	8.9	-18.4	-8.6
France	128.1	117.9	97.1	93.9	20.9	-16.7	-10.3
Germany	107.8	111.4	100.4	90.5	17.8	-13.8	-13.6
Greece	89.9	93.3	115.8	125.9	-3.3	-2.9	32.2
Hungary	128.1	122.9	93.6	75.1	45.6	-36.6	-33.9
Ireland	109.2	105.4	118.1	113.4	22.6	-16.9	7.7
Italy	98.3	97.3	90.2	83.4	0.6	-11.1	-6.1
Latvia	133.6	163.9	247.6	258.3	49.8	70.1	38.4
Lithuania	206.3	291.3	340.4	262.1	176.2	184.3	-198.4
Netherlands	101.6	110.6	100.5	87.0	10.5	0.1	-23.5
Poland	106.8	116.3	118.5	138.4	21.0	-11.0	28.4
Portugal	128.1	141.4	131.7	104.8	44.1	-6.1	-33.2
Romania	111.7	186.1	233.7	227.0	53.6	88.6	-15.2
Slovakia	211.3	193.1	207.6	186.3	104.1	-18.3	0.5
Slovenia	117.2	109.7	111.4	106.4	11.1	-4.4	-0.3
Spain	105.8	103.0	90.1	87.4	8.9	-15.9	-5.6
Sweden	98.9	107.0	93.5	94.7	7.1	-11.6	-0.8
EU27	**109.2**	**112.2**	**99.9**	**93.6**	16.2	**-12.6**	**-9.9**

Source: own elaboration based on CEFIC, 2025 Facts and Figures. Note on average: green value=increase compared to 2004; yellow value= decrease by less than 10 compared to 2004; red value= decrease by more than 10 compared to 2004. Note on difference: green value=increase compared to 2004/2015/2020; yellow value= decrease by less than 10 compared to 2004/2015/2020; red value= decrease by more than 10 compared to 2004/2015/2020.

There are several possible explanations for the stagnant trend in labour productivity within the EU chemical sector[19]. The **age of workers might be a primary driver**. 31% of employees in European chemical companies are aged 50 or older and are expected to retire within the next decade. This demographic pressure is particularly pronounced in Germany, where 38% of the workforce falls within this age group.

Moreover, the sector is constrained by a persistent labour shortage. Student enrolment in key disciplines, such as engineering and IT, has plateaued, while demand for these skills continues to grow. This mismatch intensifies competition for a shrinking talent pool. By 2030, the EU chemicals industry is projected to face an 11% labour shortage, concentrated entirely in STEM disciplines.

SMEs' limited capacity to upskill and reskill their workforce also plays a role. Although the industry is dominated by large, capital-intensive enterprises, SMEs remain prevalent. These smaller companies often lack the resources to invest in developing a highly trained workforce. **Furthermore, they are more**

[19] CEFIC (2025*a*), CHEManager (2024), European Commission (2023*a*), and InustriAll Europe (2022).

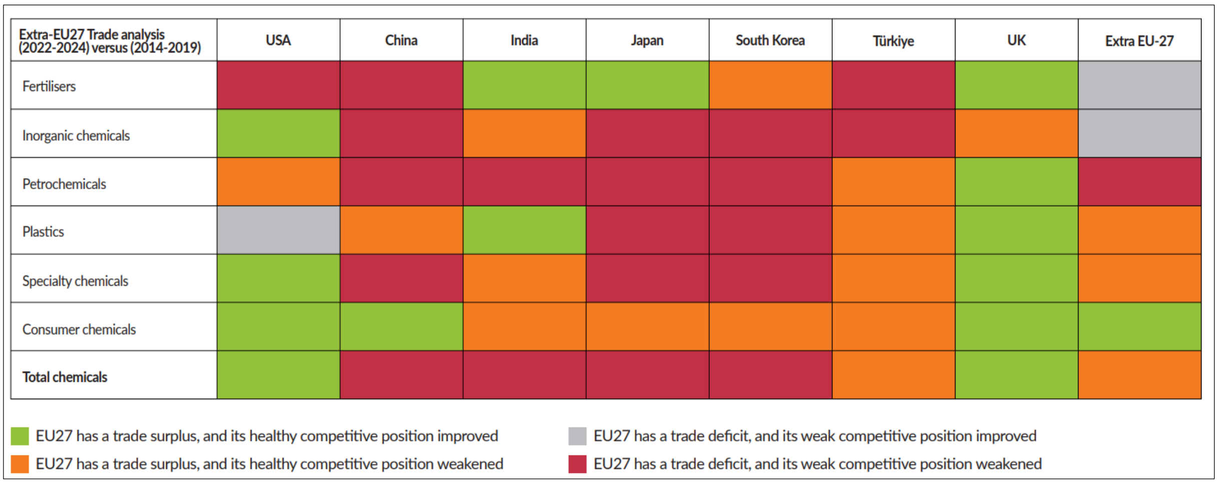
vulnerable to labour costs. The EU chemicals industry faces higher labour costs than China, India, and the Middle East—approximately double those in China or the Middle East and five times those in other parts of Asia. Conversely, labour costs in Europe are more competitive than those in the United States, which is roughly 1.6 times more expensive.

2.1.3 Trade

2.1.3.a Trade balance

With a surplus of around EUR 47 billion in 2024, **the chemical sector is a key contributor to the EU trade balance** (EUR 544 billion), following machinery and equipment (EUR 183 billion), pharmaceuticals (EUR 183 billion), automotive (EUR 136 billion) and food (EUR 52 billion)[20]. This surplus surpassed both the previous year (EUR 35 billion) and pre-pandemic levels (an average of EUR 45.3 billion between 2015 and 2019), representing a significant recovery from 2022, when it fell to less than EUR 3.2 billion. However, **only seven Member States showed a positive trade balance in 2024 relative to 2004,** namely Germany (EUR 36.4 billion), the Netherlands (EUR 24.8 billion), Ireland (EUR 21.5 billion), France (EUR 19.8 billion), and Belgium (EUR 16.7 billion), while Spain (EUR 3 billion) and Denmark (EUR 0.3 billion) recorded positive balances relative to 2022.

Figure 8: The trade position of EU upstream chemical sub-sectors against key competitors



Source: reproduced from Hadhri M. and Tuerlinckx C. (2025).

An analysis of the chemical sub-sectors reveals a net divergence between upstream and downstream performance[21]. **Upstream chemicals—comprising petrochemicals, basic inorganics, and raw material processing—currently face a deteriorating trade position** since they are transitioning into net importers due to high energy costs and global competition. For instance, the EU

[20] Hadhri M. and Tuerlinckx C. (2025).
[21] Hadhri M. and Tuerlinckx C. (2025).

petrochemical trade surplus of approximately EUR 5 billion in 2004 followed a fluctuating trend before turning negative in 2017 (EUR -0.8 billion). This decline accelerated sharply in subsequent years, reaching a deficit of EUR -20.6 billion in 2024. While downstream specialities maintain a positive trade balance, basic, high-volume, and energy-intensive **upstream chemicals are losing ground relative to the EU's key global competitors**.

2.1.3.b Exports

In total, EU Member States exported EUR 600 billion to other EU Member States or extra-EU countries, slightly down from the previous year (EUR 610 billion) but above the pre-pandemic level (EUR 429 billion on average between 2015 and 2019). The key exporters were Germany (23% of the total), the Netherlands (14.8%), Belgium (13.2%), and France (12.6%).

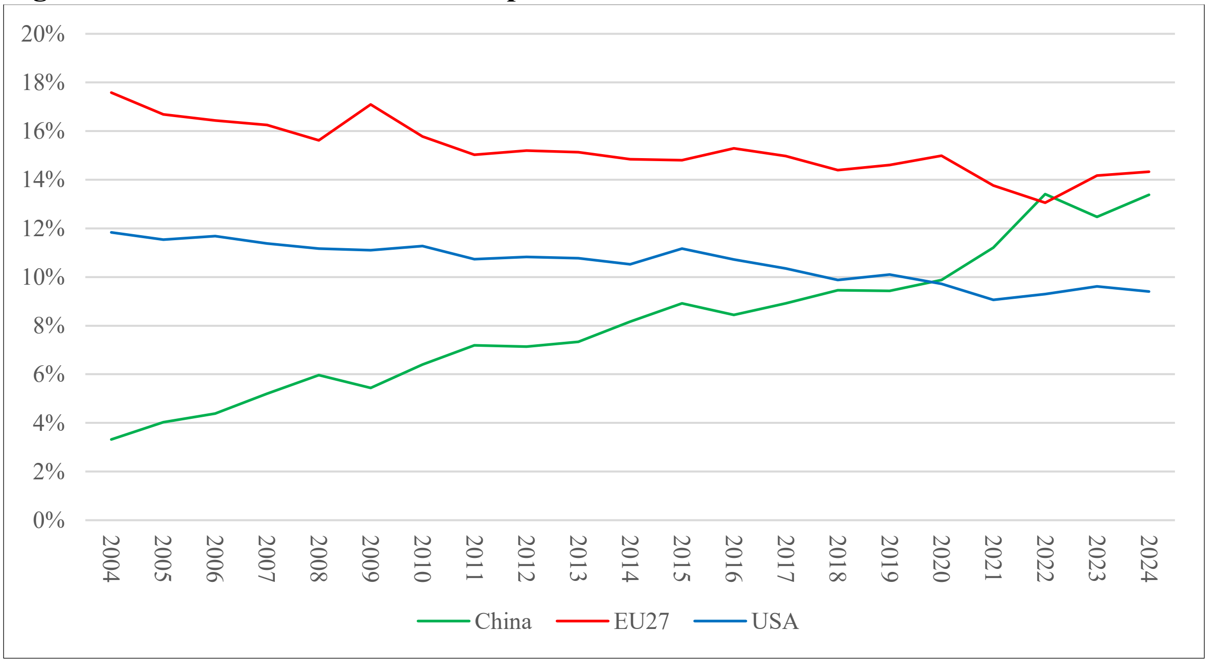
Table 7: Weight of extra-EU exports, by key destination country

Exports to:	2004	2010	2015	2020	2024
USA	22.5%	14.5%	16.2%	16.7%	17.9%
China	3.1%	6.2%	6.9%	8.9%	7.7%
UK	18.6%	16.4%	15.2%	13.6%	11.5%
Switzerland	7.0%	5.9%	4.9%	5.4%	4.8%
South Korea	1.8%	2.3%	2.6%	2.3%	2.4%
Turkey	5.0%	5.5%	5.6%	5.4%	5.6%
Japan	4.7%	3.9%	3.0%	2.7%	2.6%
India	1.2%	2.2%	2.3%	2.4%	2.6%
Singapore	1.3%	1.5%	1.9%	2.3%	2.2%
Russia	3.8%	5.9%	5.1%	5.1%	1.9%
Brazil	2.0%	3.0%	3.1%	2.6%	2.7%
Norway	1.7%	1.8%	1.8%	1.7%	2.1%
Saudi Arabia	1.0%	1.4%	1.7%	1.4%	1.6%
Mexico	1.4%	1.4%	2.1%	2.0%	2.7%
Canada	1.2%	0.9%	1.0%	1.1%	2.0%
South Africa	1.1%	1.5%	1.5%	1.4%	1.5%
Egypt	0.8%	1.1%	1.1%	1.0%	1.0%
Ukraine	1.0%	1.5%	1.2%	1.7%	1.7%
Rest of the world	20.7%	22.9%	22.7%	22.3%	25.4%
Total amount (EUR bn)	**93.8**	**126.5**	**154.8**	**169.4**	**227.2**

Source: own elaboration based on CEFIC, 2025 Facts and Figures.

Of the total trade volume in 2024, EUR 227 billion was attributed to extra-EU exports. **The geographic distribution of these exports has shifted over time.** For instance, while 22.5% of extra-EU exports were destined for the USA in 2004, this share declined to 17.9% in 2024. Another key destination, the UK, saw its share fall from 18.6% in 2004 to 11,5% in 2024. Other markets showing a reduction in extra-EU exports include Switzerland (from 7.0% to 4.8%), Japan (from 4.7% to 2.6%), and Russia following the war in Ukraine and the subsequent sanctions (from 5.1% in 2020 to 1.9% in 2024). Conversely**, several markets have seen an expansion in extra-EU trade**, notably South Korea, India, Brazil, Mexico, and Canada. As regards China, extra-EU exports accounted for 3.1% in 2004, increased to 8.9% in 2020, and then gradually declined to 7.7%. Despite this decline, China has consolidated its position as the third-largest market for extra-EU exports, with a trade value of EUR 17.4 billion in 2024 (up from EUR 2.9 billion in 2004). It now trails the USA with EUR 40.6 billion (up from EUR 21.1 billion in 2004) and the UK with EUR 26.1 billion (up from EUR 17.5 billion in 2004).

Figure 9: Share of world chemical exports



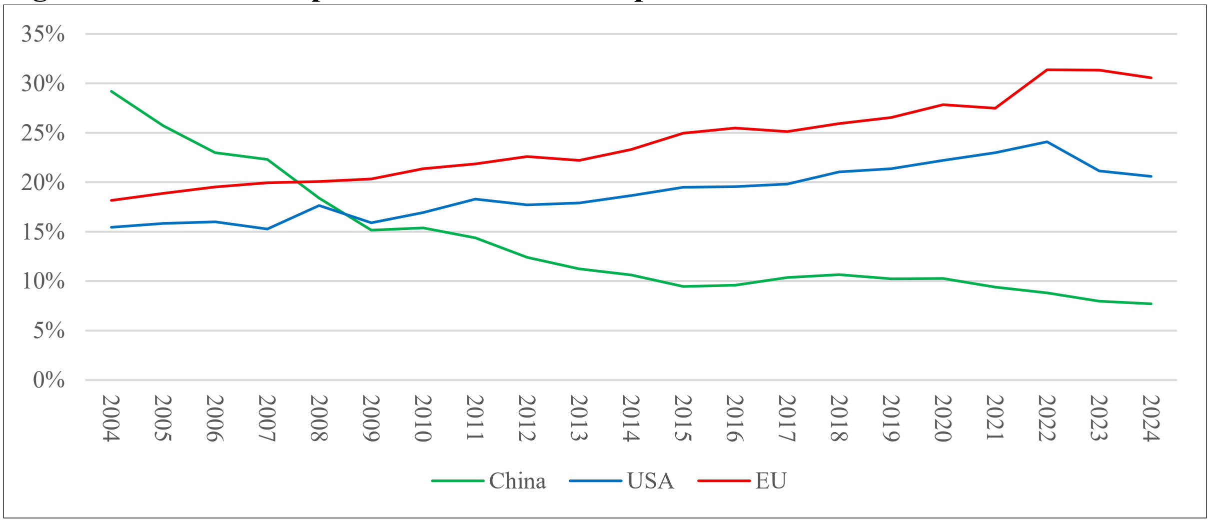
Source: own elaboration based on CEFIC, 2025 Facts and Figures.

Overall, **the EU share of global chemical exports has decreased over time**, from 17.6% in 2004 to 14.3% in 2024. Similarly, the USA has also experienced a decline, with its share falling from 11.8% to 9.4% over the same period. While the EU remains the leading exporter, Chinese exports have increased significantly, rising from 3.3% in 2004 to 13.4% in 2024.

2.1.3.c Imports

Over time, **EU imports from abroad have increased significantly**, rising from 18.2% of total consumption (nearly EUR 65 billion) in 2004 to nearly 31% in 2024 (EUR 180.1 billion). By comparison, this share in China decreased from 29.2% to 7.7% over the same period, while in the USA it increased, but at a lower rate than in the EU, from 15.4% in 2004 to 20.6% in 2024.

Figure 10: Share of imports over total consumption



Source: own elaboration based on CEFIC, 2025 Facts and Figures.

As in the case of extra-EU exports, **the composition of extra-EU imports has changed significantly over time**. In 2004, the main partner was the UK (29.8%), followed by the USA (20.3%), while China (at only 3.9%) ranked sixth, behind Switzerland (10.7%), Japan (6.6%), and Russia (4.6%). By 2024, China had become the EU's primary extra-EU import partner, accounting for 18.4% of total extra-EU imports, followed by the USA (down to 16.7%), the UK (down to 11.0%) and Switzerland (down to 7.1%). Over time, other partners have gained importance, including South Korea (from 1.5% to 5.8%) and India (from 1.6% to 6.6%).

Table 8: Weight of extra-EU imports, by key country

Import from:	2004	2010	2015	2020	2024
USA	20.3%	17.7%	17.9%	17.6%	16.7%
China	3.9%	7.3%	8.9%	11.9%	18.4%
UK	29.8%	21.4%	17.5%	15.4%	11.0%
Switzerland	10.7%	8.7%	9.2%	9.8%	7.1%
South Korea	1.5%	1.9%	3.5%	4.8%	5.8%
Turkey	1.2%	1.4%	1.7%	2.1%	2.9%
Japan	6.6%	5.7%	4.6%	5.1%	4.1%
India	1.6%	2.5%	3.3%	3.8%	6.6%
Singapore	2.0%	3.4%	3.7%	2.2%	1.6%
Russia	4.6%	6.0%	6.4%	4.6%	1.9%
Brazil	1.1%	1.6%	1.1%	0.8%	1.0%
Norway	2.4%	2.3%	2.0%	1.9%	1.5%
Saudi Arabia	2.1%	3.0%	2.9%	2.0%	2.3%
Mexico	0.8%	0.8%	0.9%	0.8%	0.8%
Canada	0.5%	0.6%	0.6%	0.7%	1.1%
South Africa	0.5%	0.6%	0.5%	0.7%	0.5%

Egypt	0.3%	0.8%	0.5%	0.8%	1.3%
Ukraine	0.8%	0.6%	0.4%	0.5%	0.3%
Rest of the world	9.2%	13.7%	14.4%	14.4%	15.2%
Total amount (EUR bn)	**64.8**	**88.8**	**113.1**	**129.0**	**180.1**

Source: own elaboration based on CEFIC, 2025 Facts and Figures.

2.1.4 Expenditure in capital and R&D

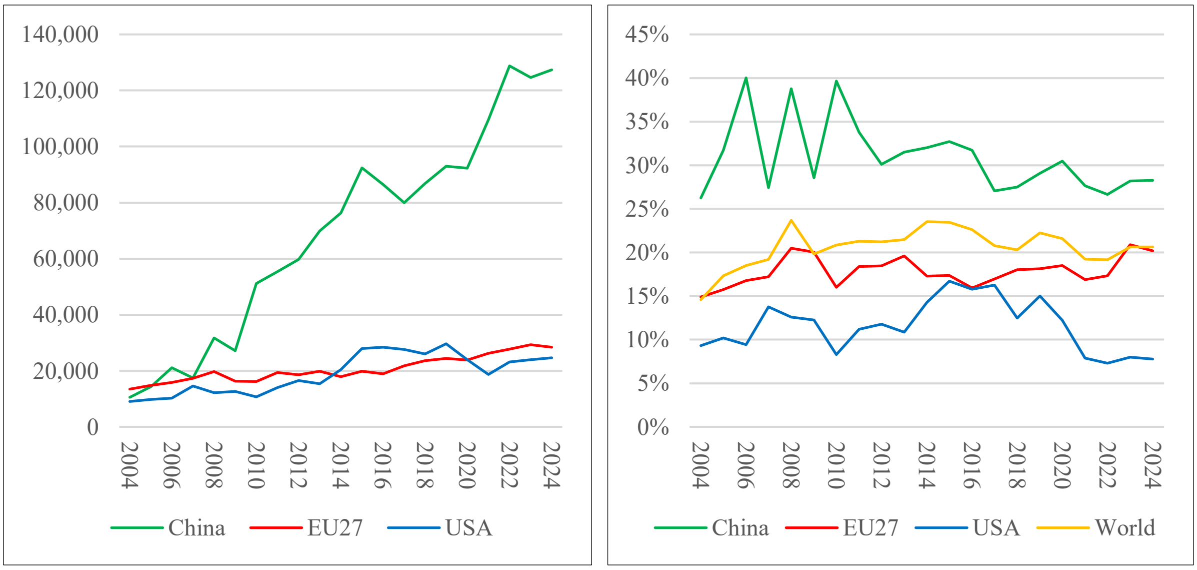
2.1.4.a Capital spending

Most global **capital spending** is concentrated in the USA (EUR 24.7 billion), the EU (EUR 28.4 billion), and China (EUR 127.4 billion), together accounting for more than 66% of the total in 2024 (with China representing 47%). Over the last two decades, global spending grew at an annual rate of 8.7% (13% between 2004 and 2014, and 4.5% between 2014 and 2024). In the last year, however, the growth rate slowed to 1.4%. Compared to the USA (6.7% per year) and China (16%), the overall two-decade growth in the EU was lower (4.2%) and turned negative in 2024 (-3.1%, compared to 2.2% in China and 2.8% in the USA).

However, when measured as a ratio of value added, capital spending in the EU (20.2% in 2024) is in line with the global average (20.6%). While this is below that of China (28.3%), it significantly surpasses the 7.8% recorded in the USA. **Compared with pre-pandemic levels (2014–2019), the EU is the only region showing an increase in 2024 (20.2% versus 17.3%) in the ratio of capital expenditure to value added**. In contrast, investment intensity declined in China (28.3% from 30%), in the USA (7.8% from 15%), and worldwide (20.6% from 22.2%).

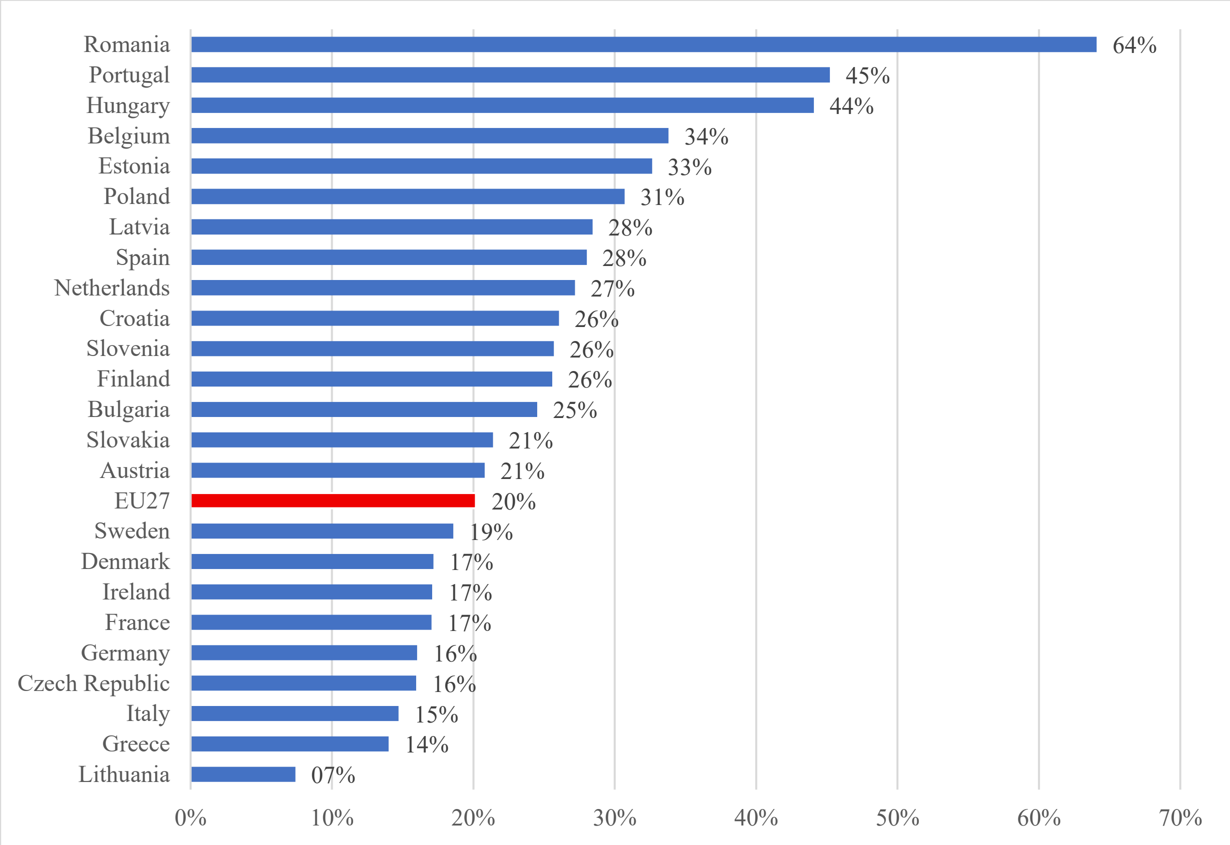
Figure 11: Capital spending

(million EUR) **(as % of value added)**



Source: own elaboration based on CEFIC, 2025 Facts and Figures.

Figure 12: Capital spending in EU Member States (as % of value added, 2024)



Source: own elaboration based on CEFIC, 2025 Facts and Figures.

By Member State, 26.3% of total EU **capital spending** in 2024 was concentrated in Germany (EUR 7.45 billion), followed by France (17.4%, EUR 4.94 billion), Spain (9.3%, EUR 2.64 billion), Belgium (8.8%, EUR 2.49 billion), Poland (7.4%, EUR 2.10 billion), the Netherlands (6.2%, EUR 1.76 billion), and Italy (6.2%, EUR 1.75 billion). However, **most of these countries exhibited relatively low annual growth rates in capital spending over the 2004–2024 period, with some below the EU average of 4.2%** (Italy 2.9%, Spain 3.6%, Germany 3.7%, and the Netherlands 4.2%). By contrast, Member States whose chemical sectors showed the highest average growth rates in capital spending over the last two decades (above 10% per year) include Ireland (25.2%), Latvia (21.6%), Lithuania (20.6%), Slovakia (17.6%), Bulgaria (16.5%), Portugal (13.5%), Estonia (13.1%), and Belgium (12%). In terms of the ratio of capital spending to value added, Romania (64.1%) ranks first, followed by Portugal (45.2%) and Hungary (44.1%), while Lithuania (7.4%), Greece (14.%), and Italy (14.7%) occupy the bottom positions.

A recent analysis by CEFIC (December 2025)[22] highlighted a sharp deceleration in **confirmed investments[23] over the period 2022–2025**, declining from 2.7 Mt to 0.3 Mt. This represents an 86% decrease between 2024 and 2025. Parallel to this, confirmed capital expenditures (CAPEX) decreased fivefold, dropping from EUR 7.6 billion in 2022 to EUR 1.5 billion in 2025. The total volume of confirmed investments amounted to 7 Mt between 2022 and 2025 (around 2% of European chemical production capacity). This remains **significantly below the 37 Mt of announced closures over the same period**, which account for roughly 9% of European chemical production capacity (see Section 2.2.6).

Among confirmed investments, petrochemicals represent the primary segment, totalling 3.8 Mt over the period. However, this volume only partially offsets the 17.8 Mt of closures in the segment. At the Member State level, the largest confirmed capacity investments are concentrated in Belgium (2.4 Mt), Germany (0.8 Mt), and France (0.4 Mt). In terms of CAPEX, the highest investment values are reported in France (EUR 1.7 billion), the Netherlands (EUR 1.5 billion), and Germany (EUR 1.4 billion). Investment themes primarily include the battery value chain (EUR 1.9 billion), emissions reduction (EUR 1.9 billion), and recycling (EUR 1.5 billion), although these areas are also following the overall decelerating trajectory observed across the industry.

2.1.4.b Expenditure in R&D

As in the case of capital spending, R&D expenditure as a ratio of value added was also higher in the EU in 2024 (7.4%) compared with pre-pandemic levels (7% on average in the 2014–2019 period), while it decreased in China (3.9% from 4.4%), the USA (4.1% from 5.5%), and worldwide (4.3% from 4.8%). This confirms **the EU chemical sector's tendency to invest more in R&D compared with its key competitors**: year on year, between 2004 and 2014, R&D expenditure accounted for nearly 7% of the value added in the EU chemical sector, compared with 3.7% in China and 4.3% in the USA and worldwide. The USA (EUR 13 billion), the EU (EUR 10.4 billion), and China (EUR 17.8 billion) lead global R&D spending, accounting for 72% of the total in 2024. In terms of growth, with a rate of 2.2% per year between 2004 and 2024, the EU lags behind both China (14%) and the USA (4.2%).

Regarding R&D expenditure by Member State, 48.1% of the EU total in 2024 was concentrated in Germany (EUR 4.98 billion), followed by France (19.4%, EUR 2.01 billion), the Netherlands (6.1%, EUR 0.62 billion), Italy (5.1%, EUR 0.52 billion), Belgium (4.1%, EUR 0.43 billion), and Denmark (3.9%, EUR 0.40 billion). Except for Denmark (5.5%), all these countries recorded annual growth rates in R&D expenditure below or close to the EU average over the 2004–2024

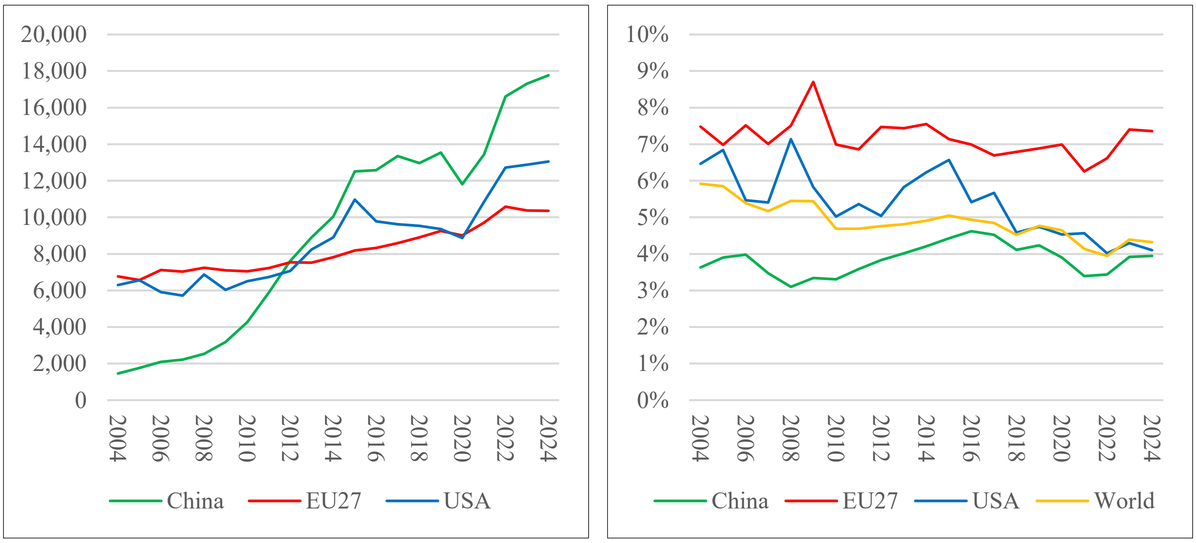
[22] CEFIC (2025*c*).

[23] They include investments that are formally approved (FID), construction start announced, or operating. See CEFIC (2025*c*), p.16.

period: the Netherlands (0.1%); France (1.9%); Belgium (2.1%); Italy (2.2%); and Germany (2.4%). In terms of the ratio of R&D expenditure to value added, Denmark recorded the highest value (17.4%), followed by Germany (10.7%), the Netherlands (9.7%), and Austria (8.4%), while the lowest ratios were observed in Eastern European countries, notably Romania (0.4%), Hungary (1.1%), Bulgaria (1.3%), and Slovakia (1.5%).

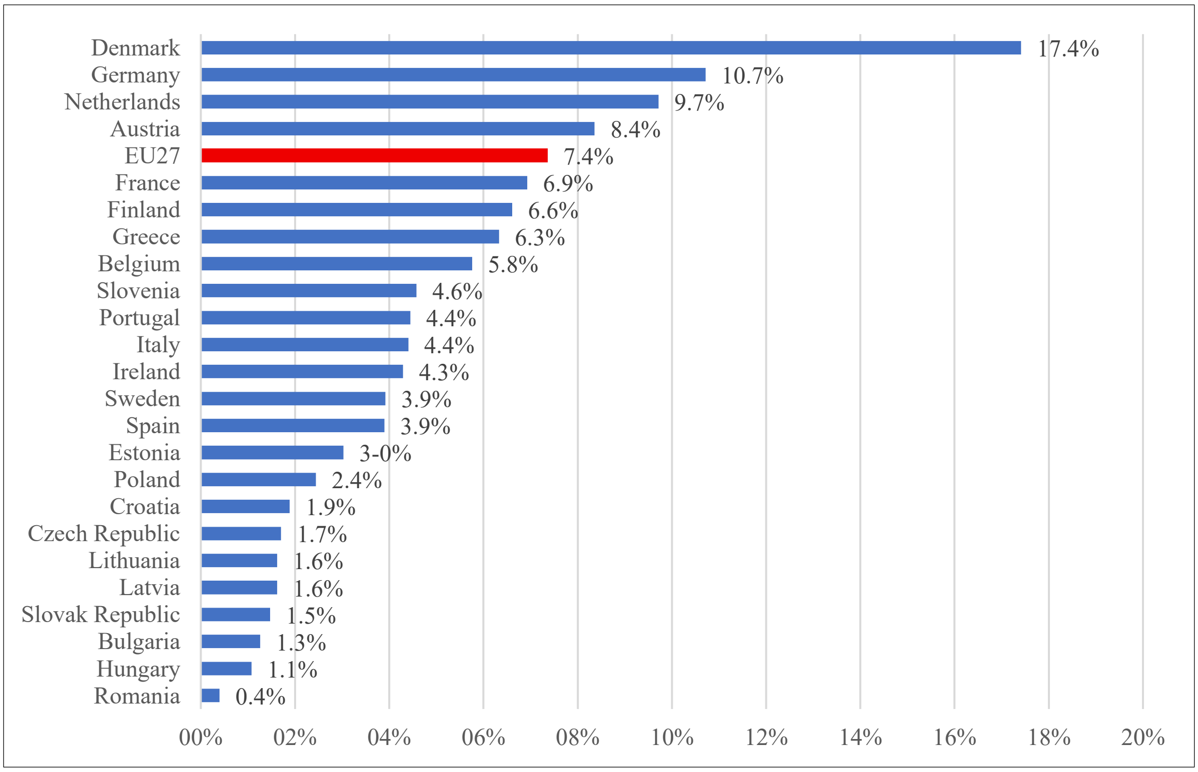
Figure 13: R&D expenditure

(million EUR) **(as % of value added)**



Source: own elaboration based on CEFIC, 2025 Facts and Figures.

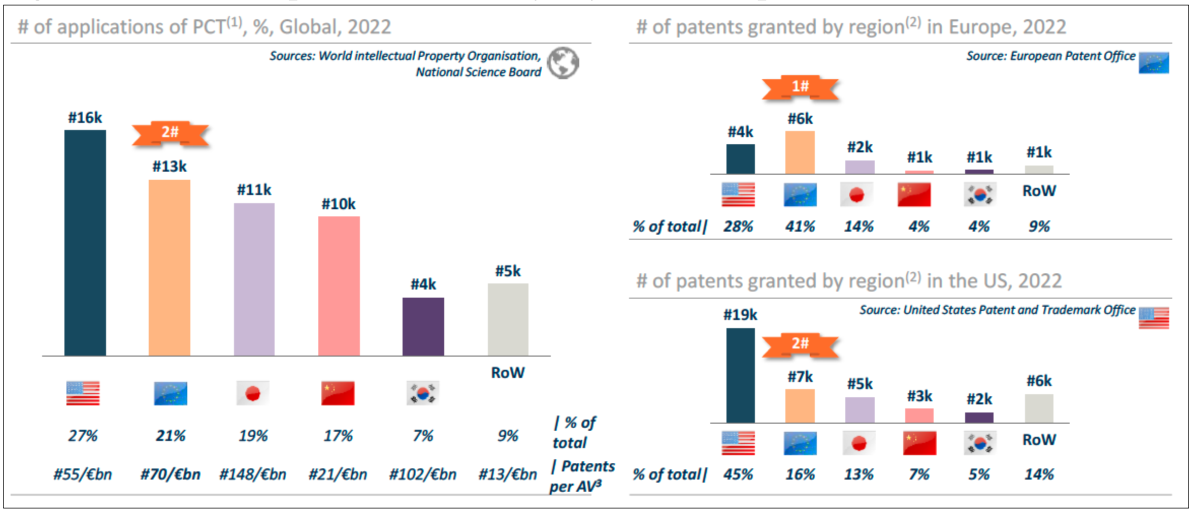
Figure 14: R&D expenditure by Member State (as % of value added, 2024)



Source: own elaboration based on CEFIC, 2025 Facts and Figures.

The **EU remains a global leader in chemical innovation. This is reflected in its share of patent applications and grants in the field**. In 2022, approximately 6 000 patents were granted by the European Patent Office. In the same year, the EU ranked second in both the number of chemical patents granted in the USA and the number of international chemical PCT applications worldwide[24].

Figure 15: Chemical patent overview by key world competitors



Source: CEFIC (2025a), p.28.

2.1.5 Environmental sustainability and remediation costs

2.1.5.a GHG emissions

The chemical sector is a major contributor to air, water, and soil pollution through the release of hazardous chemicals and residual emissions[25]. Accounting for around 5% of total net GHG emissions, the sector's high energy intensity is largely driven by its reliance on fossil-based feedstocks, which account for approximately 50% of total energy input. Combined with this, the substantial energy required for processing, production, and supply chain logistics, the widespread use of carbon-rich raw materials, the need for high-temperature heat, and complex global value chains make decarbonisation in the sector particularly challenging[26].

GHG emissions from the EU chemicals industry account for around 5% of total net GHG emissions[27]. In 2023, these emissions totalled 48 million tonnes of CO_2 equivalent (excluding Germany, for which GHG emissions data are not reported), representing a 10.7% decrease from 2022. Overall, **GHG emissions from the EU chemical sector in 2023 were around half of those in 1990**, corresponding to an average annual reduction of 1.8% over that period. This decline was more

[24] CEFIC (2025*a*), p.28.
[25] United Nations Environment Programme Finance Initiative (2025).
[26] Gabrielli P. *et al.* (2023).
[27] EEA (2025).

pronounced between 2000 - 2009 (−2.1% per year) than between 2010–2019 (−0.9% per year). **In recent years, however, the reduction has accelerated further** (−4.4% per year between 2020 and 2023), with only four Member States showing an increase, compared with 13 Member States during the 2010–2019 period. According to various reports[28], **targeted EU legislation has contributed to these substantial reductions.**

Table 9: Total GHG emissions, average yearly growth, by Member State

Member State	1990-1999	2000-2023	2000-2009	2010-2019	2020-2023
Austria	5.4%	0.1%	0.9%	0.5%	-2.7%
Belgium	-0.9%	-1.1%	-3.0%	1.5%	-2.9%
Bulgaria	38.0%	4.0%	-13.6%	25.4%	-5.5%
Croatia	-2.3%	-2.5%	0.9%	-4.3%	-6.4%
Czech Republic	5.4%	2.9%	7.3%	-6.4%	15.1%
Denmark	4.2%	-3.5%	-3.1%	-2.9%	-5.9%
Estonia	-10.6%	4.8%	-2.9%	21.2%	-17.3%
Finland	-1.1%	-1.6%	-3.1%	0.8%	-4.2%
France	1.5%	-2.4%	-0.5%	-4.1%	-2.9%
Greece	-1.2%	10.7%	5.5%	15.0%	12.8%
Hungary	-7.5%	3.5%	-10.2%	18.7%	-0.6%
Ireland	-0.7%	-0.1%	-0.3%	1.6%	-4.0%
Italy	0.2%	-3.2%	-3.5%	-3.1%	-2.3%
Latvia	-8.4%	0.7%	3.1%	0.0%	-3.3%
Lithuania	-15.9%	24.8%	62.7%	0.6%	-9.1%
Netherlands	-4.8%	-0.7%	-3.6%	2.2%	-0.9%
Poland	14.2%	-1.6%	-1.9%	0.8%	-7.0%
Portugal	2.4%	-2.9%	-3.4%	2.2%	-14.3%
Romania	7.5%	1.4%	10.9%	-2.2%	-13.8%
Slovakia	-3.0%	-5.5%	-8.9%	-2.6%	-4.1%
Slovenia	8.2%	-3.3%	-0.1%	-8.9%	2.8%
Spain	3.9%	1.4%	-0.6%	7.2%	-7.9%
Sweden	2.9%	-2.0%	-2.8%	-2.5%	0.9%
EU 27	**-1.4%**	**-2.0%**	**-2.1%**	**-0.9%**	**-4.4%**

Source: own elaboration based on the EEA database on GHG emissions. Note: green value=decrease; red value=increase.

Excluding Germany, for which GHG emissions data are not reported in the EEA database, of the 48 million tonnes of GHG emissions recorded in the EU in 2023, 17% originate from the chemical sector in Italy, followed by France (15.8%),

[28] For instance, the EEA noted that implementation of best available techniques, as mandated by the Industrial Emissions Directive, has led to less chemical pollution. See EEA (2024*a*), and Ricardo Energy&Environment (2018). Additional benefits are from the implementation of the REACH rules. See European Commission (2018), SWD(2018) 58 final.

Spain (15.4%), the Netherlands (12.2%), and Poland (10.5%). However, when emissions are considered relative to value added (measured as tonnes of GHG emissions per 1,000 euro of value added), the highest intensities in 2023 were observed in Romania (1.94), followed by Bulgaria (1.84), Slovakia (0.96), Poland (0.93), the Czech Republic (0.91), and the Netherlands (0.85). By contrast, the lowest values were recorded in Slovenia (0.15), Sweden (0.14), Ireland (0.09), Denmark (0.08), and Estonia (0.06).

At the EU level, **the ratio of GHG emissions to value added, driven by technological improvements in key production processes, declined steadily**, from 0.85 in 2004 to 0.46 in 2020 and 0.34 in 2023. The most significant reductions were observed in Bulgaria (−10.9 tonnes of GHG emissions per 1,000 euro of value added in 2023 compared with 2004), followed by Romania (−10.6), the Czech Republic (−5.9), Croatia (−5.9), and Slovakia (−4.4).

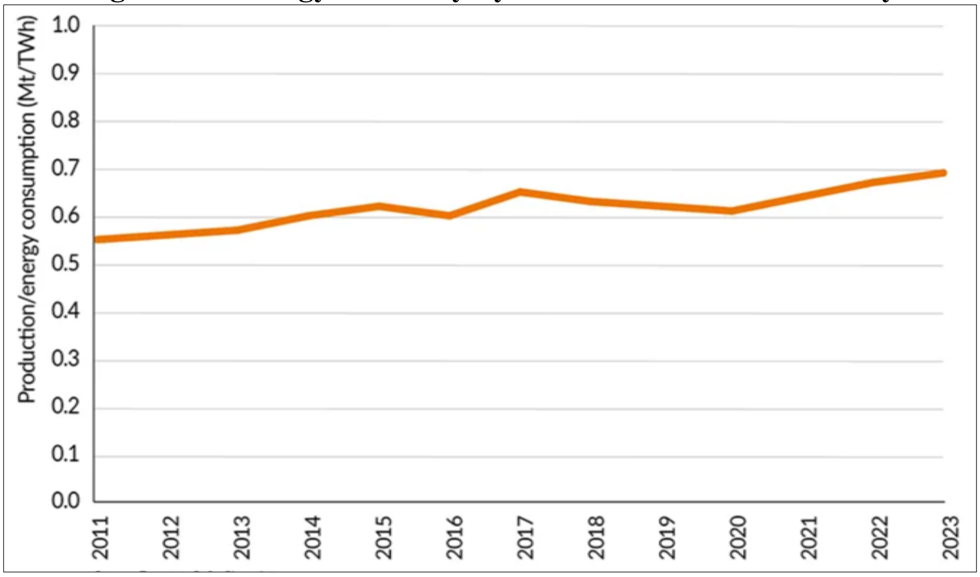
Table 10: GHG emissions (tonnes, CO_2 equivalent) per 1,000 euro of value added

Member State	2004	2010	2015	2020	2023
Austria	0.89	0.70	0.53	0.54	0.42
Belgium	0.71	0.60	0.45	0.50	0.44
Bulgaria	12.73	1.19	0.95	2.69	1.84
Croatia	6.60	2.73	1.99	1.47	0.71
Czech Republic	6.86	1.89	0.93	1.59	0.91
Denmark	0.42	0.24	0.18	0.09	0.08
Estonia	2.59	0.41	0.37	0.09	0.06
Finland	0.83	0.51	0.42	0.37	0.32
France	1.00	0.89	0.63	0.37	0.26
Greece	1.50	1.36	0.74	0.93	0.53
Hungary	0.31	0.38	0.29	0.29	0.29
Ireland	0.11	0.15	0.12	0.14	0.09
Italy	2.06	1.80	1.06	0.78	0.67
Latvia	0.97	0.52	0.63	0.26	0.24
Lithuania	1.26	1.04	0.79	0.30	0.30
Netherlands	0.81	0.72	0.65	0.83	0.85
Poland	2.51	2.40	1.74	1.45	0.93
Portugal	2.45	1.86	1.30	1.42	0.65
Romania	12.58	7.25	5.29	5.79	1.94
Slovakia	5.35	2.44	1.39	1.54	0.96
Slovenia	0.72	0.37	0.22	0.16	0.15
Spain	1.21	0.80	1.23	1.10	0.79
Sweden	0.42	0.28	0.15	0.16	0.14
EU27	**0.85**	**0.66**	**0.50**	**0.46**	**0.34**

Source: own elaboration based on EEA database on GHG emissions and CEFIC, 2025 Facts and Figures (value added). Note: green value=above the EU level; red value=below the EU level.

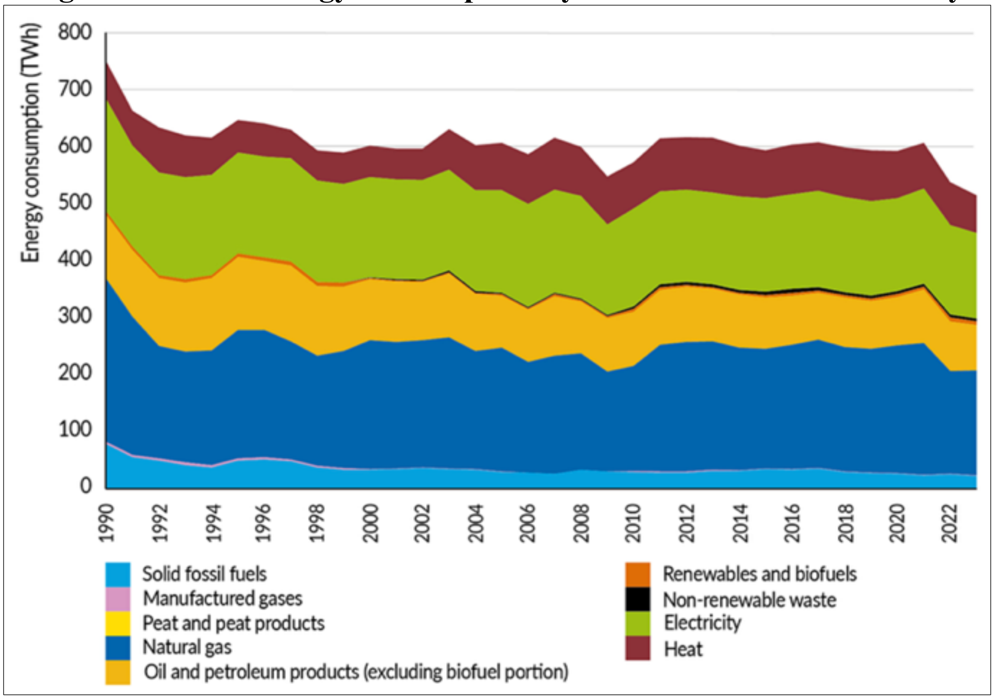
A **key factor in reducing GHG emissions is improving energy efficiency in the energy-intensive chemical sector**. According to CEFIC[29], natural gas and electricity remain the primary energy sources (as of 2022), accounting for 37% and 29%, respectively. The use of oil and petroleum products decreased gradually over the last two decades to around 15%. Energy consumption from solid fossil fuels, which was relatively low in the 1990s, decreased further by 2022, accounting for only 5% of energy consumption sources.

Figure 16: Energy efficiency by the EU27 chemical industry



Source: reproduced from CEFIC (2025d), Sustainability Performance – Industry Data, online

Figure 17: Final energy consumption by the EU27 chemical industry



Source: reproduced from CEFIC (2025d), Sustainability Performance – Industry Data, online

[29] CEFIC (2025*d*).

2.1.5.b Hazardous chemicals and PFAS

The production and consumption of various chemicals that are harmful to human health in the EU have decreased over time. In absolute terms, total EU production of chemicals that are hazardous to health[30] declined notably from 235.7 million tonnes to 171.8 million tonnes over the 20-year period from 2004. Similarly, the consumption of these chemicals decreased from 242.6 tonnes in 2004 to 169.7 tonnes in 2024. Furthermore, the total EU production of chemicals hazardous to the environment[31] (which may overlap with chemicals hazardous to health) decreased from 83.1 to 66.4 million tonnes in the same period. In terms of consumption, the value in 2024 was 53.2 tonnes, down from 84.1 tonnes in 2004.

Table 11: Production of hazardous chemicals in the EU

Type of chemicals	2004	2010	2015	2020	2024
Hazardous and non-hazardous, total production (million tonnes)	295.4	277.6	260.4	251.4	223.7
Hazardous to health (% of total production)	79.8%	78.5%	76.9%	77.9%	76.8%
Most harmful substances (% of hazardous to health)	*23.2%*	*24.1%*	*21.7%*	*23.4%*	*25.9%*
Substances of concern (% of hazardous to health)	*11.5%*	*11.2%*	*10.7%*	*10.7%*	*10.9%*
Other hazardous substances (% of hazardous to health)	*65.3%*	*64.7%*	*67.6%*	*65.9%*	*63.2%*
Hazardous to the environment (% of total production)	28.1%	28.2%	27.6%	28.1%	29.7%
Most harmful substances (% of hazardous to the environment)	*1.9%*	*2.0%*	*2.0%*	*1.4%*	*0.8%*
Substances of concern (% of hazardous to the environment)	*85.4%*	*86.5%*	*85.9%*	*87.6%*	*89.0%*
Other hazardous substances (% of hazardous to the environment)	*12.6%*	*11.5%*	*12.1%*	*11.0%*	*10.3%*

Source: own elaboration based on Eurostat [env_chmhaz], Chemicals production and consumption statistics, online.

However, while these trends are consistent with an industry shift towards non-hazardous alternatives, **the share of chemicals hazardous to health in the EU's total chemicals production decreased only slightly**, from approximately 79.8% in 2004 to 76.8%% in 2024. Over the last ten years, the decrease was marginal, at just -0.1% from 2015 to 2024. Regarding **the share of chemicals hazardous to the environment, the value increased** from 28.1% in 2004 to 29.7% in 2024 (a 2.1% increase since 2015). Furthermore, while production of the most hazardous

[30] These chemicals are divided into 3 groups: *most harmful substances for human health* are those that can cause cancer, genetic mutations in germ cells, reproductive harm, disrupt endocrine functions, or lead to organ damage with repeated exposure at low levels or respiratory sensitisation; *substances of concern for human health* are those suspected of causing cancer, genetic mutations in germ cells, reproductive harm or endocrine disruption, or those that can cause organ damage following acute exposure or repeated exposure at moderate levels) or skin sensitisation; *hazardous substances for human health* include chemicals that pose acute risks via skin, inhalation, or dermal exposure, can cause skin and eye irritation/corrosion, or present aspiration hazards. These definitions are based on Eurostat, *Chemicals production and consumption statistics*, online.

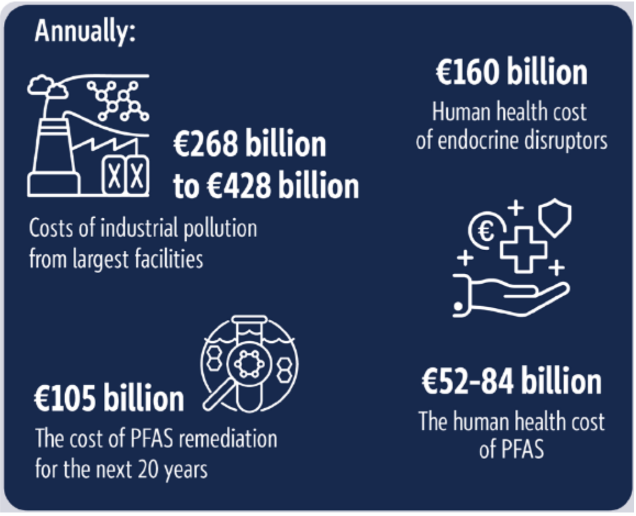
[31] These chemicals are divided into 3 groups: *most harmful substances for the environment* include chemicals that are persistent, bioaccumulative (or mobile) and toxic, have endocrine-disrupting effects, or pose hazards to the ozone layer; *substances of concern for the environment* are chemical substances that pose a threat to ecosystems, including those that are chronically toxic to aquatic life and suspected endocrine disruptors; *hazardous substances for the environment* are chemical substances that cause acute harm to aquatic organisms. These definitions are based on Eurostat, *Chemicals production and consumption statistics*, online.

chemicals to health (carcinogenic, mutagenic and reprotoxic (CMR) chemicals) decreased by 10.1 tonnes between 2004 and 2024, this decrease was relatively low compared with the other two categories of chemicals hazardous to health (i.e. substances of concern and other hazardous substances). Consequently, the relative weight of CMR substances rose to 25.9% of total chemicals hazardous to health in 2024, against 23.2% in 2004.

Therefore, **despite notable progress, there is still a significant production (and consumption) of various chemicals known to be harmful to human health**[32]. Moreover, chemical production in the EU is still responsible for[33]:

- *Water contamination*: only 29% of EU surface waters have a favourable chemical status, primarily due to the presence of persistent pollutants like mercury and brominated flame retardants.
- *Groundwater contamination*: 77% of groundwater areas meet good chemical standards, leaving 23% in poor condition due to ongoing contamination.
- *Soil degradation*: the use of synthetic chemicals continues to degrade soil health, with residues of banned pesticides and persistent organic pollutants still detected.
- *Microplastic accumulation*: between 31,000 and 42,000 tonnes of microplastics accumulate annually in EU farmland soils, largely through sewage sludge.

Figure 18: Key figures on chemicals pollution and health costs



Source: reproduced from European Parliament (2025), p.4.

Estimates indicate that the current external cost of industrial air emissions (from the largest facilities) totalled between EUR 2.7 and EUR 4.3 trillion, averaging between EUR 268 and EUR 428 billion per year[34]. However, this external cost has decreased consistently (-33%) over the last decade. Regarding the chemical sector specifically, a 2019 study estimated that human exposure to PFAS substances results in EUR 52-84 billion in annual health-related costs across Europe[35]. Estimates of the human health cost

[32] EEA (2024*b*).

[33] United Nations Environment Programme Finance Initiative (2025), *Transitioning the EU Chemical Sector - Policy levers to support viability and increase sustainable finance*, p.3.

[34] EEA (2024*c*).

[35] Nordic Council of Ministers (2019).

of endocrine disruptors[36], indicate an annual burden exceeding EUR 160 billion[37]. More recently, a European Commission report (January 2026)[38] identified four possible scenarios for the health costs from PFAS. These range from EUR 39.5 billion in 2024, decreasing to EUR 29.4 billion by 2050 under the business-as-usual scenario (Scenario 1), to zero by 2050, in the case of a complete ban on the production and use of PFAS (Scenario 4). The report concludes that **the overall present value of the health costs of PFAS over the assessment period (2024–2050) ranges from EUR 260 billion** (Scenario 1) **to EUR 360 billion** (Scenario 4).

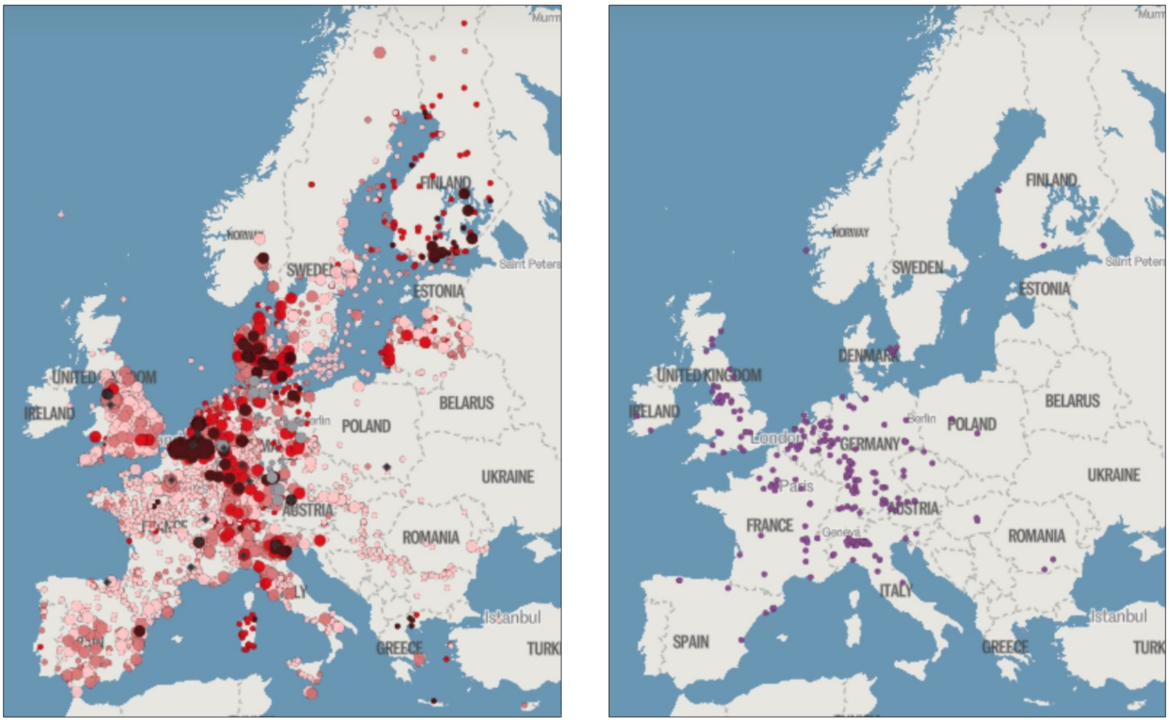
2.1.5.c Remediation costs and solutions

The Forever Pollution Project[39] has estimated that **there are around 23,000 PFAS-contaminated sites in Europe**, and, of these, approximately 2,300 are ‘hotspots’ with elevated levels of pollution that may pose a threat to human health. The analysis also mapped 20 PFAS producers (i.e. chemical plants synthesising PFAS, which are then used in many sectors) and 232 PFAS users (industrial sites using PFAS to manufacture "high-performance" plastics, paints and varnishes, pesticides, waterproof textiles, and other chemicals). The highest number of PFAS-contaminated sites was found in Belgium (6,791), the Netherlands (4,989), Italy (2,726), Denmark (2,161), Germany (2,032) and France (1,067). However, these numbers may be underestimated, as much remains unknown about the true extent and potential impact of PFAS contamination on surface and groundwater[40], underscoring **the need for more monitoring data to support an effective assessment**[41].

[36] Endocrine disruptors are chemical substances found in numerous products that interfere with our hormonal systems. They are found in food, wrapping, cleaning products, cosmetics, furniture, and so on. The connection between exposure to these substances and a large number of disorders such as cancer, diabetes, obesity, infertility, and brain development problems has been clearly established. See Dupré M. (2017).
[37] Trasande L. *et al.* (2016).
[38] European Commission (2026*a*).
[39] https://foreverpollution.eu/
[40] Grunfeld D.A. *et al.* (2024).
[41] European Commission (2021).

Figure 19: Maps of contamination sites across Europe[42]

Known contamination sites *Known PFAS users*



Source: reproduced from Forever Pollution Map - Forever Pollution Project [*online*]. *Left map: 10-100 ng/kg; 100-1,000 ng/kg; 1,000-10,000 ng/kg; >10,000 ng/kg; Unknow; ♦ PFAS manufacturing facility.*

A further analysis conducted by the European Environment Agency (EEA)[43] provided a comprehensive overview of PFAS pollution in European waters. Based on approximately 1,300 monitoring sites across Europe, the results for 2022 showed that concentrations exceeded the limits at 59% of river sites, 35% of lake sites, and 73% of sites in transitional and coastal waters. At the country level, data collected by the EEA indicated significant variability across Europe. The proportion of water bodies reportedly exceeding the environmental quality standards (EQS) ranged from 100% in Belgium and France, 96% in the Netherlands, 83% in Germany, 54% in Italy to less than 20% in Spain (18%), Ireland (6%), Poland (5%), Croatia (5%) and Estonia (2%). Bulgaria, Latvia and Montenegro reported no sites exceeding the EQS.

To support the transition to net-zero emissions in the EU chemicals industry, it is estimated that approximately 53% of primary chemical production capacity will require reinvestment by 2030, amounting to more than EUR 1 trillion by 2050[44]. To achieve this, capital expenditure in the chemicals sector would need to increase by around 50% compared with business-as-usual levels.

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[42] The maps include 'known contamination sites' (i.e. sites where PFAS have been detected) and 'known PFAS users' (i.e. industrial sites for which there is evidence of PFAS use). The Forever Pollution Project also maps 'Presumptive contamination site', i.e. on the basis of scientific investigations and expert advice, not confirmed by testing. See on-line.

[43] EEA (2024*d*).

[44] Climate Bonds Initiative (2023). See also Agora Energiewende (2020), SRIA (2021), and Accenture and NexantECA (2022).

Moreover, **a mix of different technologies is required, as only part of the net-zero target can be achieved through energy efficiency, bio-based feedstocks, and material loop closure.** This highlights the need for solutions such as hydrogen, carbon capture, and electrification[45]. As indicated in box 3 below, multiple solutions are already available (and being adopted across the EU[46]) from which the chemical sector can choose. However, each of these options entails high investment costs and specific challenges that may hinder large-scale deployment.

Moreover, a recent analysis by the Forever Pollution Project[47] calculated that **the cost of cleaning up PFAS contaminated sites is around EUR 100 billion annually for European countries (nearly EUR 86 billion for the EU27)**[48], corresponding to EUR 2 000 billion over the next two decades. Of the EU27 total costs, 20.2% is concentrated in Germany, followed by France (14.3%), Spain (12.3%), Italy (11.9%) and Poland (7.7%). The recent report published by the European Commission[49] provides similar estimates, at up to EUR 80.2 billion for the EU27 in 2024 and EUR 75.4 billion in 2050 under scenario 3 (i.e. compliance with the EQS levels proposed by the European Commission for achievement from 2030). This **totals a present value of EUR 1.480 billion over the 2024-2050 assessment period**.

Table 12: Costs of PFAS remediation, by country, EUR million (emerging scenario)[50]

Country	WW* sludge applied to compost/ag fields	WW* effluent - plants greater than 4000 m3/day	Landfill leachate - all leachate	Drinking Water - treat all reported large supply zones for TFA**	Future soil contamination	Ongoing annual costs
Austria	368	1 799	3	363	250	2 783
Belgium	145	1 100	3	371	434	2 053
Bulgaria	87	312	1	Not estimated	221	621
Croatia	51	276	0.28	135	91	553
Cyprus	27	26	0.06	25	95	173
Czech Rep.	670	976	3	211	187	2 047
Denmark	413	768	1	19	115	1 316
Estonia	86	124	0.16	33	121	364
Finland	540	477	1	207	493	1 718

45 Deloitte (2021).

46 For instance, CEFIC has mapped 219 projects across 18 different EU Member States, available online.

47 See the Forever Pollution Project, online.

48 The estimates obtained by the Forever Pollution Project also include Norway (EUR 1,5 billion), Iceland (EUR 135 million), the UK (EUR 11,8 billion) and Switzerland (EUR 1,4 billion).

49 European Commission (2026*a*).

50 The estimates provided by the Forever Pollution Project consider: one 'legacy' scenario, where emissions cease immediately and only legacy PFAS – long-chain PFAS that received the first regulatory attention for restriction and phase out (such as PFOS and PFOA) – are remediated, implying a cost of about EUR 95 billion over 20 years; and one 'emerging' scenario, where emissions continue and remediation efforts include short-chain and ultra-short chain PFAS, like TFA, which are difficult to deal with, implying a cost increase rise to around EUR 2 trillion over the next 20 years. See the Forever Pollution Project, online.

France	3 005	4 021	14	2 800	2 424	12 264
Germany	2 947	8 906	24	2 607	2 912	17 396
Greece	122	533	1	446	471	1 573
Hungary	728	623	4	334	166	1 855
Ireland	202	523	1	406	93	1 225
Italy	1 389	5.773	5	1 692	1 345	10 204
Latvia	64	96	0.40	46	59	265
Lithuania	107	148	1	80	158	494
Luxembourg	27	83	0.09	23	2	135
Malta	0	14	0.03	27	29	70
Netherlands	27	1.588	3	692	395	2 705
Poland	2 331	2 438	14	1 139	726	6 648
Portugal	386	1.257	2	550	321	2 516
Romania	695	750	3	574	247	2 269
Slovakia	113	522	1	98	50	784
Slovenia	66	181	0.25	100	118	465
Spain	3 563	4 264	13	1 744	964	10 548
Sweden	682	1 016	1	173	1 042	2 914
Total EU27	**18,841**	**38,594**	**99**	**14,895**	**13,529**	**85,958**
Total Europe*	***21,195***	***45,759***	***131***	***18,013***	***15,699***	***100,797***

Source: own elaboration based on data provided by the Forever Pollution Project, online.
*Note: *Wastewater ** Trifluoroacetic acid ***EU27 + Norway, Iceland, the UK and Switzerland.*

Box 3: Key technological options to reduce GHG emissions in the chemical sector and related challenges[51]

The key technological options to reduce GHG emissions can be grouped into **alternative energy carriers and sources,** and **circular carbon feedstocks** to close the carbon loop.

Alternative energy carriers and sources:

• **Electrification** refers to the implementation of technologies that power chemical processes with electricity instead of fossil fuels. Electricity can indirectly supply low-temperature chemical processes (e.g. via steam or heat production) using existing technologies such as electric boilers. However, technologies for the high-temperature processes (above 500 °C) required for electric crackers, electric steam methane reforming, and furnaces are still under development and need improvements in efficiency, selectivity, and scalability. In addition to power-to-heat applications, electricity can be used directly in electrochemical processes (e.g. conventional chlorine production) and/or through unconventional energy forms (e.g. plasma).

The high cost of electricity and the substantial investments required for large installations call for effective risk-sharing mechanisms to cope with higher production costs. Moreover, progress in industrial electrification critically

[51] Based on CEFIC, *Technologies for a climate-neutral chemical industry and barriers facing their implementation*, on-line.

depends on the availability of abundant, affordable, renewable and low-carbon electricity.

• **Renewable and low-carbon hydrogen** can serve as a clean energy carrier in the chemical sector. Hydrogen-fired process options include steam cracking and naphtha reforming. Hydrogen carriers such as ammonia and liquid organic hydrogen carriers (LOHCs) offer solutions for hydrogen storage and import, and ammonia can also be used directly for steam and heat production.

However, retrofitting existing facilities to use hydrogen for high-temperature processes presents challenges, including the management of air pollutant emissions. Technologies to efficiently convert LOHCs back into hydrogen, or directly into (electrical) energy, need to be further developed and optimised. In addition, the high energy cost of producing renewable and low-carbon hydrogen remains a major barrier to its deployment. Finally, the rollout of hydrogen as an energy carrier relies heavily on the availability of a dedicated transport and storage infrastructure, streamlined permitting processes, suitable feedstock, and affordable renewable or low-carbon electricity.

• **Steam and heat generated from biomass and small modular nuclear reactors** (SMRs) offer alternative low-carbon pathways for heat and steam production. Biomethane can replace natural gas in existing systems, and various bio-based materials can be used in biomass-fired units. SMRs are advanced nuclear systems with a modular design capable of delivering low-carbon electricity and/or high-temperature steam and heat at scale and with consistent output.

Key challenges include the limited availability of sustainably sourced biomass at competitive global prices and the substantial capital investments required to deploy SMRs at industrial sites.

Circular carbon feedstock to close the carbon loop:

• **Bio-based feedstock** such as plant matter, agricultural residues, and bio-waste can be used to produce chemicals and polymers with a lower carbon footprint. Many platform chemicals (e.g. ethanol), fine chemicals, and polymers can be derived from biomass (non-fossil material of biological origin, including plants and animal by-products). Various biochemical and biotechnological processes, and their combinations, can be applied to biomass conversion, pre-treatment, and downstream operations.

However, since many conversion technologies still need to be developed and demonstrated at scale, R&I are required to improve yields, intermediate molecule production, chemical transformation, and separation techniques. Moreover, biomass conversion processes are novel, require the construction of new production facilities, and must compete with highly optimised conventional processes supported by existing infrastructure. Higher raw material costs relative to fossil feedstocks, low energy density, geographical dispersion, and an insufficient transport infrastructure—particularly in remote areas—also pose significant challenges. Finally, the limited availability of sustainably sourced biomass at competitive world market prices constrains the production of bio-based chemicals.

• **CO2** can be used **as a circular carbon feedstock** for producing chemicals and polymers with a reduced carbon footprint compared to conventional routes. Several technologies—such as liquid solvent, solid sorbent, membrane, and cryogenic processes—are available for CO2 capture and purification from industrial point sources. A wide range of catalytic, electrochemical, and biotechnological processes can then be used to produce platform chemicals (e.g. methanol, ethanol), fine chemicals, and polymers.

Key challenges include scaling up and reducing the cost of capture and purification technologies, as well as improvements in energy efficiency, selectivity, and scalability of CO2-to-chemicals processes. The higher cost of CO2-based products remains a major barrier to investment, and these processes must compete with established, highly optimised production routes. Furthermore, producing large volumes of chemicals from CO2 would require substantial amounts of renewable or low-carbon hydrogen and electricity.

• **Waste as a feedstock** can be used as an alternative carbon feedstock to produce chemicals and polymers with a lower carbon footprint. Technologies include dissolution processes to recover clean polymers from sorted plastic waste, depolymerisation processes to convert clean waste into monomers, and pyrolysis or gasification (chemical recycling) for hard-to-recycle mixed plastic waste, producing pyrolysis oil or syngas.

Key challenges involve managing contaminants in waste streams and optimising process yield, energy efficiency, and industrial scalability. Chemical recycling technologies also face competition from well-established linear-economy processes. Higher production costs and limited market demand for recycled-content chemicals and polymers hinder investment. In addition, large-scale deployment requires adequate European infrastructure for the collection and sorting of plastic waste that is currently incinerated, landfilled, or exported.

Other solutions include **hydrogen production via alternative routes**, such as water electrolysis (already commercially available) or methane pyrolysis (currently in the demonstration phase), both of which depend heavily on infrastructure availability and competitive electricity prices. Further options include **process optimisation** - such as advanced separation technologies (e.g. alternatives to distillation, integrated reactive and hybrid separation processes) - which require substantial investment in R&I as well as high capital expenditures.

2.2 Key challenges and barriers

Based on the data analysis presented in the previous section, together with additional desk research, this section identifies and discusses the key challenges and barriers affecting the competitiveness and resilience of the EU chemicals sector.

These challenges are closely interrelated. The main challenge currently facing EU chemical companies and the regions in which they are located stems from international competition, which is eroding Europe's share of the global market. The growing weakness in the EU chemicals industry's competitiveness is primarily linked to higher production costs relative to competitors in international markets. These costs depend on several factors, including higher energy prices, higher labour costs, higher regulatory compliance costs (particularly those related to the EU environmental regulatory framework), and fluctuations in transport and logistics costs. These factors particularly affect SMEs, which make up the vast majority of enterprises in the chemical sector and face greater difficulties implementing new business models or adapting production processes to compete internationally.

Moreover, despite opportunities for the EU chemicals sector to restore its competitiveness by playing a key role in innovation and sustainable development—supporting decarbonisation and the transition to a circular economy—the costs of pollution remediation and the adoption of green technologies remain extremely high for most EU enterprises and related regions. **A considerable risk for the EU chemicals sector is that, in the absence of a structured policy framework and active measures, facility closures will continue, with significant repercussions on the labour market, particularly in regions where the chemicals sector is a major driver of employment and a key supplier to other manufacturing industries.**

Based on the analysis of the main challenges facing the EU chemicals sector (see table below), several key risks for the local economies and their consequent potential impact on LRAs have been identified.

Tale 13: Key challenges and related risks for local economies and the impact on LRAs

Identified challenge	Risks for local economies	Impact on LRAs
Increased international competition	• Increasing competition and global overcapacity diminish the capacity of local companies to enter new markets, negatively affecting revenues and production profitability. • Import substitution—especially from China—can reduce demand for local production, particularly for polymers and intermediates, which largely rely on local demand.	• Risks of closures, with consequent impact on unemployment and increasing social costs.

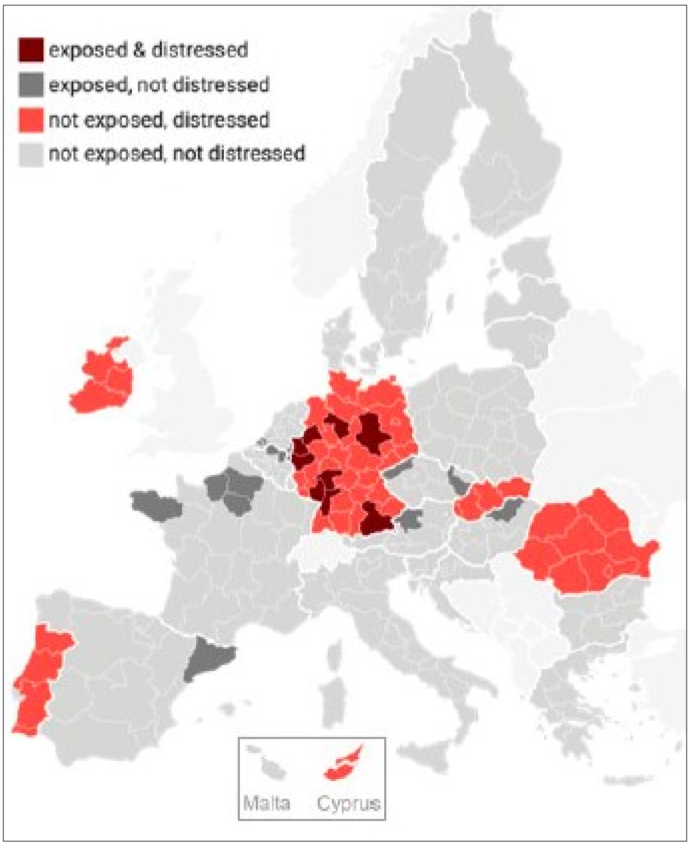
	• The increasing use of chemical raw materials imported from countries with weak environmental regulatory frameworks may raise the consumption of hazardous substances.	• Impact on the local environment and human health, with rising costs for environmental and health protection and remediation.
High production costs	• While energy prices affect all regions, those more specialised in upstream chemicals may be more severely impacted, as production is energy- and capital-intensive. • Regions more specialised in downstream chemicals may be more affected by labour costs, as production in these segments is more labour-intensive.	• Risks of closures, with consequent impact on unemployment and increasing social costs.
	• Full electrification of the chemical sector remains highly dependent on regional electricity prices, which vary significantly across EU regions.	• Higher costs for improving energy infrastructure.
	• Increasing or volatile logistics and transport costs have a greater impact on companies located in regions far from transport and trade hubs.	• Higher costs for improving transport infrastructure.
Size of enterprises	• Regions with a higher presence of small companies may be more affected by a decline in the chemical sector, even when these companies only use chemicals as production inputs. • The closure of large companies may severely affect smaller enterprises operating along the value chain, particularly within regional clusters.	• Risks of closures, with consequent impact on unemployment and increasing social costs.
	• A high concentration of small companies may expose local economies more severely to the negative effects of international competition, as these companies may face more difficulties in innovating and digitalising.	• Higher investments are needed for innovation/digital infrastructure and to attract and retain skilled workers.
Complying with EU regulations	• In regions specialised in chemicals, higher regulatory costs may reduce profitability and investment capacity, delay or discourage new projects, and increase the risk of plant closures, particularly for small companies. • Regions with energy-intensive chemical clusters may face greater challenges in complying with the ETS, carbon pricing mechanisms, and decarbonisation pathways.	• Risks of closures, with consequent impact on unemployment and increasing social costs.

	• Bottlenecks in permitting procedures can slow down investments and innovation. • Increasing regulation may lead to disharmonised implementation and uneven compliance, creating an uneven investment landscape across EU regions. • Timing issues and regulatory uncertainty can complicate long-term planning for both enterprises and regions.	• LRAs may be understaffed or lack the technical expertise needed for permissions and inspections, thus necessitating training and upskilling.
High costs for pollution remediation	• The presence of contaminated sites may reduce investment attractiveness. • Limited access to affordable low-carbon energy and related infrastructure imply higher remediation costs.	• Higher investment costs for cleaning up contaminated sites.
	• Investing in new green technological infrastructure entails higher capital and operating costs than fossil fuel-based alternatives.	• Higher investment costs for green technology infrastructures.
Risks of additional site closures	• Risk of losing integrated industrial ecosystems if anchor firms relocate or shut down operations. • Site closures risk further reinforcing regional vulnerabilities and destabilising European industry and regional industrial ecosystems/clusters.	• Higher social costs and investment needed for reindustrialisation and specialisation differentiation.
	• Plant closures may lead to increased imports of chemicals with highly embedded CO_2 emissions from countries with less stringent environmental standards.	• Impact on the local environment and human health, with rising costs for environmental and health protection and remediation.

As outlined in a recent analysis by the European Commission on industrial vulnerability across EU regions[52], **22 regions in 6 Member States are exposed to the decline in the chemicals sector and are in distress**[53]**. 9 of these regions, all located in Germany, are both exposed and economically distressed.** Among these, the Rheinhessen-Pfalz region stands out as particularly affected by the decline. The region is home to BASF's headquarters in Ludwigshafen which recently announced facility closures (see section 2.2.6).

An additional report[54] highlighted that **industrial activities, such as chemical production, are among the sectors most vulnerable to decarbonisation in the EU.** This analysis further indicates that **regions in eastern and southern EU Member States generally exhibit greater vulnerability to decarbonisation**, regardless of the economic sector.

Figure 20: Regional exposure to chemicals industry's decline



Source: reproduced from European Commission (2025b), p.18.

Box 4: Notes from interviews

- *"The current critical situation (tipping point) appears to be the war in Ukraine. Due to the high energy costs in the early stages of integrated production, European producers are currently more expensive than their competitors (at least until these costs are traded internationally or offset)."*
- *"China has become competitive in areas that were previously dominated by the EU"*
- *"Another major challenge is the regulatory burden and its complexity. This includes extensive rules, such as those related to the ETS, the circular economy, and many other*

[52] European Commission (2025), *Mapping the impact of industrial decline on European regions - Single Market Economics Briefs.*

[53] The 'distress' indicator is a composite index based on the weighted average of the four components: production change (since 2019); employment change (since 2019); current employment expectations according to surveys; change in competitive position according to surveys (since 2019). See European Commission (2025), *Mapping the impact of industrial decline on European regions - Single Market Economics Briefs*, pp.12-13.

[54] Coppola, G. and Shayegh, S. (2024), *Report on vulnerability of EU economic sectors and businesses at NUTS-2 level*, Deliverable 7.1.

regulatory frameworks. There are numerous regulations with different requirements, which create significant complexity to the point that it is extremely difficult for companies to fully understand and implement them all. This complexity is particularly challenging for SMEs, which often lack the resources to manage the full scope of regulatory and environmental requirements."

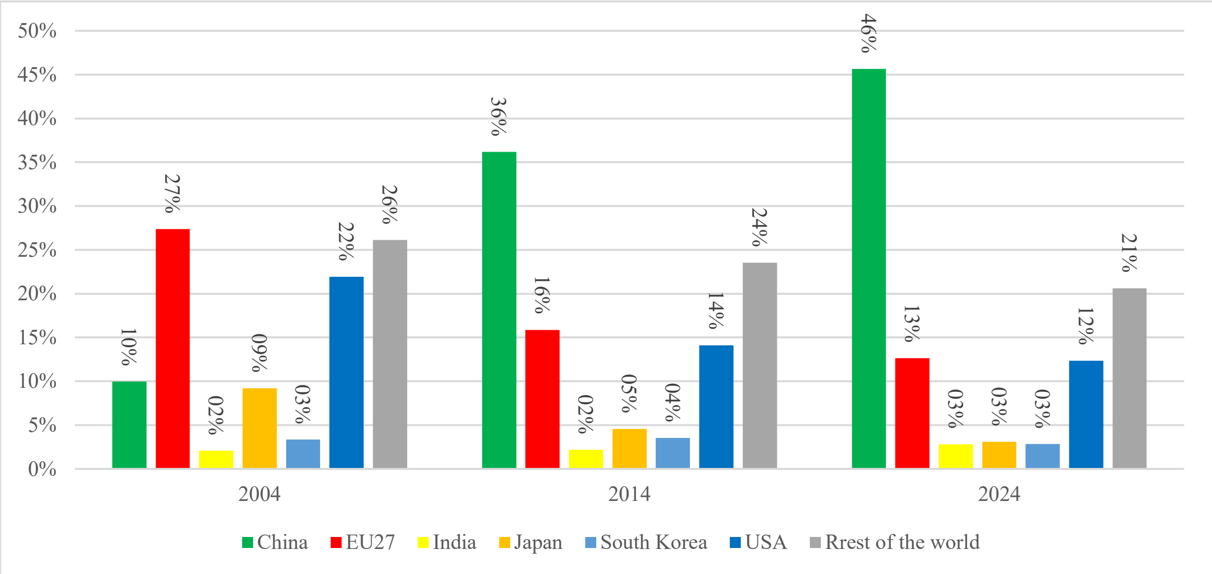
• *"There is a gap between policy ambitions and the practical pace of the transition, particularly in areas such as the low-carbon economy, the circular economy, waste management, and recycling. While strong strategies exist at the policy level, implementation at the regional level is often much more difficult. This may be due to a lack of adequate infrastructure or mismatches in skills and competencies."*

• *"International competitive pressure, the regulatory complexity associated with the Green Deal and the implementation of environmental standards, and the difficulty in sourcing specialised skills—particularly in the fields of sustainability, digitalisation, and technological scale-up—represent cross-cutting obstacles to growth."*

2.2.1 Increased international competition

The EU chemicals industry **is facing several trends that are reshaping the global chemical landscape and eroding its market share in world chemical trade**. Weaker growth in export markets and the decline in the EU's market share have been driven by several factors, including China's rapid economic expansion, the rise of cheap shale gas in the USA, the economic diversification of the Gulf States, and the growing presence of India and Southeast Asia in specific segments (e.g. fine chemicals)[55].

Figure 21: Evolution of market shares over total world chemical sales



Source: own elaboration based on CEFIC, 2025 Facts and Figures.

As per Section 2.1.3, the EU experienced a gradual erosion of its market share in world trade between 2004 and 2024, characterised by a rising share of imports

[55] CEFIC (2025*a*), p.74.

and a declining share of exports. Overall, **the EU's global market share in terms of nominal sales declined significantly**—by around 15 percentage points—from 27.4% in 2004 to 12.6% in 2024. Compared with the USA, the EU's decline has been more pronounced. In contrast, China's rise in global sales has been dramatic, increasing from 10% in 2004 to nearly 46% in 2024.

China is the primary competitor to the EU chemicals industry, having outperformed the global chemicals industry over a 20-year period. Between 2002 and 2022, China accounted for close to 25% of the increase in global industry market capitalisation[56]. Moreover, in almost every major chemical segment, from polyurethanes to coatings, at-scale Chinese players are competing in both domestic and global markets. China's success was officially recognised in 2024, when it became the world's leading exporter of chemical products, surpassing both the USA and the EU[57]. The country's accelerated drive for self-sufficiency—driven by economic and geopolitical forces—may further reshape trade flows across many value chains in the coming years. For example, by 2028 China is expected to add more than 20 million tonnes to its annual polyethylene capacity, while its annual demand is projected to increase by less than 10 million tonnes[58].

Box 5: Notes from interviews

"China has a large production capacity that cannot be absorbed in its domestic market, so it exports abroad. At present, due to US tariffs, China cannot sell its chemical products to the USA. As a result, China is looking for alternative markets to absorb even more of its production, and Europe is a key destination."

Beyond China, **other new Asian markets** such as India and Thailand **are also threatening the EU chemicals industry**. Accounting for about 10% of global chemicals industry capitalisation, this region has benefited from strong economic ties with the USA and Western Europe, geographical proximity to the Chinese market, a young and increasingly well-educated workforce, and—in some countries—a low-cost feedstock position stemming from proximity to hydrocarbon resources in or around the South China Sea[59].

Additional challenges come from the Middle East. Although accounting for a relatively small share of global chemical market capitalisation (around 3–4%), the region's chemicals industry has performed strongly in recent years. This has been driven by a domestic push to monetise hydrocarbon resources through greater participation in downstream value chains—notably petrochemicals and plastics—as well as by efforts from Asian and European speciality chemical companies to enhance supply security by sourcing more basic chemicals from the Middle East.

[56] Ezekoye O. *et al.* (2023).
[57] Bidoia L. (2025).
[58] Lorbeer C. and Ezekoye O. (2024).
[59] Ezekoye O. *et al.* (2023).

Finally, the **USA still represents a significant competitor to the EU chemicals industry due to several long-standing advantages**, such as low energy and feedstock costs, a large domestic market, and a skilled workforce. However, similarly to the EU, exports from the USA to Asia may become less attractive as the region—particularly China—becomes increasingly self-sufficient.

As shown in the next section, production costs and compliance with the EU legislative framework are key bottlenecks that have led the EU to lose its position in the global chemicals industry.

2.2.2 High production costs

Compared to its key competitors (the USA and China), EU chemical companies face higher production costs. Despite some indications of a decrease, production costs in the EU in 2024 remained higher (19%, after a peak of 30% in 2022) than in 2021. This increase was larger than that in the USA (9%) and contrasted with the trend in China, which was down (-6%). In 2024, the situation was particularly critical (above the average EU) in Germany and Romania (20%), the Czech Republic and Latvia (21%), Finland and Slovenia (23%), Belgium (29%), Sweden (33%), Austria (37%) and Hungary (71%).

Table 14: Producer price, 2021=100

Country	2004	2014	2020	2021	2022	2023	2024
Austria	62	84	81	100	137	141	137
Belgium	54	88	76	100	149	143	129
Bulgaria	50	78	79	100	154	129	118
Croatia	65	95	89	100	106	102	99
Czech Rep.	67	97	76	100	135	123	121
Denmark	69	96	97	100	108	114	114
Estonia	70	94	79	100	134	108	107
Finland	64	91	88	100	133	131	123
France	74	93	84	100	137	120	114
Germany	72	92	91	100	125	124	120
Greece	78	98	98	100	109	111	113
Hungary	34	68	74	100	151	164	171
Ireland	76	95	98	100	144	129	112
Italy	73	91	92	100	122	120	115
Latvia	47	81	88	100	124	122	121
Lithuania	80	108	79	100	151	116	111
Netherlands	63	92	74	100	131	118	115
Poland	62	85	87	100	135	125	119
Portugal	71	90	86	100	128	116	113
Romania	56	88	84	100	148	131	120
Slovakia	68	84	88	100	123	121	119
Slovenia	64	94	94	100	115	124	123

Spain	60	85	83	100	125	114	113
Sweden	58	77	89	100	131	137	133
EU27	67	90	86	100	130	123	119
USA	*57*	*87*	*85*	*100*	*115*	*112*	*109*
China	*75*	*88*	*84*	*100*	*108*	*98*	*94*

Source: own elaboration based on CEFIC, 2025 Facts and Figures.

2.2.2.a Energy prices

As an energy-intensive industry, **the higher costs borne by EU producers primarily stem from higher energy prices**. Although energy costs have normalised significantly in recent years since the surge following Russia's war in Ukraine in 2022, **they are expected to remain higher for Europe in the next years than for other international competitors**. Natural gas prices are projected to be two to three times higher in 2030 than in the USA, electricity costs 1.5 to 2 times higher, and crude oil prices are expected to remain higher than in China and India due to discounted Russian oil supplies, with an estimated gap of 5–10%.[60].

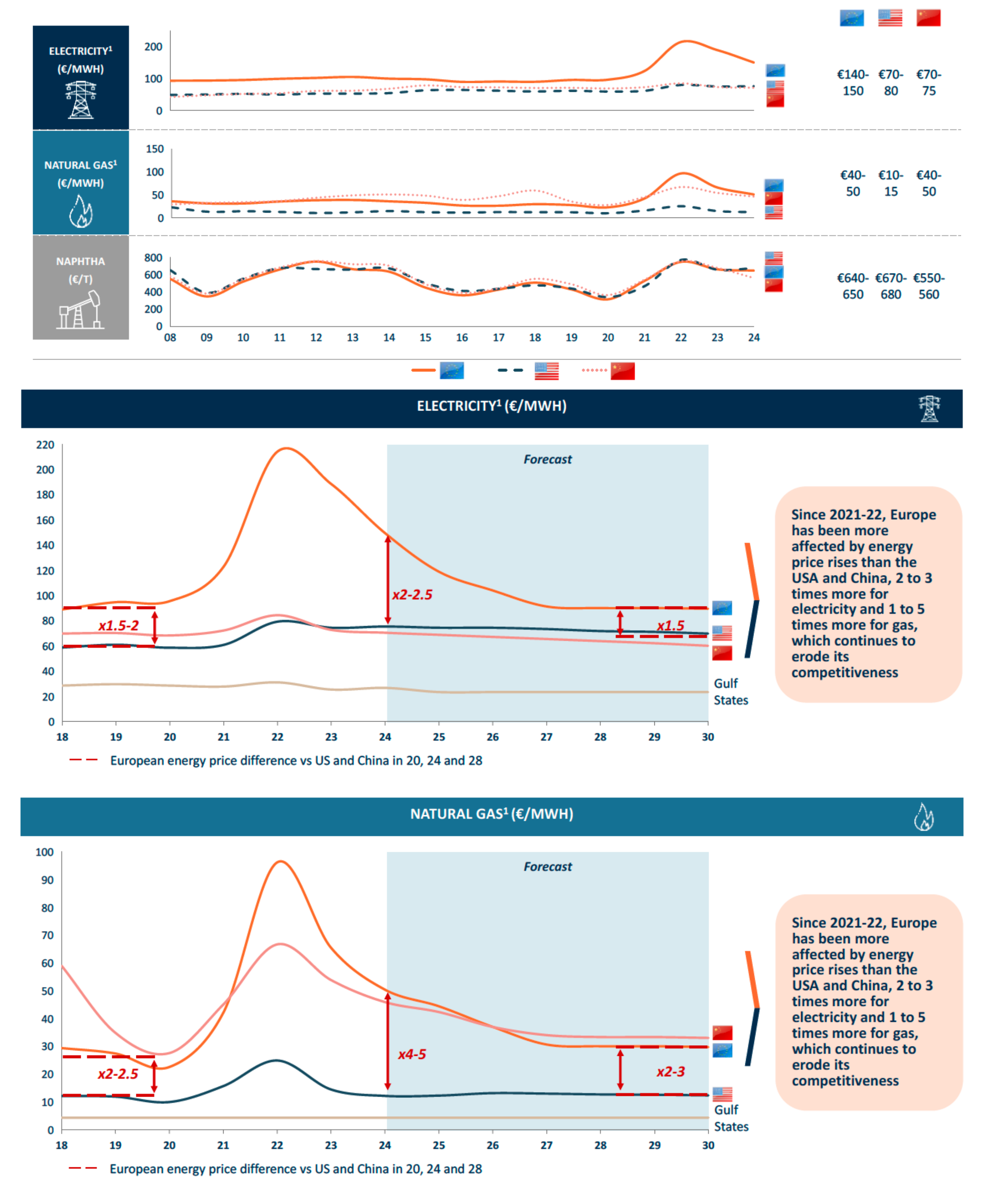
Box 6: Notes from interviews

> *"At present, the main challenge is energy prices, which are much higher than those in the USA and the Far East. This has already led to significant relocation of production outside the EU. This situation is highly problematic, because once production leaves Europe, bringing it back is far more difficult than letting it go."*

According to a recent analysis by Oxford Economics, based on 2023 data[61], European producers using electricity as an energy source pay between 12 and 21 cents more per euro of output than US producers. Similarly, when using natural gas, European producers pay between 7 and 11 cents more per euro of output than their US counterparts. Moreover, in addition to being an energy source, natural gas is also an essential input for many chemical production processes. Consequently, energy price differentials imply that European producers face even higher relative production costs than these estimates suggest. Since industrial electricity prices for European producers are currently between two and three times higher than industrial gas prices, unless industrial electricity costs fall substantially, higher rates of electrification (as required by environmental regulation) may further erode the European chemicals sector's competitiveness and resilience.

[60] CEFIC (2025*a*), p.37.
[61] Oxford Economics (2025).

Figure 22: Energy prices and projections in the EU, USA and China



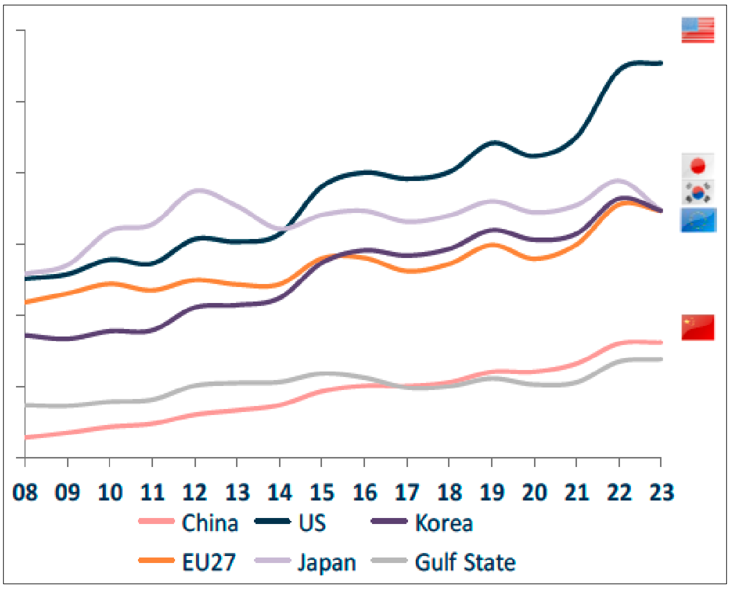
Source: reproduced from CEFIC (2025a), pp.47-48.

2.2.2.b Labour costs

Another factor contributing to the higher production costs faced by EU chemical producers is labour. The European chemicals industry incurs higher labour costs (EUR 70 000/FTE in 2024) than in China, India, and the Middle East—approximately twice as high as those in China or the Middle East and around five times higher than those in the rest of Asia[62]. However, labour costs in Europe are about 1.6 times lower than those in the USA (EUR 110 000/FTE).

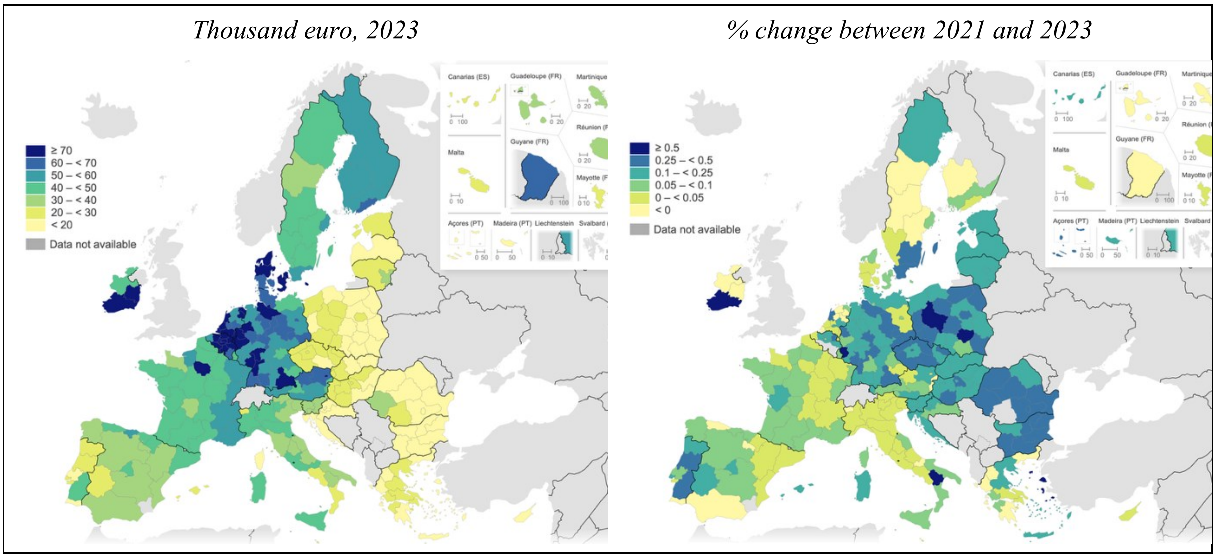
The regional picture, based on Eurostat data up to 2023, **is highly differentiated across EU regions**, ranging from less than EUR 20.000 in most eastern regions to more than EUR 80.000 in Belgium, Germany, Denmark, Ireland, and the Netherlands. Moreover, **labour costs increased in all leading chemical regions between 2021 and 2023**, with the only exception being the Eastern and Midland region in Ireland (-6%). Geographically, **the average increase was three times higher in regions located in eastern Member States** (+20,6%) compared to regions in northern, central, and southern EU countries (+6,9%).

Figure 23: Labour cost in the EU chemicals industry compared to key competitors



Source: reproduced from CEFIC (2025a), p.55.

Figure 24: Labour costs per person employed in local units, by region



Source: own elaboration based on Eurostat [sbs_r_nuts2021]

[62] CEFIC (2025), *The competitiveness of the European chemical industry*, p.55.

Table 15: Labour costs in the top NUTS2 regions within each Member State in terms of number of persons employed in chemical local units as a share of the national total

Member State	NUTS code	Name of the region	Persons employed in local units		Labour cost	
			Number	% of national total	Thousand euro	2023 vs 2021
Austria	AT31	Oberösterreich	7,347	37.9%	68.85	1.8%
	AT12	Niederösterreich	4,819	24.9%	61.23	10.6%
Belgium	BE21	Prov. Antwerpen	19,487	43.7%	92.92	16.2%
	BE23	Prov. Oost-Vlaanderen	6,187	13.9%	84.60	12.9%
Bulgaria	BG42	Yuzhen tsentralen	4,583	30.3%	13.25	28.8%
	BG33	Severoiztochen	3,616	23.9%	17.61	31.9%
Croatia	HR02	Panonska Hrvatska	2,470	42.6%	15.09	8.8%
	HR06	Sjeverna Hrvatska	1,669	28.8%	16.00	16.9%
Czech Republic	CZ04	Severozápad	6,911	21.7%	27.35	28.8%
	CZ07	Střední Morava	5,402	17.0%	22.28	21.4%
Denmark	DK01	Hovedstaden	6,286	49.4%	91.21	9.5%
	DK03	Syddanmark	2,472	19.4%	68.13	4.7%
Finland	FI1B	Helsinki-Uusimaa	6,065	48.2%	61.89	2.5%
	FI1C	Etelä-Suomi	2,832	22.5%	57.50	6.1%
France	FR10	Ile de France	28,632	18.9%	71.88	4.5%
	FRK2	Rhône-Alpes	22,766	15.1%	55.85	3.2%
Germany	DEB3	Rheinhessen-Pfalz	45,727	12.1%	85.81	29.4%
	DEA1	Düsseldorf	44,312	11.7%	82.61	32.7%
Greece	EL30	Attiki	9,014	69.7%	26.31	3.6%
	EL52	Kentriki Makedonia	2,202	17.0%	21.59	14.7%
Hungary	HU31	Észak-Magyarország	4,781	29.7%	29.35	11.5%
	HU21	Közép-Dunántúl	3,349	20.8%	25.92	19.8%
Ireland	IE06	Eastern and Midland	5,108	45.9%	75.77	-6.0%
	IE05	Southern	4,922	44.2%	82.77	71.0%
Italy	ITC4	Lombardia	45,886	40.5%	44.30	2.8%
	ITH5	Emilia-Romagna	14,588	12.9%	44.97	4.1%
Lithuania	LT02	Vidurio ir vakarų Lietuvos	4,985	67.2%	26.65	10.2%
	LT01	Sostinės regionas	2,438	32.8%	32.28	20.9%
The Netherlands	NL36	Zuid-Holland	10,028	16.8%	81.01	3.3%
	NL41	Noord-Brabant	8,043	13.4%	71.86	0.3%
Poland	PL91	Warszawski stołeczny	11,991	13.2%	22.79	31.4%
	PL21	Małopolskie	9,878	10.8%	19.61	8.0%
Portugal	PT11	Norte	5,046	21.4%	24.02	14.7%
	PT16	Centro	3,706	15.8%	26.42	27.1%
Romania	RO32	București-Ilfov	3,699	20.6%	19.95	31.6%
	RO12	Centru	3,161	17.6%	19.69	26.2%
Slovakia	SK02	Západné Slovensko	5,360	65.5%	21.13	19.0%
	SK04	Východné Slovensko	1,134	13.9%	14.31	13.2%
Slovenia	SI04	Zahodna Slovenija	3,996	55.4%	33.08	15.1%
	SI03	Vzhodna Slovenija	3,220	44.6%	34.61	15.2%
Spain	ES51	Cataluña	40,229	40.4%	47.13	4.8%
	ES52	Comunitat Valenciana	19,079	19.2%	34.88	4.7%
Sweden	SE23	Västsverige	5,031	25.3%	47.56	2.7%
	SE22	Sydsverige	4,268	21.5%	52.72	27.4%

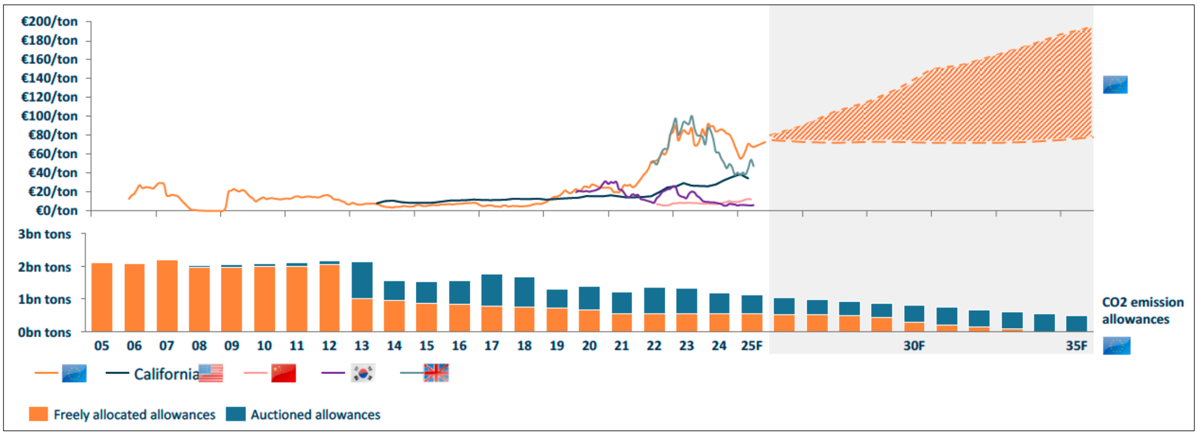
Source: own elaboration based on Eurostat [sbs_r_nuts2021]. Note on thousand euro: green value=lower than EUR 30 thousand; yellow value= between EUR 30 and 50 thousand; red value=greater than 50 thousand. Note on 2023 vs 2021: green value=decrease; yellow value= increase between 0,1% and 20%; red value= increase greater than 20%.

2.2.2.c Regulatory costs

Regulatory costs are the third factor influencing European production costs**.** While delivering substantial health and environmental benefits, the EU's regulatory framework imposes significant, quantifiable costs (see section 2.2.4 for details) **which negatively impact operational efficiency and contribute to an investment-unfriendly perception**[63]. The benefits of the EU regulatory framework are diffuse, long-term, spread across the entire population, and difficult to quantify precisely, whereas the costs are immediate, concentrated, and borne directly by the chemical companies. Companies in the European chemical sector also face the high costs of increasing regulation that foreign competitors can avoid.

Furthermore, linked to the environmental regulatory framework is **the EU Emissions Trading System (ETS), which is expected to have an increasingly notable impact on the chemicals industry in the coming years**[64]. On the one hand, the EU ETS is significantly broader than those of other competitors[65]. On the other hand, ETS prices have increased considerably in recent years (rising from EUR 20 to nearly EUR 79 per tonne of CO_2 emitted between 2020 and September 2025[66]) and have shown considerable volatility, creating uncertainty for long-term investments in decarbonisation. These prices are also expected to continue rising, further widening the gap with other key competitors. As a result, **the already substantial environmental costs for producers operating in the EU are likely to increase further.**

Figure 25: ETS prices and their forecast (to 2035), EU versus key competitors



Source: reproduced from CEFIC (2025a), p.51.

[63] Ujaczki É. and Backmann J. (2025).

[64] CEFIC (2025*a*), p.51.

[65] The EU ETS covers over 10,000 installations in the energy and manufacturing sectors, as well as emissions from aircraft operators and maritime transport. Together, these categories account for around 40% of total EU GHG emissions. By comparison, the US system covers just over 400 installations, regulating emissions from the electricity, industry, transport, and buildings sectors. China's ETS oversees more than 2,000 companies in the electricity sector, which account for around 40% of the country's CO_2 emissions. See CEFIC (2025*a*), p.51.

[66] Oxford Economics (2025), p.5.

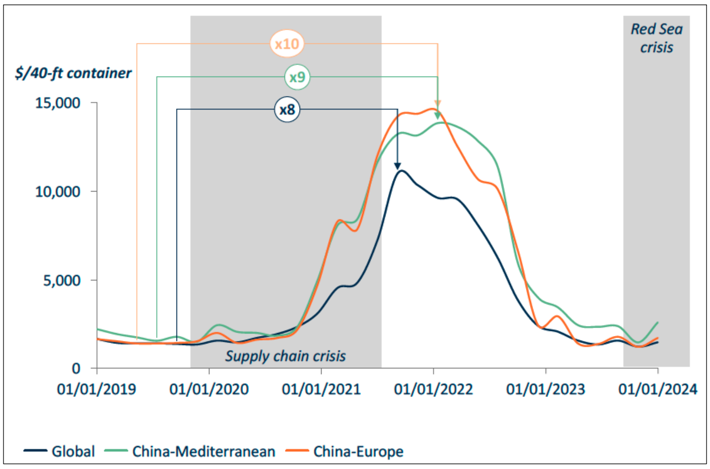
Box 7: Notes from interviews

> *"We must therefore ensure that energy prices and ETS costs—which are crucial and directly linked to CO_2 neutrality—allow for a balance that does not undermine Europe's basic chemical industry. This segment of the industry is in fact extremely energy-intensive, far more so than chemical activities further downstream in the value chain."*

2.2.2.d Transport costs

Finally, although the European chemicals industry benefits from a comparatively well-functioning infrastructure, this infrastructure does not operate as a single market due to differing rules and technical requirements for rail and road transport across Member States. **In recent years, the EU chemical industry, like many trade-dependent sectors, has been affected by fluctuations in transport and logistics costs**. Disruptions to global supply chains caused by the COVID-19 pandemic led to a tenfold increase in European maritime transport prices. After a significant decline throughout 2022, a more moderate increase occurred in late 2023, driven by disruptions in the Red Sea, through which around 23% of European imports transit. In 2023, shipments through the Panama Canal also faced difficulties. Transport costs were gradually returning to historical levels when the situation in the Suez Canal in 2024 significantly impacted transit costs.

Figure 26: Evolution of container shipping costs on different major global shipping routes



Source: reproduced from CEFIC (2025a), p.56.

2.2.3 Size of enterprises

Although the EU chemicals industry includes many large, well-known companies, most chemical companies are SMEs. While both large companies and SMEs face common challenges, **the latter encounter specific difficulties, particularly in relation to the twin transition and the war in Ukraine**[67]. SMEs often depend on a single chemical product and have limited product portfolios. Furthermore, they are frequently deeply rooted in the regions where they operate and cannot easily relocate production, rapidly redesign products, or introduce entirely new business models.

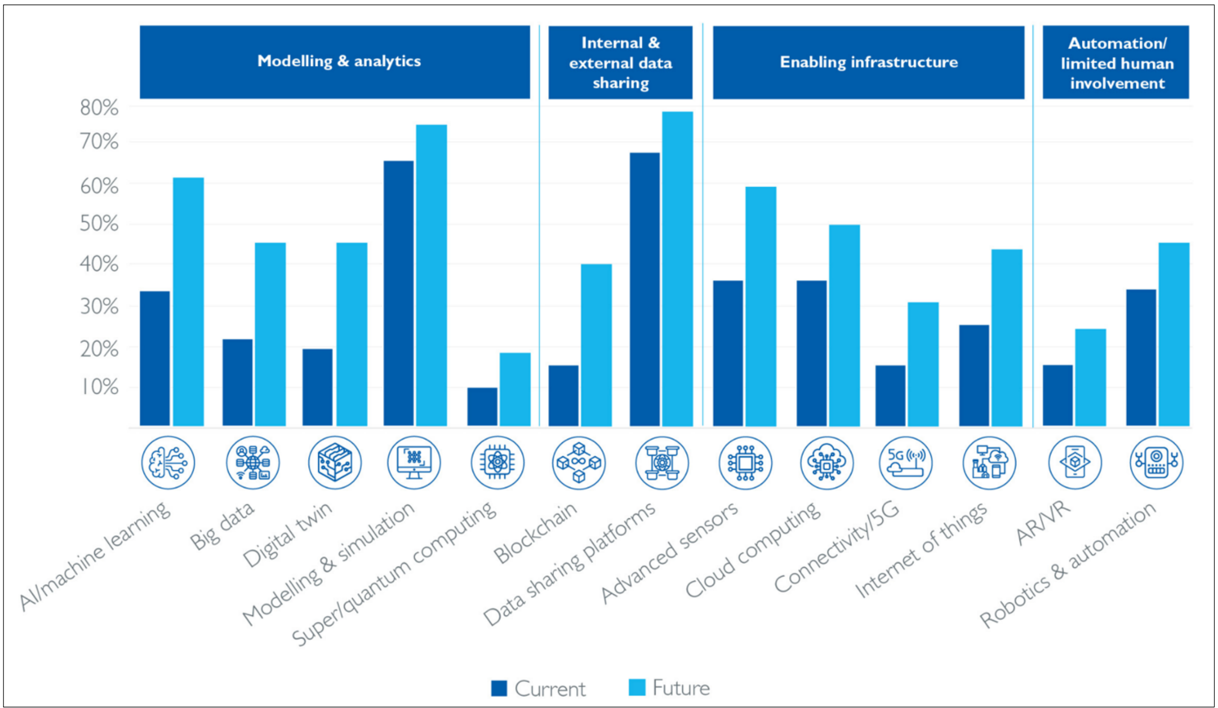
[67] European Commission (2023*a*).

Box 8: Notes from interviews

> *"The challenges facing the EU chemicals industry are particularly significant for SMEs, which make up the majority of chemical companies and typically have more limited investment capacity and resources compared to larger firms."*

SMEs are therefore more likely to **struggle to implement new sustainable business models promptly and effectively, or modify product designs due to their limited product lines, reliance on individual chemicals and limited resources to invest in the adoption of new technologies aimed at environmental sustainability** [68]. Furthermore, **SMEs face particular challenges in digitalisation,** including limited knowledge of which technologies to adopt and which providers to choose, difficulties in accessing advice and support, and constraints in obtaining finance for digitalisation. They also often lack the digital and managerial skills needed to digitalise their businesses and implement the necessary organisational changes. **As digital technologies become increasingly important in the coming years** (see the figure below), **there is a risk that smaller enterprises in the sector will further lose competitiveness.**

Figure 27: Digital technologies currently used and planned to be used in the future by chemical companies (%)



Source: reproduced from CEFIC (2023), p 25. Data based on CEFIC's survey on 70 experts from 50 companies.

Access to EU funding for research and innovation is also more complex for SMEs, as they often lack the time, experience, and skilled staff required to apply successfully. Given their small size, SMEs rarely have dedicated personnel to manage the administrative requirements for accessing EU funding. **Overall,**

[68] Di Lorenzo, G., Bischi, A., and Desideri, U (2025).

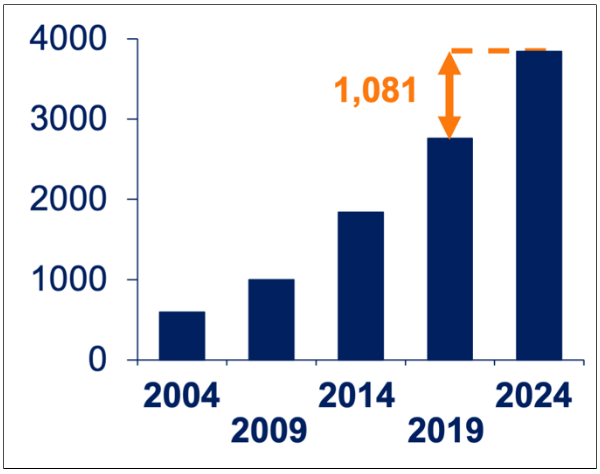
compliance with regulatory obligations for the chemical sector is more costly for SMEs. For instance, SMEs face significant financial challenges when registering under REACH, as this requires the expertise of well-trained professionals in fields as diverse as toxicology, risk assessment, and IT. Many SMEs lack the necessary in-house expertise to meet these requirements and therefore often need costly external support. This imbalance in the competitive landscape can potentially lead to the formation of monopolies[69]. Indeed, several SMEs were found[70] to struggle with the high costs of registration, in particular, regarding letters of access and participation in Substance Information Exchange Forums (SIEFs). As a result, several companies are forced to rationalise their substance portfolios and seek alternative solutions, such as reconsidering their production and import volumes in order to remain below the one-tonne-per-year threshold that triggers registration obligations.

However, as indicated in the following sub-section, compliance with regulatory obligations is an increasingly significant challenge for the entire sector, not only SMEs.

2.2.4 Complying with EU regulations

The increasing costs of complying with European regulations over the past 20 years have risen even further in recent years due to additional legislation and stricter constraints affecting the chemical industry. High regulatory costs are a key factor undermining industrial competitiveness. The rapid adoption of numerous regulations, coupled with frequent amendments, often prevents full implementation before new requirements are introduced. This cycle increases unpredictability for potential investors.

Figure 28: Number of EU legislative measures on health, safety and the environment (net of repeals)



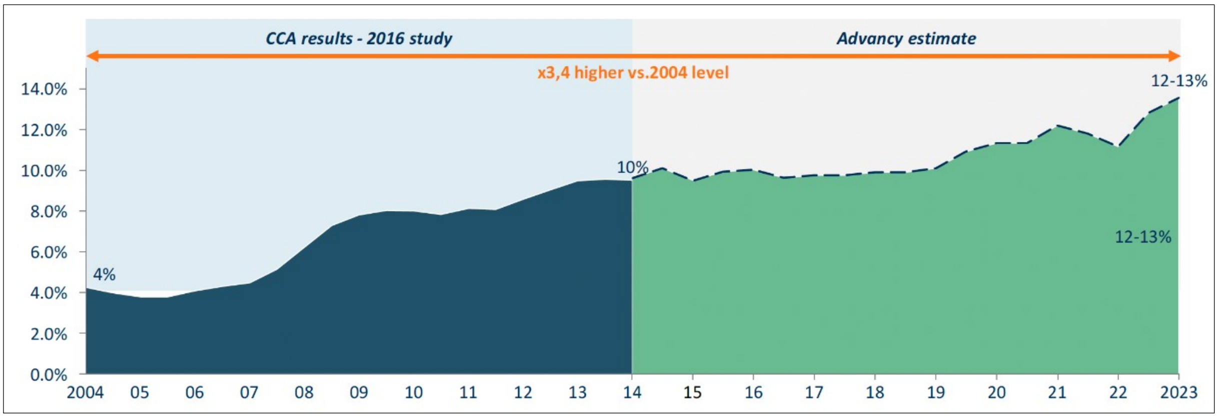
Source: reproduced from Federchimica (2025a), p.4, based on European Union, Compendium of Community acts in force on the environment, consumers and health protection.

Before the adoption of the EU Green Deal, a Cumulative Cost Assessment (CCA) study conducted by the European Commission in 2016[71] showed that Europe's complex regulatory framework posed a significant burden on EU chemical

[69] SME United (2025).
[70] RPA (2017).
[71] European Commission (2016).

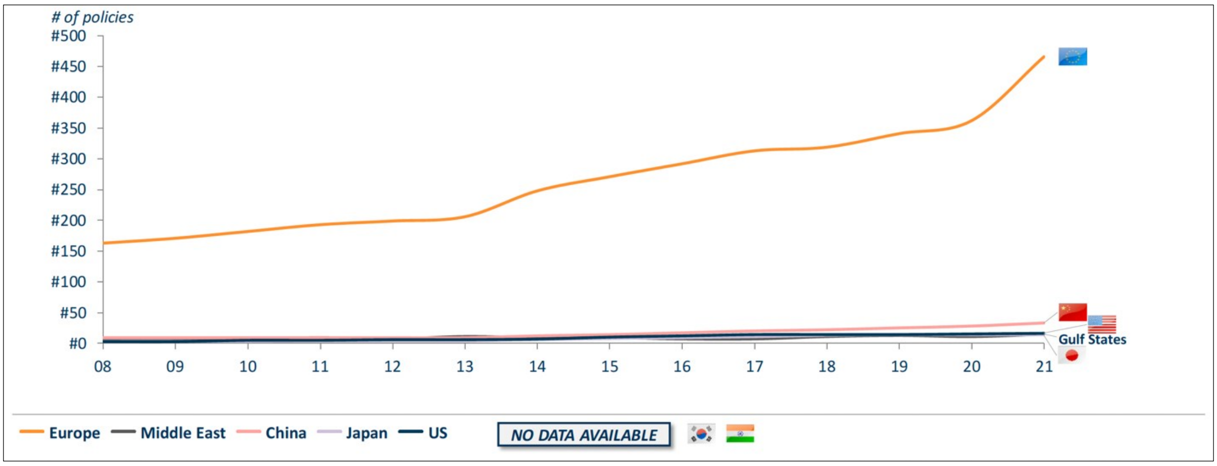
companies, amounting to around EUR 10 billion per year between 2004 and 2014. The three main drivers of regulatory costs were identified in the emissions and industrial processes package (approximately 33% of the regulatory cost), the chemicals package (29%) and worker safety (24%). New estimates from CEFIC[72] indicate that **the overall regulatory costs accounted for around 13% of the value added of the EU chemicals industry in 2023. A significant increase from the 4% and 10% figures reported in the European Commission's CCA for 2004 and 2014, respectively.**

Figure 29: Regulatory costs in the EU as % of the value added of the chemical industry



Source: reproduced from CEFIC (2025a), p.53.

Figure 30: Evolution of environmental regulations in Europe compared to other regions (cumulative number of policy interventions)



Source: reproduced from CEFIC (2025a), p.53.

As underlined by Federchimica, the Italian association of chemical companies, the EU's regulatory 'bulimia' – with 1,081 new legislative measures introduced in the areas of health, safety and the environment between 2019 and 2024 alone – represents an increasingly unsustainable cost[73]. CEFIC specifies that these regulatory constraints have a significant impact on the operating expenses and

[72] CEFIC (2025*a*), p.53.
[73] Federchimica (2025*a*).

capital expenditures of EU chemical enterprises, limiting their flexibility, particularly in times of crisis[74], as well as their competitiveness in international markets, where competitors such as the USA and China have a significantly lower number of regulations.

However, **these compliance costs also depend on disharmonised implementation**, i.e. discrepancies among Member States in the implementation of regulations. For instance, **regarding the adoption of policy measures to tackle PFAS**, while some European countries are implementing national action plans, **the vast majority of Member States have minimal or no policies in place. This creates an uneven health protection landscape across the EU**[75]. **There is also high heterogeneity in the adoption of EU Directives**. For example, only three Member States (Austria, Denmark and France) and two regions of Belgium (see section 3.2.2 for details) have adopted national or regional action plans dedicated to PFAS, while three Member States/EEA countries (Finland, Norway and Sweden) have more general chemical strategies which contain some actions related to PFAS. Moreover, only three Member States (Denmark, France and the Netherlands) have adopted national legislation prohibiting or restricting the launching of consumer products containing PFAS. As of June 2025, 26 Member States had transposed the Drinking Water Directive (2020/2184), however, there is considerable heterogeneity in the national requirements concerning the limit of PFAS in drinking water across the EU[76]. Finally, Member States have imposed very limited additional requirements on food products beyond maximum concentration levels, with the only exception being Denmark, which has adopted maximum levels in feed or livestock blood.

Box 9: Notes from interviews

- *"Complex regulations also affect permitting procedures for site development and infrastructure projects, which are often very lengthy. Long permitting timelines make it difficult for investors to decide whether to invest in a specific territory or even within existing industrial clusters, as there is a high level of uncertainty about timing and outcomes."*
- *"For companies, the issue of permitting is a major challenge. It can take several years to obtain a licence for new infrastructure, such as pipelines or renewable energy projects. If these infrastructures are not licensed and permitted in a timely manner, investment projects*

[74] CEFIC (2025*a*), p.53.

[75] HEAL (2025).

[76] The Directive 2020/2184 introduced two parameters for PFAS in drinking water, Sum of 20 PFAS (0.1 micrograms per litre), and Total PFA (0.5 micrograms per litre), but over a third of Member States have transposed only the Sum of PFAS parameter. Of these: three Member States (Denmark, Italy and Sweden) have extended the Sum of PFAS parameter to additional PFAS not included in the 20 covered by the Directive; five Member States (Belgium, Bulgaria, France, Spain, and Sweden) are requiring the monitoring of the PFAS parameters, as well as keeping the obligation to comply with the them; four Member States (Denmark, Germany, Italy, Sweden) have adopted a binding parameter for the Sum of 4 PFAS; in two other Member States (France and the Netherlands), a governmental or advisory body has issued a guideline value for the Sum of 4 PFAS; only two Member States (Denmark and Italy) – have adopted a binding drinking water parameter for Trifluoroacetic acid (TFA); in five Member States (Belgium, Germany, France, Luxembourg, and the Netherlands), governmental or advisory bodies have issued guideline values for TFA in drinking water. See HEAL (2025), p.8.

can be significantly delayed. Therefore, if regions could help streamline and accelerate permitting procedures, it would be extremely helpful for the industry.”

2.2.5 High costs for pollution remediation

As outlined in Section 2.1.5, the EU chemical industry has made significant progress in reducing GHG emissions and limiting the production and use of PFAS. However, the transition to net-zero emissions in the EU chemicals industry will require investments exceeding EUR 1 trillion by 2050, with an additional EUR 86 billion per year over the next decades, estimated as the cost for the EU27 to fully clean up PFAS-contaminated sites.

The substantial resources required to eliminate the negative impacts of chemicals on the environment and human health can be partially supported through the adoption of new production technologies. **While some of these technologies are still under development, changes to production processes can be costly, especially for SMEs.** For instance, integrating electrification technologies into existing chemical processes can be complex, as many traditional systems were designed for fossil-fuel heating and processing, requiring substantial modifications to accommodate electrified alternatives[77]. Such retrofitting entails not only technical challenges but also significant investments in new equipment, personnel training, and potential downtime during the transition. Moreover, a critical challenge in implementing electrification at scale lies in ensuring the reliability and stability of the electricity supply. Dependence on regional grid stability can constrain investment in electrified plants, particularly in areas where infrastructure is weak or fossil-based generation remains dominant**. The feasibility of full electrification of the chemical sector remains highly dependent on regional electricity pricing, carbon policies, market conditions and the availability of abundant, low-cost renewable electricity.**

As a result, **companies may be reluctant to invest in new technologies due to concerns about operational disruption and the return on investment**. In fact, investments in innovative solutions may be hindered by the fact that many carbon-intensive chemical products with large production volumes have comparatively limited profit margins[78]. **Similarly**, since the transition to a green chemicals industry necessitates a significant adaptation of local existing infrastructures and the development of new ones, as in the case of electrification, **LRAs may be discouraged from investing in new technological infrastructures, since these can have higher capital expenditure and operating costs than those based on fossil fuels.**

[77] See Segovia-Hernández J.G. *at al.* (2025).
[78] Di Lorenzo, G., Bischi, A., and Desideri, U (2025).

Box 10: Notes from interviews

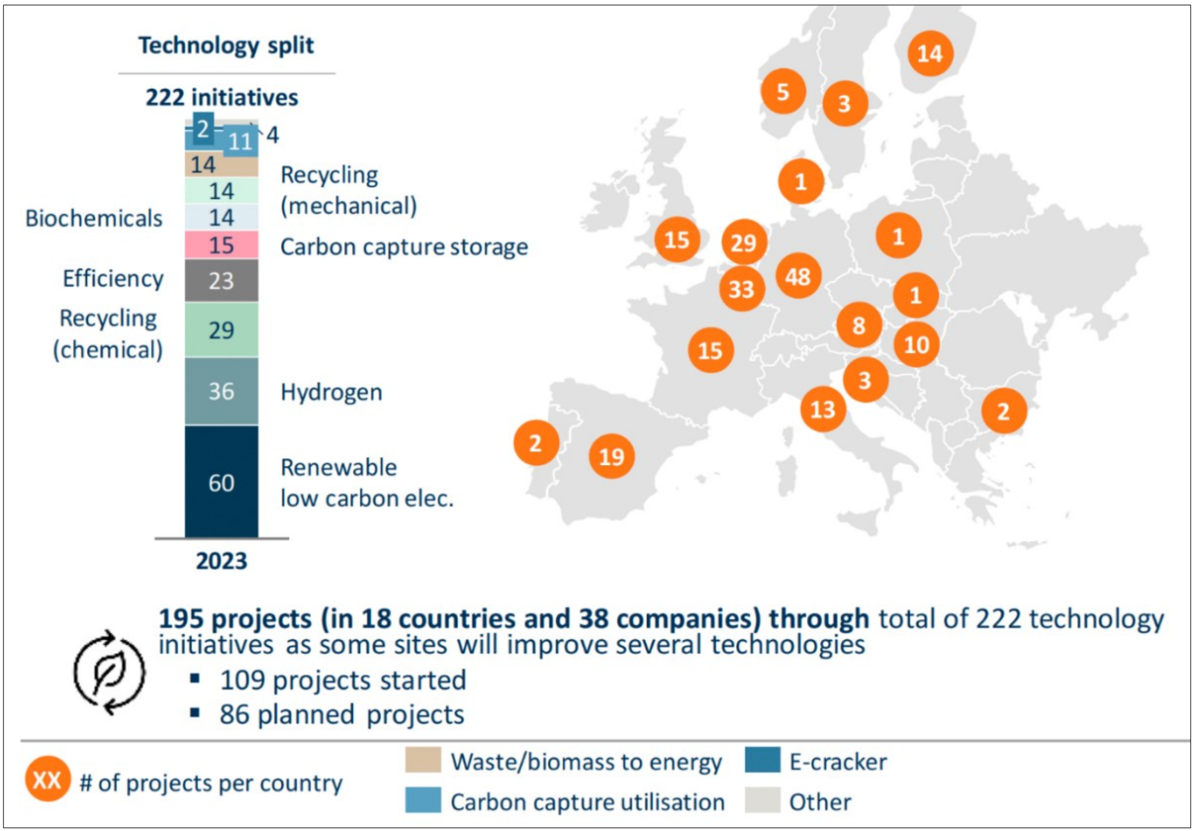
• *"Transformation processes require a combination of different solutions, including the conversion of energy supply, the production and use of green hydrogen, the expansion of the circular and bioeconomy, and the use of biogenic raw materials."*
• *"In order to achieve the clean transition, massive investments are needed across the entire European industry, including the chemicals sector, and these investments will need to increase over time. However, what we have seen in recent years is a decline in investment in the sector. In the short term, the industry needs resources to invest in order to restore profitability. In the long term, additional resources will be required to achieve climate neutrality and circularity. The key problem is that remediation technologies are not yet sufficiently developed, despite the significant amount of research currently underway. Based on what we know today, environmental clean-up—particularly soil remediation—is extremely expensive. The costs are enormous, and the major debate is: who will bear them? The companies that caused the pollution? And under what conditions? This is a highly complex issue."*
• *"There is significant untapped potential in the circular economy, not only at the territorial level but across Europe as a whole. Europe is more advanced in this area than many of its competitors, but this potential has not yet been fully realised. This is particularly concerning given that recycling industries—especially plastic recycling—are currently facing closures. More could and should be achieved in this area."*

Moreover, the **limited availability of reliable, standardised data on emissions, resource use, and technology performance further constrains investment decisions in the chemical sector**[79]. The complexity of adopting new production processes also often requires specialised knowledge and expertise that may not be readily available within the existing workforce. **This skills gap highlights the need for targeted training programmes and knowledge-sharing initiatives to equip engineers and operators with the competencies required to adopt and implement sustainable technological solutions.**

However, several projects across the EU are investing in low-carbon and circular technologies. For instance, in 2023, CEFIC assessed 222 initiatives[80] already in the pipeline in 18 countries (including Norway and the UK). 60 of these initiatives focused on renewable low-carbon electrification, or hydrogen-related projects (36). Other initiatives ranged from biochemicals and carbon capture to digitalisation and recycling.

[79] United Nations Environment Programme Finance Initiative (2025), p.12.
[80] The map and localization of the projects is available on-line.

Figure 31: Projects in the chemicals industry for low-carbon transition development in Europe (2023)



Source: reproduced from CEFIC (2025a), p.109.

Box 11: Notes from interviews

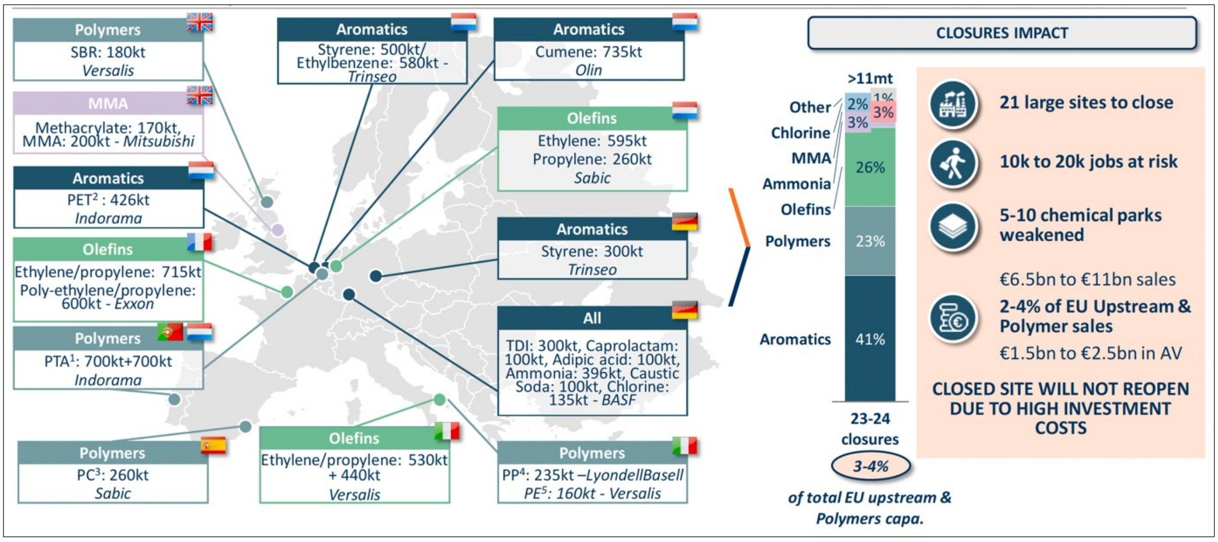
• *"In terms of sustainable growth, the main critical issues concern the difficulty of transferring green chemistry solutions from the laboratory to the market, the need to ensure continuous access to sustainable, low-impact feedstocks, and the systematic adoption of environmental and economic assessment tools—such as life cycle assessment, life cycle costing, and techno-economic analysis—within industrial innovation decision-making processes. The adoption of green technologies is often hindered by high investment costs, uncertain economic returns, and infrastructure limitations, particularly in areas such as process electrification and access to renewable energy. Public support, including at the regional level, is therefore crucial to reduce risk and promote the scalability of solutions. Technologies with the greatest potential benefits include advanced bioprocesses, the use of renewable and recycled feedstocks, industrial symbiosis, and the digitalisation of production processes. The full potential of systemic supply chain integration and the extensive use of digital tools for sustainable design, however, remains only partially explored."*

• *"The future of chemistry lies in sustainability. This involves moving away from fossil fuels and replacing fossil-based raw materials—beyond just energy—whenever possible. This is being achieved through chemical recycling and the use of biomass. Companies are already developing the necessary innovations, but they are not yet able to scale them up. Current framework conditions are not conducive to this, neither in terms of facilitating the required transformation nor in maintaining the competitiveness of companies."*

2.2.6 Risks of additional site closures

Considering the challenges previously described, additional chemical site closures pose the biggest risk to the EU chemical sector and the regions specialised in it. **In 2023-2024 alone, approximately 11 million tons of capacity closures were announced in Europe, impacting 21 major sites and between 10 000 and 20 000 jobs.** This represents the closure of 3 to 4% of the EU's total upstream and polymer capacity, weakening 5 to 10 chemical parks. These closures put between EUR 6.5 billion and EUR 11 billion in sales at risk, with an estimated value-added loss of EUR 1.5 billion to EUR 2.5 billion[81]. The primary closure announcements were in Germany, Belgium and the Netherlands.

Figure 32: Closure announcements in 2023-2024 (non-exhaustive list)



Source: reproduced from CEFIC (2025a), p.107.

Additional closures were announced in 2025. For instance,[82] Dow disclosed a package of closures in July, including the ethylene cracker at Böhlen, the chlor-alkali and vinyl assets at Schkopau in **Germany**, and the siloxanes plant in Barry, UK. These shutdowns will take place between mid-2026 and the end of 2027 and are expected to affect about 800 jobs. Other closures in Germany were announced by LANXESS, for its hexane-oxidation intermediates plant in Krefeld-Uerdingen, and by Solvay, which will cease production of TFA-related organic products at its Bad Wimpfen site, affecting around 100 jobs. Moreover, INEOS Phenol announced the permanent closure of its facility in Gladbeck in June 2025, affecting 279 jobs, while INEOS Oxide halted production of propylene oxide and propylene glycol at its Cologne site in early September 2025. Concerning BASF's Ludwigshafen site, after the announcement in August 2024 to end production of adipic acid, cyclododecanone (CDon) and cyclopentanone (CPon) during 2025,

[81] CEFIC (2025*a*), p.107.

[82] Based on ChemBizR (2025).

affecting 180 workers[83], it decided to exit the hydrosulfites business and close the respective production facility in September 2025, impacting another 65 employees[84]. These closures are part of a plan to cut about EUR 1.1 billion in annual costs at BASF's headquarters site in Ludwigshafen by the end of 2026 due to the high costs and slow demand in Germany[85].

In **France**, Arkema confirmed the restructuring of its Jarrie site, resulting in about 150 job losses, while INEOS Inovyn mothballed chloromethane production at its Tavaux site, while shifting part of its production to Rosignano, **Italy**. In **the Netherlands,** Vynova announced the stop of PVC production at its Beek site, which had a capacity of about 225,000 tonnes per year. In April 2025, Orlen announced that it would decommission its phenol and acetone plant in Płock in **Poland**, since the nearly 60-year-old plant requires extensive modernisation investment costs to meet the environmental regulations[86]. Finally, in **Italy**, Trinseo permanently ceased production of methyl methacrylate at its Rho site near Milan and closed it acetone cyanohydrin unit at Porto Marghera near Venice[87].

Figure 33: Closure announcements in 2025 (non-exhaustive list)

Company	Country	Site	Action and Timing	Product Scope	Notes and Impact
Huntsman	Germany	Moers	Permanent closure announced May 28, 2025; completed end Q2 2025	Maleic anhydride	Around 10 million USD EBITDA loss in 2024; EU demand to be supplied from the United States.
INEOS Phenol	Germany	Gladbeck	Intent to permanently close announced June 17, 2025	Phenol, acetone	High energy and carbon costs; major capacity loss for Europe.
Dow	Germany / UK	Böhlen, Schkopau, Barry	Closures announced July 7, 2025; shutdowns mid-2026 to end-2027	Ethylene cracker, chlor-alkali, vinyls, siloxanes	About 800 jobs affected; upstream closures impacting specialty supply chains.
LANXESS	Germany	Krefeld-Uerdingen	Closed end of Q2 2025	Hexane-oxidation intermediates	Part of a wider cost-saving and efficiency program.
LANXESS	United Kingdom	Widnes	Closure planned for 2026; announced August 2025	Aroma chemicals	Cost competitiveness cited as main reason.
Solvay	Germany	Bad Wimpfen	Announced September 18, 2025; TFA-related organics to end early 2026; selected inorganics (including HF) to end 2026	TFA-related organics and selected inorganics	Around 100 jobs affected; competitiveness and regulation cited.
Arkema	France	Jarrie	Restructuring announced January 2025; withdrawals to complete by 2026	Chlorine, methyl chloride, soda, technical fluids	Around 150 jobs lost; site to focus on hydrogen peroxide and chlorates.
Vynova	Netherlands	Beek	Permanent closure announced July 8, 2025; target November 2025	PVC (225,000 tons per year)	Weak demand and high costs; closure subject to consultation.
INEOS Inovyn	France	Tavaux	Mothballed September 1, 2025	Chloromethane	Production idled; partial shift to Rosignano, Italy.
INEOS Oxide	Germany	Cologne	Production halted September 2025 (indefinite stop)	Propylene oxide, propylene glycol	Tightens PO and PG supply; high energy costs cited.

Source: reproduced from ChemBizR (2025).

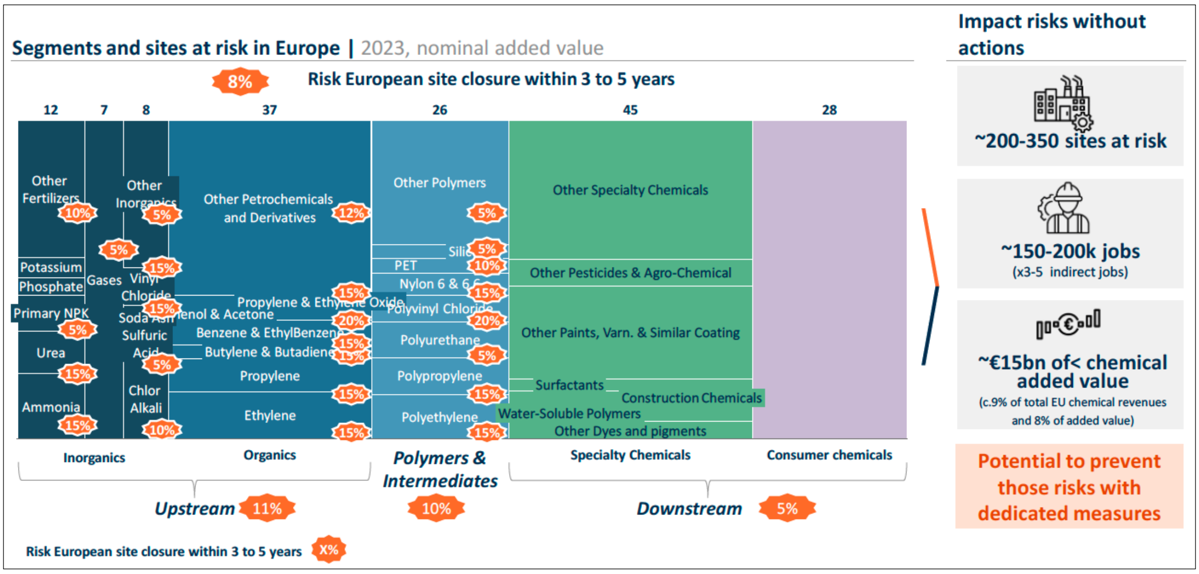
The **announcement of closures continued in January 2026**. Domo Chemicals filed for insolvency for three of its subsidiaries in **Germany**, leaving 585 employees with wages guaranteed for only three months[88]. The reasons lie in the overwhelming economic and competitive pressures: demand for chemical

[83] BASF (2024).
[84] BASF (2025).
[85] Tullo A. (2024).
[86] ChemicalUnited (2026),
[87] ChemicalUnited (2025).
[88] ChemicalUnited (2026).

intermediates in Europe has been weak for years, energy prices remain elevated, and cheap imports from China have flooded the market.

In **Belgium,** due to high energy and labour costs, Envalior announced that it would stop fibreglass production at the Port of Antwerp-Bruges by the end of the year, putting 220 people—more than a quarter of its national workforce —at risk of losing their jobs[89]. A few weeks earlier, Vioneo announced its decision to abandon plans to build a fossil-free plastics plant in Antwerp, which was announced in September 2024[90], and to relocate the project to China. The company explained[91] that this move would allow it to achieve its objectives significantly faster and at a lower cost than in Europe. A critical factor influencing the decision is access to green methanol, a key feedstock for producing green plastics, as China currently offers more abundant and competitively priced supplies of this material. The cancellation of the Vioneo project represents a notable setback for the Port of Antwerp-Bruges, which had positioned itself as a leading European hub for green energy, circular economy initiatives, and the low-carbon industry. Hosting a large-scale green plastics plant would have reinforced the strategic importance of the Gunvor refinery site, transformed it into a green energy hub, and attracted further sustainable investments. With an anticipated annual output of up to 300 000 tonnes of green plastics, the Antwerp facility was expected to supply high-value sectors such as healthcare, automotive manufacturing, and advanced packaging. Its absence leaves a significant gap in Europe’s emerging fossil-free materials ecosystem.

Figure 34: Short-term (within the next 5 years) risk of closures



Source: reproduced from CEFIC (2025a), p.108.

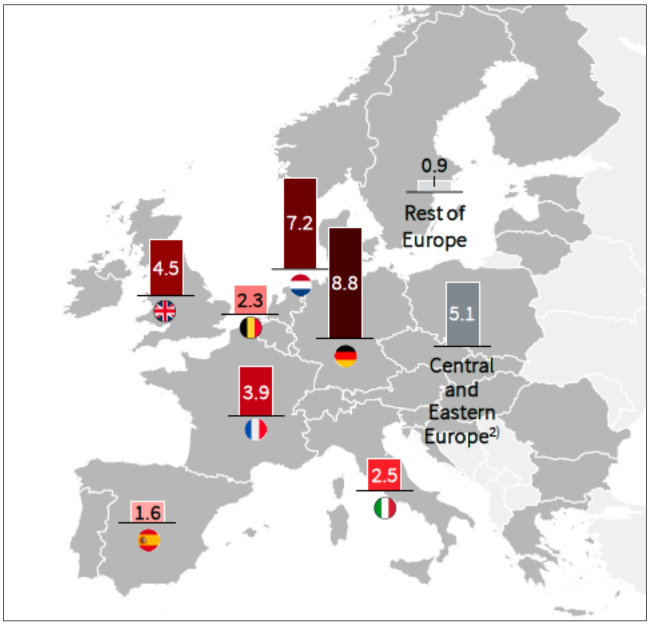
[89] Belganewsagency (2026).

[90] The plan was to build a 300,000 tonnes/year polypropylene (PP) and polyethylene (PE) plant using green methanol as feedstock in the Port of Antwerp, Belgium, cutting at least 1.5 million tons of CO2 emissions annually. See Vioneo (2024).

[91] PolyesterTime (2026).

According to CEFIC's estimates[92], **up to 350 sites in Europe could be at risk within 3 to 5 years**. **This could lead to the loss of 150,000 to 200,000 direct jobs, up to 8% of EU chemical sales, and up to EUR 15 billion in added value.** The impact would be particularly significant in the upstream market (11% of value added), especially in organic chemicals, and the polymer market (10% of value added). In contrast, the impact on the downstream market would be smaller, at around 5% of its value added. A more recent analysis[93] estimated that between 2022 and 2025, the capacity closure announcements increased sixfold from 2.9 Mt to 17.2 Mt. This figure doubled (2.2x) between 2024 and 2025, totalling 37 Mt. **The 129 announced closures between 2022 and 2025 represent 9% of the European chemical production capacity and affect around 20,000 direct and 89,000 indirect jobs.** Closure announcements were seen across all segments, with the petrochemical segment most exposed (48% of the capacity announced for closure), followed by basic inorganics (32%) and polymers (15%). Steam crackers are particularly affected, with a net 16% announced capacity reduction compared with the 1% capacity reduction observed between 2017 and 2022. All these closures are located in clusters, putting integrated sites under pressure. At Member State level, Germany and the Netherlands account for around 45% of the capacity announced for closure. The impact on labour is particularly severe in Germany (34,000 direct and indirect jobs affected), in France (15,000), Belgium (11,000) and in the Netherlands (9,000). Finally, the lack of energy cost competitiveness is the dominant rationale for closure, cited in 49% of the announcements, followed by low demand (19%), overcapacity (9%), and regulations (8%).

Figure 35: Overview of announced closures by country, between 2022 and 2025 (Mt)



Source: reproduced from CEFIC (2025c), p.11

Moreover, as highlighted by Federchimica[94], **further closures** would compromise the growth prospects not only of the chemical sector but of the entire EU manufacturing industry. This would **result in the importation of massive quantities of CO2 embedded in goods from countries with less stringent environmental standards**. Site closures also risk **reinforcing vulnerabilities**

[92] CEFIC (2025*a*).

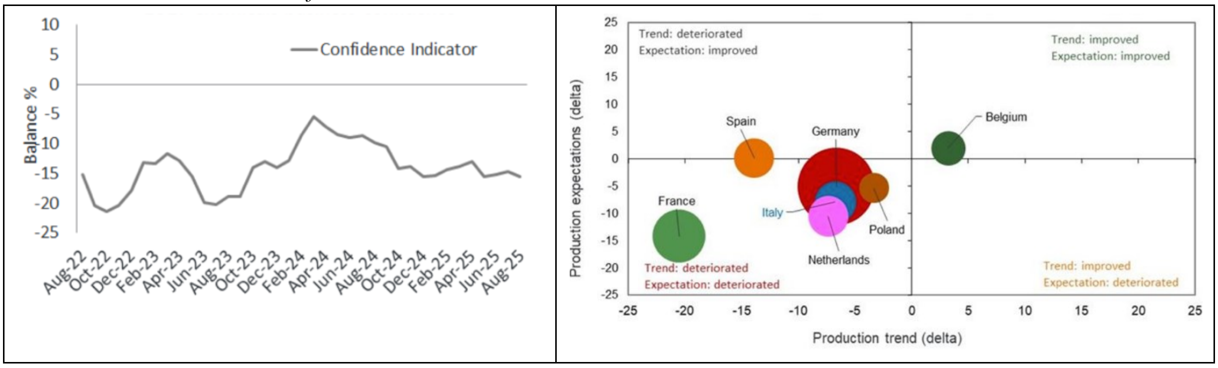
[93] CEFIC (2025*c*).

[94] Federchimica (2025*a*).

and destabilising European industry and local clusters; once closed, sites are unlikely to reopen due to the high capital costs required and, in some cases, local opposition. Such developments would have significant impacts on local employment and industrial value chains.

Figure 36: EU27 chemicals industry business confidence and sentiment

Business confidence *Business sentiment*



Source: reproduced from CEFIC (2025*b*)*, p.4.*

Finally, according to the latest EU Commission business and consumer survey of 2025[95], **confidence in the EU27 chemicals industry weakened significantly between January and August 2025** compared with the same period in 2024. Among the largest EU27 chemical producers, the confidence indicator declined sharply in Germany (-8,5), France (-7,7), Poland (-5,3), Italy (-5,2), Spain (-5,1), and the Netherlands (-4,8). Only Belgium saw a modest improvement (1,9)[96]. Moreover, 'business sentiment'[97] in the chemicals industry fell within the "red box" in most key countries, indicating a deterioration in 2025 compared to 2024 in both production trends and future expectations.

Box 12: Notes from interviews

• *"Plans to shut down facilities, together with the associated production units, will lead to the loss of multiple activities at integrated sites and will have knock-on effects on other regional and local companies. When parts of a fossil-based integrated production system are dismantled, significant collateral damage occurs, affecting the regions' overall capacity for economic development."*

• *"There are serious consequences when industrial sites or clusters shut down. Industrial clusters function as ecosystems, and their closure has a major impact on regions, affecting employment, innovation capacity, logistics, and the overall economic fabric."*

• *"The transformation towards sustainability required in the chemical sector differs from the structural changes occurring elsewhere: for example, mechanical recycling reduces dependence on fossil raw materials, which means that crackers will be less utilised in the*

[95] Information available here.

[96] CEFIC (2025*b*).

[97] Business sentiment is based on two parameters from the European Commission survey data: (i) Production trend observed in recent months, and (ii) production expectations for the months ahead.

future and may need to be dismantled. This is part of the necessary structural change. As a result, some parts of the chemicals industry will shrink or disappear, while others will grow."

2.3 Facing the challenges: the European Chemicals Industry Action Plan

Against the recent developments in the chemicals industry and the challenges and barriers identified in the previous sections, this section reviews the adequacy of the European Chemicals Industry Action Plan[98] and related EU policies. The analysis begins with a short summary of the main pillars of the Action Plan in relation to the identified challenges and their potential effectiveness, before assessing its coherence with other relevant EU legislation. It concludes by highlighting challenges that may not be addressed by EU policy actions, which could serve as a basis for further policy initiatives at different levels of government.

2.3.1 Review of the European Chemicals Industry Action Plan

The Plan is structured around four main pillars, designed to address the specific challenges currently facing the sector. The following table summarises these pillars and the corresponding challenges.

Table 16: Challenges addressed by the Action Plan by pillar

Pillar	Corresponding challenges addressed
(1) Strengthening resilience: maintaining critical production in the EU, opening new markets and protecting the EU industry	• Counteract the significant decline in the EU's global market share and the erosion of competitiveness resulting from the accumulation of several unfavourable developments (high energy and feedstock prices, geopolitical tensions, and low market demand). • Avoid further closures of core chemical production capacities, which would further challenge maintaining critical production levels. • Overcome structural weaknesses in production, such as outdated crackers, making the production less efficient than that of global competitors. • Overcome unfair global competition and trade diversion, often stemming from practices like dumping due to massive overcapacities in third countries. • Help to ensure that imports respect the EU rules and close loopholes that allow non-compliant imports, particularly those bypassing safety rules, which distort competition and undermine the competitiveness of compliant EU producers.
(2) Securing an affordable energy supply,	• Overcome the lack of competitiveness resulting from high energy prices.

[98] European Commission (2025*a*), COM(2025)530.

supporting decarbonisation and the shift towards a clean and circular economy	• Reduce the sector's dual dependency on imported fossil fuels (for energy and as raw material inputs), contributing to its vulnerability to price volatility and supply chain disruptions. • Overcome the challenge of decarbonisation, which requires technology-neutral, step-by-step transitional approaches, including not only a shift in the use of resources but also the effective deployment of chemical recycling. • Improving incentives for decarbonisation through better regulation (e.g. recognising captured CO2 in non-permanent products in ETS rules). • Accelerate grid access for chemical installations to allow for the transition of production processes.
(3) Creating lead markets and promoting innovation	• Overcome the lack of off-takers that constrain investments in non-fossil feedstocks and low-carbon technologies, making it difficult for frontrunner companies to reap the "green premium". • Overcome the lack of investments, which hinders the scaling up of innovative applications for industrial deployment (due to uncertainties and market perspectives). • Support the development of safer and more sustainable solutions (Safe and Sustainable by Design - SSbD) to overcome innovation barriers, particularly for SMEs. • Overcome the innovation gap through modernised chemical testing and transition towards New Approach Methodologies (NAMs) to accelerate risk assessments, close information gaps, and phase out animal testing for chemical safety assessments. • Improve data availability through a common data platform.
(4) Simplifying the regulatory framework	• Reduce the administrative burden for businesses to enhance competitiveness. This includes, inter alia, overcoming burdensome processes within core legislation, particularly the REACH Regulation, which require simplification and faster procedures. • Streamline rules and reduce complexity in related legislation (e.g., Classification Labelling and Packaging Regulation, Fertilising Product Regulation, and Cosmetics Product Regulation). • Overcome ambiguity in standards and requirements, such as more clarity on the universal restriction of PFAS (Per- and polyfluoroalkyl substances).

Source: based on European Commission (2025a), COM(2025)530.

The Action Plan combines immediate actions with long-term structural activities to address both cost pressures and regulatory challenges. Cost pressures are to be eased by various means, including updating state aid guidelines for ETS, removing administrative burdens, and reducing dependence on fossil fuels by accelerating the transition to alternative feedstocks. Several actions aim to release pressure in the short term. Others are part of the more strategic approach. to partially reduce cost pressures. In addition, strategic measures, such as the revision of REACH and the new ECHA Basic Regulation, will also improve investment certainty. Other strategic measures aim to increase reliability in low-carbon technology markets and enhance the scaling up of pilot projects for industrial deployment.

Box 13: Notes from interviews

- *"Chemistry and biochemistry offer significant development opportunities, in line with EU initiatives such as the European Chemicals Industry Action Plan and the Critical Chemicals Alliance. To fully capitalise on these opportunities, it is essential to strengthen support for industrial scale-ups, energy infrastructure, and market-based instruments for sustainable products. It is also strategic to continue investing in skills, innovation, and public-private cooperation, enhancing the role of regions as drivers of the European industrial transition and consolidating their position as hubs of excellence in green chemistry and the bioeconomy."*
- *"A difficult market environment is expected in the short to medium term. In some areas, the competitive advantage of foreign (non-EU) production sites is virtually insurmountable in the short term. Measures to protect and strengthen the resilience of European sites are therefore essential. The transformation process in the chemicals industry must be reinforced and supported, and unfair trade and production practices must be restricted. In this regard, the approach outlined in the Action Plan is appropriate and effective, making it an important building block for improving the framework conditions for the chemical industry."*

Overall, the Plan aims to reverse the decline in the chemicals industry through this combination. In particular, the Critical Chemical Alliance is intended to improve the industry's strategic resilience by mapping the risks of site closures and identifying harmful trade impacts. However, the plan acknowledges that the effectiveness of these actions will depend on the degree of stakeholder commitment: "Successful implementation of this Action Plan will require a concerted effort from all stakeholders, including European Institutions, Member States, industry, and civil society. It is essential to work together to create a favourable business environment, to promote investment in decarbonisation and innovation, to reduce the sector's dependencies, and to provide access to the resources necessary for the transition to a more competitive and sustainable future."[99]

The following box summarises the current state of the Critical Chemical Alliance work (as of January 2026).

Box 14: The current state of the Critical Chemical Alliance work

Four working groups have been established under the Critical Chemicals Alliance. These are tasked with implementing the European Chemicals Industry Action Plan by carrying out technical work in high-priority areas. The groups are expected to start working by mid-February 2026. Each group has a distinct

[99] European Commission (2025*a*), COM(2025)530, p.18.

focus and a defined timeline for deliverables, which have been tentatively agreed upon:

Critical molecules and Critical sites

This group is responsible for developing an EU-wide methodology to identify molecules and production sites essential to the European economy and economic security. It differentiates between "critical" (based on supply risk and importance) and "strategic" (those enabling the green and digital transitions or defence). A key priority is identifying "last-of-a-kind" sites where the loss of a facility would eliminate domestic production of a specific chemical.

The group aims to deliver the methodology for assessing criticality and the final set of criteria by April 2026 and provide recommendations for a matrix of critical and strategic molecules and sites across the EU by June 2026.[100]

Trade

This group is mandated to address trade-related issues like global overcapacities, import surges, and supply-chain dependencies, with a particular focus on critical molecules – complementing the work of the critical molecules and critical sites working group. It aims to provide early warnings of potential trade distortions and improve the process for requesting trade-defence instruments. It also examines growth opportunities through free trade agreements and partnerships to secure access to raw materials such as biomass.

To fulfil the group's objective to act as an early warning system, it will provide monthly early warning reports on import surges, complemented by quarterly chemical sector trade monitoring reports, including overcapacity risks. By July 2026, the group will provide recommendations on accelerating trade-defence measures, and by October 2026, recommendations on cooperation agreements and partnerships to improve market access.[101]

Modernisation and Investments

This group addresses the challenges of an ageing production infrastructure, such as European steam crackers, which are on average 47 years old. It aims to identify high-technology solutions to improve the competitiveness of steam cracker and ammonia production and address potential plant closures, to enable timely policy responses.

To ensure the early-warning function on plant closures and downsizing decisions, the group will develop quarterly early-warning reports. By June 2026, the group will finalise a Charter outlining reforms and funding mechanisms at the EU, national, and regional levels to support modernisation.

[100] European Commission (2026*b*).
[101] European Commission (2026*c*).

And as of September 2026, it will coordinate the implementation of the modernisation charter.[102]

Lead Markets

This group focuses on developing market-pull measures to encourage the uptake of "cleaner chemical products", specifically low-carbon products and sustainable-carbon products (derived from biomass, recycled waste, or captured CO_2). It assesses the feasibility of minimum content requirements, fiscal incentives (such as reduced VAT), and certification schemes to link end markets with chemical production.

The group's work details two deliverables: a report identifying priority end markets for both private and public procurement, including a socio-economic assessment due by April 2026; and a package of policy options detailing market-pull mechanisms and financial incentives to inform future legislation to be delivered by July 2026[103]

2.3.2 Coherence with other EU legislation

The European Chemicals Industry Action Plan is a core sectoral component of a broader approach outlined in other industrial and economic strategy documents designed to restore European competitiveness. Overall, the strategic coherence between the Plan and other relevant legislation and strategies is high or even very high. However, the focus of the documents and their relationship with the Plan differ, as detailed below and summarised in Figure 37:

- The **Clean Industrial Deal**[104] is the overarching growth strategy bringing together climate and competitiveness goals. The Plan is a central sectoral implementation of the Clean Industrial Deal tailored to the "industry of industries" addressed by the overarching strategy and foreseen as a core implementation measure of the growth strategy[105].
- The **Competitiveness Compass**[106] extends beyond industrial sectors by establishing a long-term vision for the EU economy globally focused on innovation-led productivity and overcoming structural weaknesses. Both foci are elements of the Plan. In addition, the Plan seeks to utilise the Competitiveness Coordination Tool proposed by the Competitiveness Compass, which in turn aims to overcome inconsistencies arising from policy fragmentation across Member States.

[102] European Commission (2026*d*).
[103] European Commission (2026*e*).
[104] European Commission (2025*c*), COM (2025)85.
[105] Other sectors explicitly mentioned by the Clean Industrial Deal are the automotive, steel and metal, sustainable transport and bioeconomy sectors.
[106] European Commission (2025*d*), COM(2025)30.

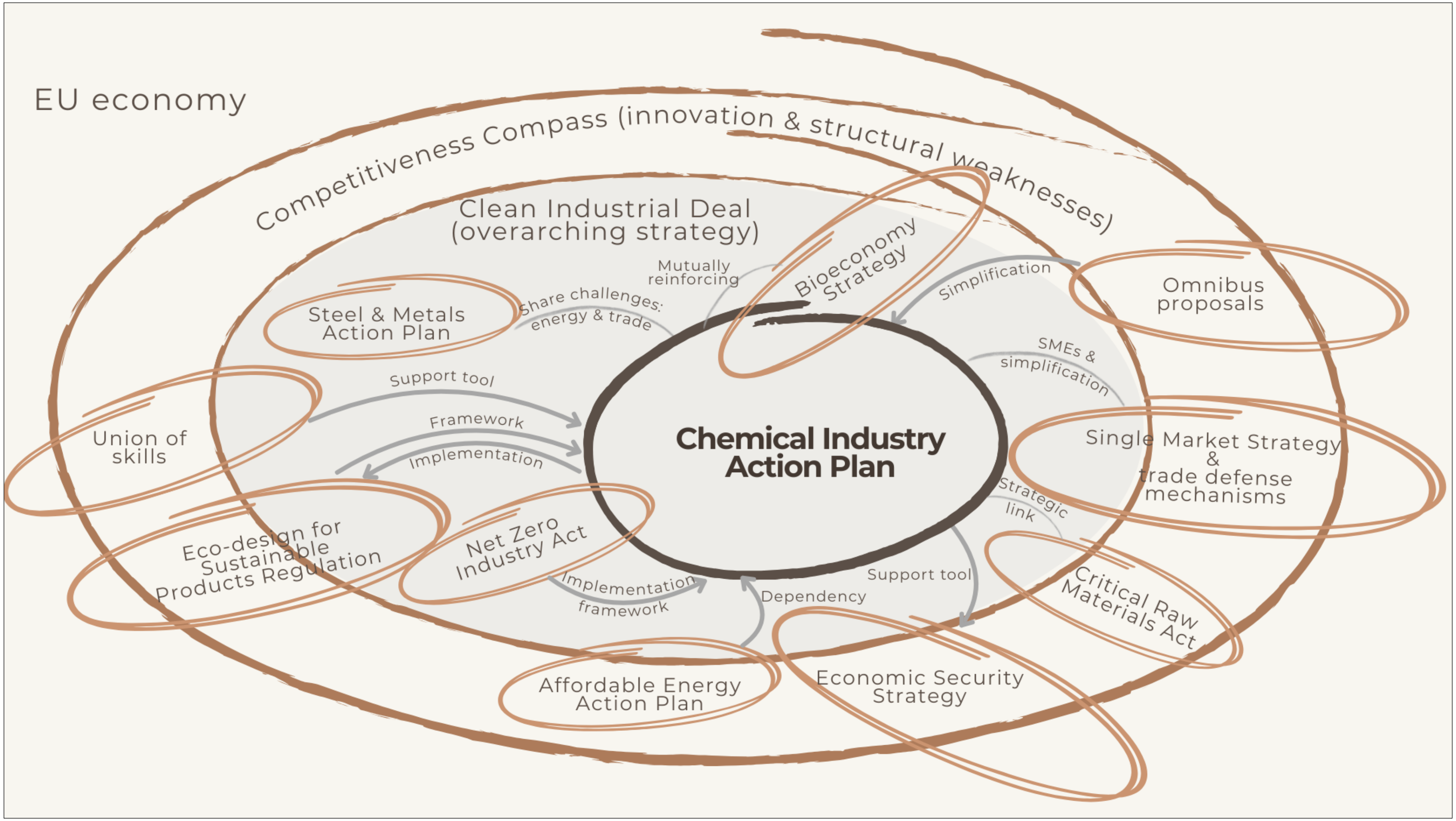
- The **Strategic Framework for a Competitive and Sustainable EU Bioeconomy**[107] is one of the sector-specific implementation tools introduced by the Clean Industrial Deal. With its focus on biological "raw materials", the bioeconomy strategy addresses the chemical sector supply chain. This strategic framework and the Plan share strategic coherence across several aspects and address similar structural weaknesses, including the required feedstock transition, technological synergies, the development of lead markets, the shift to a circular economy, and the need for innovation support infrastructure/ecosystems. Thus, both documents are interconnected and mutually reinforcing.
- The **Steel and Metals Action Plan**[108] is another sector-specific implementation tool introduced by the Clean Industrial Deal. This sector plan addresses challenges similar to those in the Chemicals Industry Action Plan, particularly the effects of high energy prices, decarbonisation efforts and uneven global trade positions. Thus, the two action plans are consistent in terms of their fundamental challenges.
- The **Action Plan for Affordable Energy**[109] provides the structural energy reforms necessary to reduce energy prices and achieve decarbonisation. While the Action Plan for Affordable Energy does not mention specific industries, it is a tool to improve cost-effectiveness across the EU economy, both for the chemical industry and EU citizens in general. Thus, the Plan is heavily dependent on the delivery of the Action Plan for Affordable Energy.
- The overarching aim of the **Single Market Strategy**[110] in reducing barriers to trade and investment diverges somewhat from the Plan's approach to overcoming unfair global competition and trade diversion. However, both documents aim to simplify and ensure product compliance to seek fair trade conditions. Consistency is exemplified by the Digital Product Passport (DPP) and simplification, especially in addressing SMEs, which are referenced in both documents.
- In this context, **Trade Defence Instruments**, especially the Anti-Dumping Regulation[111] and the Anti-Subsidy Regulation,[112] are crucial for ensuring a level playing field in international markets for chemical industry supplies and products. Through the proposed Critical Chemicals Alliance, the Chemicals Industry Action Plan directly complements trade defence to increase its effectiveness.

[107] European Commission (2025*e*), COM(2025)960.
[108] European Commission (2025*f*), COM(2025)125.
[109] European Commission (2025*g*), COM(2025)79.
[110] European Commission (2025*h*), COM(2025)500.
[111] European Parliament and the Council (2016*a*), Regulation (EU) 2016/1036.
[112] European Parliament and the Council (2016*b*), Regulation (EU) 2016/1037.

- The **Economic Security Strategy**[113] is a further element shaping international trade; it is highly relevant to the chemicals industry as it focuses on risks to the EU's strategic autonomy. Several identified risk areas are relevant to the sector, notably strategic dependencies in goods and services and competence in critical technologies. Similar to trade defence instruments, the Critical Chemicals Alliance is a tool supporting the Economic Security Strategy.
- The **Critical Raw Materials Act**[114] aims to ensure a secure and sustainable supply of materials such as lithium and cobalt, which are vital for the green and digital transitions. It addresses risks in the chemicals industry sector similar to those in the Plan. Thus, the two documents are strategically aligned in their aim to reduce strategic dependencies on single third countries.
- The **Ecodesign for Sustainable Products Regulation (ESPR)**[115] provides an overarching framework for product sustainability, while the Plan addresses the industrial transformation of chemicals used in those products. Thus, these two documents reinforce each other. A key element of the ESPR framework is the DPP, which serves as a tool for implementing the Plan.
- The **Net Zero Industry Act**[116] establishes a framework of measures for strengthening Europe's net-zero manufacturing ecosystem for technology products, including the chemicals industry. The Plan explicitly identifies the chemicals industry as a cornerstone of cleantech applications and builds upon the Net Zero Industry Act governance model, thereby providing a high degree of consistency and direct links between the two documents. By referencing specific production processes, the act also explicitly refers to chemical products.
- The **Omnibus Proposals for simplification**[117] address several challenges identified in the chemicals industry. This will contribute to reducing the administrative burden of companies and especially SMEs, which is coherent with the Plan's goal of safeguarding critical chemical production in the EU.
- Finally, communication on **The Union of Skills**[118] is another overarching strategy relevant to many economic sectors, which aims to overcome labour shortage and to support the workforce in mastering the digital and green transitions. Without exemplifying the chemicals industry in the Union of Skills, the up- and reskilling of the workforce is one means to overcome the risk of significant direct job losses in this sector.

[113] European Parliament and the Council (2025), JOIN/2025/977.
[114] European Parliament and the Council (2024*a*), Regulation (EU) 2024/125.
[115] European Parliament and the Council (2024*b*), Regulation (EU) 2024/1781.
[116] European Parliament and the Council (2024*c*), Regulation (EU) 2024/1735.
[117] European Commission (2025*i*), COM(2025)80, and European Commission (2025*j*), COM(2025)81.
[118] European Commission (2025*k*), COM(2025)90.

Figure 37: Relations between the Chemicals industry Action Plan and other relevant EU legislation and strategies



Source: own elaboration.

The preceding analysis shows that coherence between the Chemicals Industry Action Plan and other relevant EU legislation and strategies address several recurring issues. Above all, numerous documents cover the dual aspects of decarbonisation and simplification, both of which aim to mitigate cost and structural weaknesses. These two overarching priorities are complemented by measures to ensure a level playing field in the chemicals industry supply and product markets, ranging from the mitigation of cost distortions to quality standards. While this indicates a comprehensive approach to supporting the industry's transition, the sheer variety of legislative acts also signals a high degree of regulatory complexity. This may challenge LRAs in their capacity to respond effectively.

2.3.3 Unaddressed challenges

The analysis reveals that not all the challenges identified in the chemicals industry are addressed by EU policies. Some challenges stem from fragmentation between EU Member States and regions. Addressing these effectively requires a coordinated, integrated approach between Member States, the European Commission and the other stakeholders involved, as illustrated by the Action Plan's reference to the support offered to Member States.

Relevant challenges arising from fragmented responsibilities include, for example:

- a lack of consistency between national interventions and regional policies for competitiveness and the twin green and digital transitions;
- decarbonisation challenges resulting from insufficient grid and storage development; and
- insufficient investment and cooperation in place-based innovation strategies, including smart specialisation strategies, to enable strategic collaboration between regional chemical sites and innovation clusters[119].

However, the Action Plan does not address all EU-wide challenges equally or sufficiently, especially when considering the tentative information on its implementation via the working groups of the Critical Chemical Alliance:

- The needs for reskilling/upskilling are only partially addressed through an implicit reference to the Pact for Skills. Within this framework, a large-scale partnership for energy-intensive industries, including the chemical industry, has been established. This partnership includes the ECRN as a regional partner and implements projects relevant to the industry.[120] While this partnership provides a framework for cooperation, it remains

[119] See Bianchi *et al*. (2024), and, for examples illustrating the need for investment and cooperation, Andreoni *et al*. (2024).
[120] More information available here.

to be seen to what extent the urgent needs of the chemical sectors can be addressed through effective change to curricula and other measures with existing funding sources.

- The impacts of demographic change on the labour force and the challenge of ensuring sufficient skills in the medium to long term are not addressed. While the current focus must remain on the survival and modernisation of the industry, it is questionable whether the European labour force will suffice, given demographic trends, should the chemicals industry overcome the current crisis. Successfully developing lead markets for a greener chemicals industry to enhance strategic autonomy will require a skilled workforce that current projections may not support.
- The current approach of the Critical Chemical Alliance working group on trade to overcome trade disadvantages primarily considers trade-defence and early warning measures with a focus on critical molecules. This may not sufficiently address trade disadvantages arising from imports that do not comply with EU rules, thereby undermining the competitiveness of compliant EU producers.
- While simplification is one of the four pillars of the Action Plan and certain activities are underway to streamline the regulatory frameworks (e.g. the Omnibus VI package, REACH), strategic and systematic rationalisation remains undefined. Furthermore, these streamlining efforts do not fall under the mandate of either of the working groups established under the Critical Chemical Alliance.

Given that many of the strategic EU documents analysed above were adopted recently (between January and November 2025), their implementation has only just started and consequently, many measures have yet to be enforced. With the work of the Critical Chemical Alliance due to start (February 2026), the degree to which the considerable variety of new frameworks and measures will effectively address the identified challenges remains to be seen.

Box 15: Notes from interviews

• "How can we prevent too much of the chemicals industry from breaking away too quickly? And how can the conditions for upscaling be improved so that new industries, which represent a promising starting point, can be successfully scaled? In this respect, the Action Plan is moving in the right direction and is generally positive. However, in detail, there are issues that indicate the effects of certain measures have not been, or are not being, fully thought through. Some fundamental principles need to be reconsidered. For example, is the ETS the right instrument at a time when energy supply is still insufficient, causing prices to rise before companies are able to complete the transition?

Moreover, it is possible to aim at developing lead markets—such as for low-carbon basic chemicals—but the necessary prerequisites (pipelines, renewable electricity, etc.) must be in place. The extent to which lead markets actually promote innovation is also debatable. Many instruments are inherently bureaucratic—for instance, defining what constitutes "green *steel" and subsequently calculating the steel and aluminium content in a machine to determine the proportions subject to higher taxation.*

In terms of international trade, the Action Plan risks perpetuating competitive disadvantages in export markets if fossil fuels become too expensive. The Carbon Border Adjustment Mechanism, for example, is viewed critically, as the disadvantage for EU producers remains regardless of the measure.

The mindset of the European Commission has changed on many issues, and there is now a greater willingness to address certain topics. However, the problem remains that, although the Action Plan will certainly bring improvements, it cannot solve all the challenges facing the chemical industry."

• *"The Critical Chemicals Alliance is also moving in the right direction. However, this alone does not solve the problem. From an economic perspective, industry-specific actions are insufficient, as they do not address the broader, cross-industry challenges. It is necessary to adopt a pragmatic, cross-industry approach."*

3 Opportunities to enhance the competitiveness and resilience of the chemicals sector

Addressing the manifold challenges of competitiveness while simultaneously driving the green transition of the EU chemicals industry requires a tailored approach. There is no one-size-fits-all solution; strategies must be calibrated at the EU, Member State and LRA levels. The following section explores different opportunities available to LRAs from several strategic perspectives.

3.1 Opportunities for LRAs to develop the chemicals industries in their regions

The crisis facing the European chemicals industry impacts EU territories in different ways, depending on the industry structures and the specific conditions of regional and local frameworks. As LRAs are immediately affected by chemical production site closures or significant reductions in activities, their capacity to counteract decline and to foster chemical production in their regions is of central importance. This is clearly acknowledged by the Chemical Industry Action Plan: "*Under the Pact for Skills a regional partnership led by the European Chemical Regions Network, has as primary commitment to assist regions in navigating the challenges posed by the industry's transition to green and digital practices*."[121]

Overall, the Action Plan identifies several opportunities for LRAs to support the chemical industries in their regions. These opportunities are grouped under the three main headings summarised in the table below, reflecting the distinct thematic areas of LRA intervention.

Table 17: Roles of LRAs according to the Action Plan

Management of critical chemical sites	Workforce development and skills	Market surveillance and enforcement
Matching local needs and resources, bringing industry, academia, and start-ups together	Participation in regional partnerships under the Pact for Skills	Contribution to market surveillance efforts to protect local industries

[121] European Commission (2025*a*), COM(2025)530, p.4.

Using the Cohesion policy to modernise and decarbonise infrastructure	Administrative support for collaboration focused on SMEs	Environmental management of legacy pollution (orphan sites)
Facilitating funding synergies and streamlining fragmented support structures		

Source: own elaboration, based on European Commission (2025a), COM(2025)530.

Apart from the thematic activities expected of LRAs, evidence from interviews, case studies and focus groups identifies additional roles and responsibilities for LRAs to consider in fostering the development of their existing or future chemicals industry. While some of these overlap with those mentioned in the table above, they provide nuanced perspectives on specific activities:

- While the Action Plan is considered a good starting point, it cannot be expected to solve everything. Thus, LRAs will need to **manage expectations** and create a cooperative environment in the search for pathways for the local and regional chemicals industry.
- LRAs are key to understanding regional particularities and challenges and the specific needs of their companies. Thus, they play a pivotal role in **regional and local permitting and investment processes**. Effective facilitation of these processes is crucial, yet it may be hindered by excessive top-down regulation.
- Experience reveals varying levels of institutional readiness among LRAs regarding investment facilitation. LRAs with established chemical industry sites tend to be more effective than those with less experience. This creates significant **scope for learning and knowledge transfer,** enabling less experienced or underperforming authorities to implement the essential processes required to improve reliability and accelerate permitting decisions.
- Chemical industry value chains are frequently regionally embedded, relying on products and services produced by various companies along the value chain. LRAs are best placed to **understand this embeddedness and the intricate links with connected sectors.** These relationships are crucial for the competitiveness not only of the chemicals industry, but also of other manufacturing sectors in their region relying on the chemical industry.
- While competition between regions is a driver for innovation, it should not jeopardise cooperation between them. To be successful, **regions need to collaborate** and pursue joint decision-making for the benefit of all. This approach respects the different chemical industry specialisations across

European regions, while enabling LRAs to provide more effective support through shared expertise. A primary example is the collaboration in the European Chemical Regions Network (ECRN) illustrated in the box below. Furthermore, the ACTIONbook[122] provides a framework for LRAs and other stakeholders within the quadruple helix to navigate innovation in place-based transformation processes, such as those faced by the chemicals industry.

Box 16: Benefits from ECRN membership

Chemical regions are strengthened through:

- knowledge transfer and the exchange of best practices;
- joint representation of interests vis-à-vis EU institutions, making regional concerns more visible in regulatory and funding debates and enabling regional stakeholders to help shape the framework conditions; and
- easier access to funding projects and partnerships, enabling location-specific development policies for the chemicals industry to be designed in a more targeted, evidence-based and impact-oriented manner.

ECRN facilitates a comprehensive dialogue between chemical companies and regions in Europe that are equally affected by EU regulations and decisions. Consequently, regions can adapt proven measures for industrial investment, innovation promotion or environmental technology rather than developing them from scratch.

Source: own elaboration, based on interview with an ECRN member.

- In this context, LRAs play a vital role in promoting **clusters and providing the corresponding regulatory and physical frameworks**. Experience demonstrates the benefits for the chemical industry when it is organised within clusters or specialised industrial parks. Successfully operated clusters leverage integrated approaches, including bespoke infrastructure, research and innovative ecosystems, and dedicated spaces for learning and collaboration. A key success factor is the adoption of an integrated perspective of the regional chemical industry ecosystem. This is exemplified by the Lombardy model, which includes internal activities such as networking and supply chain dialogue, knowledge transfer and capacity-building services, support for European project design, guidance on funding opportunities and internationalisation initiatives. Furthermore, the regional network extends its impact by seeking synergies with other national and European clusters and networks. This strategic positioning allows the region act as a bridge between the Lombardy system and the EU bioeconomy ecosystems.

[122] Bianchi *et al*. (2024).

The benefits of clusters are evident in both the numerous designated zones for chemical industries, such as chemical or industrial parks, and the cooperation between these sites (e.g. in the Trilateral Region or ChemCologne). A recent OECD study[123] categorises these parks as a form of place-based policy using territorial zoning[124].

- Technological disruption inevitably creates both losers and newcomers. LRAs need to identify when specific chemical sub-sectors may face decline due to technological change. By adopting a proactive stance, they can **support industrial transformation** and actively embrace the need for structural change. This is exemplified in the ChemCologne cluster, which notes that "structural change has been a constant companion of the chemical industry in the Rhineland" for decades[125].
- To support these transformation processes, the key task of LRAs is the **provision of an adequate framework**. This includes the development of infrastructure aligned to the needs of the chemicals industry. These needs are shifting rapidly, driven by the transition to renewable energy and sustainable feedstocks, along with the increasing use of digital services.
- While many framework conditions are subject to decision-making at the EU and national levels, regional authorities play a key role, together with higher levels of government, to **advocate for specific framework improvements** for their chemical industries. Strategic priorities include the promotion of internationally competitive energy prices, adequate carbon leakage protection and other measures to bolster the competitiveness of the chemicals industry.
- The current disruptive changes in the chemical industry require corresponding adjustments in skills, supported by expanded tertiary education options within the regions. Apart from offering courses tailored to the needs of the regional industry, these programmes should incorporate foresight regarding the developments in the sector. Curricula should transcend the natural and technical sciences to include digital literacy and EU legislative education, ensuring that graduates understand the need for innovative products. LRAs can **shape educational institutions** in their regions accordingly and thereby facilitate the skills transition necessary for a transformed chemical industry while embedding a carbon-neutral mindset within the research and development community.

[123] OECD (2025).
[124] Other zone-based policies are e.g. Special Economic Zones, Export Processing Zones or Free Trade Zones, which are also place-based but usually require initiation and intervention from higher levels of government. See OECD (2025).
[125] ChemCologne (2022 n°3).

- In times of transformation, not all companies will survive. However, chemical industries often have **significant production facilities and installations that need to be maintained to prevent permanent loss before a potential new use is identified**. In these situations, LRAs play a crucial role in facilitating the preservation of these assets for future repurposing.
- Leveraging diverse EU funding can be advantageous for the chemicals industry. While several instruments are available, finding the most appropriate and promising funding source may be challenging for individual members in the chemical industry ecosystem. **LRAs can assist in the search for adequate funding schemes, especially with those implemented at a decentralised level**. While HORIZON supports research and development, the chemicals industry requires other sources beyond subsidies (e.g. venture capital) to bring innovative products and processes to market. Other support schemes, including Cohesion policy, Just transition policies and Erasmus+, provide further opportunities through national programmes.

Box 17: Lack of venture capital to close the gap in marketed innovation

The EU has acknowledged a widespread lack of venture capital[126]. The IMF has linked this observation to the need for a capital market union to overcome the fragmentation between Member States, which implies high dependence on banks. Such a union would enhance financial resilience and risk-sharing, which would be beneficial for boosting funding for innovation – a particularly important consideration for the green transition. The IMF concludes that a capital market union would "enhance resilience and cross-border risk sharing, reduce the cross-country dispersion in firms' financing costs, and increase returns on savings"[127].

This was corroborated by a recent study on German industrial competitiveness, which highlighted an investment gap in key technologies, resulting in fewer Unicorns. It also clearly identified the need for private capital, beyond public funding, to address the scale-up gap. The study identified five leverage points to overcome these challenges and develop a demand-oriented innovation ecosystem: capital leverage, cooperation leverage, demand leverage, regulatory leverage and governance leverage. These points highlight the interrelations between different measures to support industrial scaling.

Source: own elaboration, based on BCG and UnternehmerTUM (2026).

[126] See here.

[127] IMF (2023).

- **Smart Specialisation Strategies** (S3) developed as a place-based tool under Cohesion Policy, should be implemented wherever available at the regional level. These strategies emphasise the importance of fostering local innovation by focusing on areas of comparative strength. They are designed to boost competitiveness and resilience, building on comparative advantages and enabling conditions for new technologies.
- The regulative framework is challenging for the chemical industry, despite being essential for achieving a sustainable industrial structure in line with emission and pollution objectives. SMEs, in particular, may benefit from LRA support in **navigating these complex rules** and increasing their capacities to manage their business operations under stricter rules.

LRAs do not need to fund these activities alone. They can also draw on various EU funding sources, although these are not always sufficient. Interviews suggest that LRAs could make better use of available cooperation support to enhance the future of the chemicals industry in their regions. While national and regional funding schemes exist in some Member States, the table below provides an overview of the primary EU instruments available. These could be systematically accessed through the public-private initiative proposed by CEFIC (see the box below). Although LRAs are not exclusively eligible, as some funds primarily target private entities, these sources are listed to demonstrate the complementarity of different funding streams. Promoting a more coordinated deployment of these resources reinforces the LRA's role as moderators and coordinators in their regions.

Box 18: The CEFIC proposal for a Public-Private Initiative to Modernise the EU Chemical Industry

To address the multiple and simultaneous challenges currently faced by the EU Chemical Industry, CEFIC has initiated a discussion to promote a Public-Private Initiative

- within the European Competitiveness Fund anticipated for the post-2027 programming period, to achieve a better leverage/impact ratio of technologies for a greener chemical industry, overcoming the current deployment gap;
- to mobilise financing and align funding at different levels to leverage National Partnership Programmes and the Clean Industrial State Aid Framework.

Source: own elaboration, based on CEFIC (2026).

Table 18: Current EU Funding sources deployable to support the transition of the chemical industry

Funding source	Eligibility of LRAs & chemical industry	Description and purpose
Recovery and Resilience Facility (RRF)	Public and private	As a post-COVID recovery instrument, it supports the transition to a safe and sustainable chemicals sector and facilitates other green transition investments needed, inter alia, by the chemical sector.
Cohesion Policy Funds	LRAs and private entities	Different funds can be deployed for the chemical industry in various ways and subject to the priorities and eligibility criteria of the national and regional programmes: ERDF: supports research, development and innovation, SMEs, low-carbon economy and digitalisation As part of the ERDF, Interreg programmes can also be tapped, e.g. to enhance learning between experienced and inexperienced regions. ESF+: supports skills, reskilling, upskilling, labour mobility and social inclusion Cohesion Fund (low-income countries): supports large-scale transport and green infrastructure. Just Transition Fund (in transition territories): supports green and digital transition, innovation in sustainable technologies, reskilling of vulnerable groups
Just Transition (Pillars 1 and 2)	Pillar 1: mainly private Pillar 2: LRAs	Pillar 1: Under InvestEU financial instruments funding supporting the green and digital transitions Pillar 2: Public Sector Loan Facility (PSLF) supports public investments in transition territories
InvestEU Programme	Mainly private	Supports sustainable infrastructure, SMEs, research and innovation and skills development through guarantees to development banks to enhance funding access
HORIZON Europe	Mainly education & private	The R&I programme funds innovative solutions, inter alia, in the chemicals sector.
Innovation Fund	Mainly private, but involving LRAs	It supports innovative low-carbon technologies in energy-intensive sectors and aims to bridge the gap between invention and commercialisation.
Digital Europe	Mainly private	Supports supercomputing, artificial intelligence, digital skills and technology use, as well as cybersecurity, to bridge the gap between digital R&D and market deployment.

LIFE Programme	LRAs & private	Through various sub-programmes, it supports investments in circular economy approaches, clean energy, and chemical-related projects, such as the substitution of harmful substances.
Erasmus+	LRAs & private together with education institutions	Skills partnerships provide funding for strategic partnerships to develop new curricula meeting sector needs. In addition, reskilling can be supported through vocational education and training programmes and continued professional development.

Source: own elaboration, based on United Nations Environment Programme Finance Initiative (2025).

3.2 Experiences from LRAs

LRAs across the EU have already utilised many of these opportunities This report highlights six specific cases, which are analysed in detail in Annex I, with key findings summarised in the following sub-section. Moreover, Section 3.2.2 provides a brief overview of other regional initiatives at the LRA level.

3.2.1 Key findings from the case studies

The six cases, described in detail in Annex I, are **good practices from different perspectives** and represent various Member States: ChemCologne, Germany; Lyon Vallée de la Chimie, France; Espoo Innovation Garden and Green Chemistry Park, Finland; Lombardy Green Chemistry Association (LGCA), Italy; ChemMed Tarragona, Spain; and the Trilateral Chemical Region, Germany/the Netherlands/Belgium. These experiences involve different territorial levels, spanning city-level and metropolitan initiatives (Espoo in Finland, Lyon in France, Cologne in Germany, Tarragona in Spain), regional industrial clusters (Lombardy in Italy), and cross-border regional cooperation across multiple Member States (Germany/the Netherlands/Belgium).

All six experiences show a strong focus on coordination among industry, research entities, and public authorities. They also share common goals: promoting R&D, supporting decarbonisation, and developing transition trajectories to enhance the competitiveness and resilience of chemical companies. However, each case presents unique features. These include the specific place-based approach adopted, the role played by LRAs, and the main lessons learnt.

<u>Specific place-based approach and strategic focus:</u>

• *ChemCologne* in Germany integrates various industrial players, service providers, universities, and local authorities within a concentrated regional cluster. In this **mature chemical region**, a dense network of chemical parks, companies, research institutions, and local/regional authorities creates an integrated industrial ecosystem focused on **industrial decarbonisation**. Shared infrastructure, multi-level governance, and close collaboration with public stakeholders enable coordinated investments in skills, innovation, and decarbonisation. These investments, supported by EU and national resources, are tailored to the specific needs and strengths of the territory. This network approach enables the coordination of climate-neutral transition pathways, collaborative R&D, and the scaling of innovative technologies—such as chemical recycling and circular economy solutions—anchored in local industrial, educational, and policy assets.

• *Lyon Vallée de la Chimie* in France **focuses on industrial transition within a dense urban–industrial corridor**. It explicitly addresses industrial–urban coexistence, land-use constraints and societal acceptance by integrating economic performance, environmental transition, and territorial planning. The approach combines coordinated governance, spatial planning, and brownfield reconversion. It leverages both "hard" instruments (land, infrastructure, and sectoral projects) and "soft" instruments (voluntary commitments, collective strategies, and facilitation) to enhance territorial competitiveness, decarbonisation, and integration of industry within the spatial context of a metropolitan area.

• The *Trilateral Chemical Region* presents a **cross-border place-based strategic approach** that treats the integrated chemical clusters of North Rhine-Westphalia in Germany, Flanders in Belgium, and the Netherlands as a single functional economic and industrial territory. By leveraging geographic concentration, shared infrastructure (pipelines, ports, logistics), and cross-regional innovation and workforce networks, the strategy fosters collaboration among ministries, industry, academia, and intermediaries. This cooperation enhances competitiveness, sustainability, and industrial transition. Dense spatial interconnections and multi-stakeholder coordination enable the region to plan jointly for energy, infrastructure, and circular chemical value chains, making the territory itself a core asset of the strategic approach.

• The *Espoo Innovation Garden and Green Chemistry Park* in Finland represent **a university-anchored innovation ecosystem** where higher-education and research institutions act as the primary organising nodes linking green chemistry research, start-ups and industrial applications. Territorial assets - dense research infrastructure, universities, corporate anchors, and public authorities - are deliberately integrated by concentrating actors and infrastructure within a compact metropolitan corridor. This proximity enables co-creation, experimentation and scale-up pathways for sustainable chemistry, circular solutions, and clean technologies. Relying on long-term, cumulative investments, the local ecosystem embeds sector-specific innovation hubs within broader territorial strengths rather than developing isolated facilities.

• *The Lombardy Green Chemistry Association* (LGCA) in Italy is an **established regional coordination platform.** It brings together firms, universities, and research and innovation actors and promotes innovation among start-ups and innovative SMEs through initiatives dedicated to green chemistry. By coordinating regional capabilities, facilitating EU and interregional projects, and supporting technology scale-up, LGCA exemplifies how strategic, location-specific collaboration can strengthen competitiveness, foster circular bioeconomy solutions, and position the Lombardy region as a centre of excellence for green and sustainable chemical production.

• *ChemMed Tarragona* in Spain focuses on **investment attraction for industrial transition**, combining coordinated cluster governance with EU de-risking finance to mobilise private capital for first-of-a-kind circular projects. By coordinating companies, public authorities, research institutions, and shared infrastructure, the cluster strengthens Tarragona's attractiveness for large-scale investment while enabling green transition and circular economy initiatives. Its governance and integrated services reduce transaction costs, facilitate innovation, and align regional assets with EU funding instruments, demonstrating how territorial coordination can drive industrial competitiveness, sustainability, and strategic positioning at both national and European levels.

<u>Role of LRAs:</u>

• *ChemCologne* includes representatives from chemical companies, academia, LRAs, the chambers of commerce, the chemical industry employers' association and trade unions. LRAs play a central role, providing the regulatory framework for infrastructure and approving investment and funding. **LRAs are not only regulators but also strategic partners securing the region's industrial future and planning for long-term perspectives** with specific roles and tasks tailored to their responsibilities and capacities.

• *Lyon Vallée de la Chimie* is a "territorial pilot" of the metropolitan vision. This platform acts as a point of entry for industrial actors, coordinating public–private cooperation, and supporting the implementation of projects aligned with long-term territorial objectives. The Metropole of Lyon is a **facilitator of industrial projects**. Beyond its regulatory and planning competences, the metropolitan authority organises and manages sector-based collectives in strategic industrial fields, including chemistry, energy, the environment, health, mobility and construction. It provides project engineering, connects industrial actors to relevant partners and funding schemes, and helps overcome coordination failures that often hinder industrial transition at the local level.

• The *Trilateral Chemical Region* cooperation initiative operates on three different levels: a strategic level with a steering committee consisting of ministries (including regional ministerial bodies of North Rhine-Westphalia in Germany and Flanders in Belgium) and industrial associations; an operational level with all stakeholders across three working groups; and an operational/activity level for sub-groups and concrete projects. The governance structure focuses primarily on the ministerial level rather than on local players. LRAs, such as municipalities, are mainly involved in information sharing and **consultation processes** during the planning stage of the various activities outlined in the strategy. The regional ministerial bodies of North Rhine-Westphalia and Flanders are responsible **for policy coordination to reduce regulatory, financial and administrative obstacles as well as for infrastructure development.**

• *Espoo Innovation Garden and EriCa Green Chemistry Park* in the City of Espoo acts primarily as a facilitator, supporting networks, shared spaces and city-as-a-testbed practices, with **infrastructure investments reinforcing the ecosystem's attractiveness for knowledge-intensive activities**. At the regional level, the Helsinki–Uusimaa Regional Council ensures **strategic continuity and alignment with regional and European priorities,** setting thematic focus areas and financing frameworks. Together, these authorities create a stable, multi-level governance environment that lowers coordination costs, translates national and EU objectives into locally adapted actions, and strengthens the territory as an innovation ecosystem for green and sustainable chemistry.

• *Lombardy Green Chemistry Association* is a non-profit association, granted legal recognition by the Lombardy Region, functioning as an **institutionalised platform that convenes firms, universities, and research and innovation organisations along the green chemistry and bioeconomy value chain.** It leverages both public and private actors to strengthen innovation, industrial competitiveness, and the transition to circular and low-carbon chemical production, while also linking Lombardy's ecosystem to wider European networks and interregional projects.

• *ChemMed Cluster* is a transversal group led by the Chemical Business Association of Tarragona (AEQT) and its six associated companies, the Port of Tarragona and AITASA. The cluster has embedded the representation of the national and LRAs, including the Spanish government, the Government of Catalonia, the Tarragona Regional Council, and the municipalities of the 13 towns and cities connected with the region's chemicals industry. LRAs support the **availability of common utilities, industrial connectivity**, **logistics integration and land availability.**

Table 19: Key features of the six case studies in terms of governance structure and the role and strategic focus of LRAs

Initiative	Governance structure	Role of LRAs	Strategic focus
ChemCologne	Multi-actor governance, including representatives from industry, academia, public institutions, employers' associations and trade unions	Central role: regulatory framework, infrastructure planning, approval of investments and funding, strategic partner for industrial development	Long-term territorial planning and industrial development

Lyon Vallée de la Chimie	Cluster functioning as a territorial platform coordinated by the metropolitan authority	Strong facilitation role: public–private coordination, project engineering, access to funding, management of sectoral networks	Coordination of industrial transition and territorial integration
Trilateral Chemical Region	Multi-level governance: strategic (steering committee consisting of ministries and industrial associations), operational (working groups), and project-based sub-groups	Policy coordination, removal of regulatory barriers, and infrastructural development	Cross-border policy coordination and regulatory alignment
Espoo Innovation Garden & EriCa Green Chemistry Park	Multi-level city–regional governance	City: ecosystem facilitator, testbed environment, infrastructural investments. Region: strategic continuity and alignment with EU priorities	Development of innovation ecosystems and technological experimentation
Lombardy Green Chemistry Association	Institutionalised non-profit association officially recognised by the regional authority.	Regional institutional recognition and strategic support	Strengthening innovation capacity and European/interregional networking
ChemMed Cluster	Cross-sector industrial cluster led by an industry association with embedded public representation	Operational support: provision of common utilities, logistics integration, industrial connectivity, land availability	Operational optimisation and territorial industrial competitiveness

Lessons learnt:

These cases demonstrate that successful place-based industrial strategies rely on leveraging territorial assets, dense networks, and embedded governance structures. A defining feature across these six experiences is **the integration of production, infrastructure, and knowledge within clearly defined ecosystems**. Shared infrastructure—from chemical parks and logistics networks to laboratories and co-working spaces—enables efficiency, industrial symbiosis, and lower entry barriers for start-ups, while fostering cross-firm collaboration and sectoral innovation. Involving local, regional, and sometimes national authorities, alongside universities, research centres, and intermediaries, ensures strategic alignment, coordination, and continuity, creating a stable framework for long-term investment and industrial upgrading. **Facilitation and orchestration capacities are more critical than formal top-down control**. Intermediary platforms, cluster management, and structured engagement routines reduce transaction costs, align stakeholder priorities, and mobilise public and private resources efficiently. These examples demonstrate that a cumulative, context-sensitive, and territorially anchored approach is essential for sustaining industrial competitiveness and resilience, enabling green transition, and enhancing regional innovation ecosystems. More in detail:

• From the perspective of public authorities, the principle of **multi-level governance and partnerships** at the decision-making level is essential to achieving successful outcomes, particularly for decisions concerning investments and structural transformations.
• **Strengthened territorial coordination and governance are key in areas such as decarbonisation pathways and industrial ecology**, where collective action at the territorial level is essential.
• **Close partnerships with education institutions and research centres** support the supply of skilled labour and ensure consistency between industrial needs and the development of skills.
• **Innovation and workforce linkages** leverage the geographic concentration of knowledge institutions and skilled labour, which contribute towards closing skills gaps for available employment in industries based in regions.
• **Shared transport and logistics networks** improve sector competitiveness and resilience by reducing costs.
• Place-based support for chemistry is **cumulative and long-term.**
• Sector-specific assets work best when **anchored in a wider innovation environment.**
• The creation of regional coordination platforms is key to facilitating dialogue between key stakeholders. These include companies, trade unions, research and innovation actors, educational bodies and social partners, as well as local, national and EU authorities. Such platforms support the industry's sustainability and digital transitions, innovation, and internationalisation.
• **Cluster coordination with the national and LRA level** can reduce transaction costs for firms, strengthen the visibility of the industrial location, and create a structured interface between companies and institutions.
• **Cluster governance and shared infrastructure are essential to attract and enable large-scale green industrial investments**.

3.2.2 Other LRAs experiences

The following experiences briefly illustrate other diverse but complementary approaches through which LRAs enable decarbonisation, circularity, and resource efficiency in the chemicals industry, highlighting the importance of place-based governance and integrated industrial ecosystems in supporting its competitiveness and resilience.

Collaboration and cluster ecosystem governance

In Italy, Piemonte provides an example of **regional cluster network governance** that connects sector platforms under a shared operating model. Launched in 2022, the ***Sistema Poli Piemonte***[128] model aims to strengthen sector-specific skills developed within local innovation clusters and to expand knowledge and opportunities for companies, SMEs, and the wider regional economy. The initiative pursues four main objectives: enhancing the impact of regional research and innovation policies; promoting technology transfer to support smarter regional development; accelerating the growth of the Piemonte production ecosystem; and establishing a shared methodology to foster cooperation and project generation, thereby enhancing territorial resilience and extra-regional competitiveness. As part of this network, the CGreen innovation cluster (Green Chemistry and Advanced Materials) supports competitive growth by **facilitating technology transfer, networking and cooperation among firms, research actors and other territorial stakeholders**. It is managed jointly by three organisations: the IBIS Consortium (Novara), which connects innovative chemical companies focused on sustainable and bio-based products and processes; the Proplast Consortium (Alessandria), a technology centre for plastics specialising in research, advanced laboratories and training that integrates industrial and academic capabilities; and the Science and Technology Park in Valle Scrivia (Tortona), promoted by the Piemonte Region to foster innovation diffusion and knowledge exchange between research and enterprises in south-eastern Piemonte. The scope of CGreen is deliberately cross-sectoral, encouraging partnerships around enabling technologies, including digital transition, and solutions linked to health and community wellbeing.

In **Belgium**, **Catalisti Cluster**[129] was founded in 2017 as one of the Spearhead Innovation Clusters in Flanders. The cluster showcases a **neutral intermediary model** that structures open innovation across the whole industrial sector. Supported by the Flemish government and driven by its members, the cluster spans the entire chemicals and plastics value chain, including multinationals, SMEs, start-ups, universities, research institutes and international partners. Catalisti facilitates open innovation projects through four strategic programs: Biobased Value Chains (renewable chemicals), Process Intensification (efficient processes), Circularity (waste-to-resource transformation), and Advanced Sustainable Products (clean technologies). As a neutral intermediary, **it aligns**

[128] The official Sistema Poli Piemonte website can be found at the following link.

[129] Catalisti's official website and the main information about the cluster can be found at the following link.

stakeholders, accelerates business innovation, and enhances the global competitiveness of the Flanders' chemical and plastics sector[130].

Furthermore, Catalisti is the lead partner of Moonshot, an industrial innovation programme[131] that unites citizens, governments and industries. Its goal is to transform Flanders into a CO2-neutral society by 2050, through the development of marketable, innovative and sustainable technologies. To this aim, the government of Flanders is investing a total of EUR 400 million across various Moonshot projects[132].

In **Poland,** the **West Pomeranian Chemical Cluster "Green Chemistry"** (established in 2007) exemplifies a **scale-and-representation model.** It aggregates a large membership base with a strong export orientation, representing the chemical and biotechnology industry at both national and European levels. The cluster consists of 188 entities, including 142 SMEs, 28 large enterprises, 7 research units and universities, 6 LRAs, and 5 business environment units[133]. Together, cluster members employ 38,000 workers and generate an overall turnover of more than EUR 26 billion, more than half of which is associated with exports.

In the Opole Region, **Chem-Ster in Opole** illustrates an **investment-oriented cluster that operationalises applied cooperation around speciality chemicals**[134]. Established in August 2013 and awarded Key Cluster of the Opole Region status in 2017, it brings together 20 companies, 3 scientific partners and an educational centre under the same governance structure with the Kędzierzyn-Koźle Industrial Park, which acts as coordinator, while Grupa Azoty ZAK Kędzierzyn plays a leading role. Its mission combines support for speciality-chemicals innovation with a service logic approach for firms. This aims to make joint technology development, upgrading and business cooperation easier to organise and repeat over time.

In Germany, **ChemDelta Bavaria** is a **business-led regional initiative** representing the South-East Bavarian Chemical Triangle, a multi-site chemical production area anchored around major facilities such as Chemiepark Gendorf, the largest chemical park in Bavaria[135]. Bringing together around 25 chemical and related companies, the initiative aims to strengthen the competitiveness, visibility and policy representation of the regional chemical industry. ChemDelta Bavaria is driven by industry coordination, focusing on regional infrastructure connectivity, energy transition challenges, workforce development and

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[130] Catalisti's profile from the European Cluster Collaboration Platform can be find here.

[131] Further information on the Innovation Roadmap of the Catalisti experience can be found here.

[132] Chemical industry in Flander region, link.

[133] Additional information can be found here, link

[134] Additional information on the Chem-Ster Speciality Cluster could be found here.

[135] See also the Bavaria's profile by Burghausen for additional detail on the structure of the Bavarian industry and planned transformation plans, link.

community engagement across a geographically dispersed industrial cluster. It shows a complementary perspective on how private-sector platforms can structure territorial priorities and support the long-term transition of a specialised chemical region.

The combined joint action of the cooperation network **Chemie+ is an example of the transition coalition model.** Located in the Mitteldeutsche Chemiedreieck (Saxony-Anhalt) in **Germany,** this **supports the energy-intensive industries in the region by facilitating joint transformation efforts** and coordinated representation of common interests. The network has recently been activated and is now embedded within the Forum Rathenau Association, which supports development of the region across multiple sectors to strengthen its competitiveness at the European level. Chemie+ brings together industry, SMEs and start-ups, public authorities, research institutions and others. The initiative integrates different thematic perspectives, including chemical industry transition, sustainable construction, education and circular material use, and is framed around a shared vision of rethinking carbon use ("Kohlenstoff neu denken").

Research, skills and industry interface

In the **Czech Republic**, **ORLEN UniCRE** offers a clear example of how an industrial chemicals site can be turned into a **structured interface between research, education and production**. UniCRE is the ORLEN Unipetrol Group's research and education centre in Litvínov, located within the **Chempark Záluží** industrial site, and set up to link applied chemical research with industrial practice and skills development. The initiative, launched in 2008, built on existing on-site testing capacity and expanded through new laboratory and training facilities[136], starting its activities in October 2010[137]. The proximity to industrial operations helps shorten the loop between problem identification, experimental work and validation. At the same time, the nearby University Centre in Litvínov[138] strengthens the skills pipeline by providing students with opportunities to work on real projects in cooperation with UniCRE. In recent years, the centre has contributed to applied R&D on green hydrogen, plastics recycling (including chemical recycling routes), biofuels, decarbonisation and digitalisation, as well as pilot testing of alternative feedstocks and related process implications.[139]

In **Mazovia**, Poland, the **Mazovian Green Chemistry Valley[140]** (MGCV) is a representative example of a **cluster and research consortium linked to industry, focusing on education and innovation**. Partners include the institutes

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[136] Additional information available at the following link.
[137] Additional information can be found at the following link.
[138] Further information on the links between UniCRE and the University of Litvìnov can be found here.
[139] ORLEN Unipetrol (2024), ESG Report on sustainable development of the Orlen Unipetrol Group for 2023 p.63, link.
[140] Additional information on the Mazovian Green Chemistry Valley can be found in the Interreg Europe good practice database and on the official CORDIS webpage.

of the Polish Academy of Sciences (Institute of Physical Chemistry PAN, Institute of Organic Chemistry PAN), research institutes (Institute of Nuclear Chemistry Technology, Industrial Chemistry Research Institute, Institute of Industrial Organic Chemistry, Pharmaceutical Research Institute) and the chemical departments of universities (Warsaw University of Technology, University of Warsaw). The MGCV helps consolidate operations and link research units located in the Central Vistula Valley. This creates added value for the development of didactics, science and innovation activities for industry.

In **Ireland**, the Applied Polymer Technologies (APT) Gateway is a national, **industry-focused research and innovation centre** based at the Technological University of the Shannon, in the **Midlands Region**. Through a collaborative approach between the university and industry, it supports companies and SMEs in developing and improving polymer-based products by providing applied research, technical expertise and access to advanced facilities. By working directly with industry on near-to-market projects, APT facilitates technology transfer, accelerates product development and enhances the competitiveness and sustainability of Ireland's polymer and plastics industry. Since its formation in 2013, APT has successfully completed over 825 projects with companies, amounting to a value of over EUR 5,3 million. This work is supported by the national enterprise development agency, Enterprise Ireland, through its Technology Gateway Programme.

Shared industrial infrastructure and platform for decarbonisation and circularity

NextGen District is an 88-hectare zone within the **Port of Antwerp**, in Belgium, dedicated to the **recovery of raw materials** from end-of-life products (recycling) by process industries and energy transition projects[141]. The NextGen District is a perfect example of an **industrial symbiosis approach**[142] **that clusters circular feedstocks and energy transition** in one port-based zone. In fact, it is home to multiple pioneering projects, including plastics recycling (PureCycle and Triple Helix)[143]; repurposing chemicals from end-of-life tyres (Bolder Industries); green hydrogen production (Plug); and producing cooling and process water out of municipal wastewater (Ekopak).

In the **Netherlands**, the **Botlek Steam Network in Rotterdam** illustrates how **shared utilities serve cluster-wide efficiency and emissions reduction**. The project brings together LyondellBasell, Cabot, AVR, NetVerder, Air Liquide, LANXESS, and Huntsman, with strong support from the Port of Rotterdam, the Rotterdam municipality, and the Province of South Holland. The initiative builds on existing infrastructure to expand a steam pipeline network that connects energy

[141] Further information on the NextGen District available here.
[142] CEFIC (2025*e*).
[143] Further details on the PureCycle plant are available here.

producers and consumers across the industrial cluster in the Rotterdam area[144]. Steam generated from Cabot's carbon black production process, which would otherwise be wasted, is now recovered and delivered as a valuable energy source to neighbouring facilities, primarily LyondellBasell's Botlek site. By replacing natural gas-fired steam generation with recovered steam, the project enables a reduction of at least 50 million cubic meters of natural gas annually. This translates to about 100,000 tonnes of avoided CO_2 emissions per year, with potential to reach up to 400,000 tonnes as capacity grows; significant water savings, with Cabot's water withdrawal reduced by more than 50% through condensate return and the reduced use of water-cooled condensers; lower NO_x emissions and improved overall energy efficiency across the industrial cluster. The project turns flue gas with caloric value into a shared energy source, contributing directly to the EU Green Deal and Dutch decarbonisation goals.

Poland's hydrogen valleys illustrate an ecosystem deployment model that links supply, infrastructure and end-use to accelerate implementation. Poland is the third largest producer of hydrogen in Europe[145] (around 1.3 million tonnes per year). However, all of this output is still fossil-based and used on-site in refining and chemicals, particularly in refineries and fertiliser production. Building on this, Poland's hydrogen valleys **are conceived as ecosystems that organise the entire value chain locally**, from production and storage to distribution and multiple end-uses, with a strong emphasis on demonstration and deployment. At the **local level**, different valleys reflect various pathways for linking hydrogen to industrial decarbonisation, including in the chemical sector. In **Mazovia**, the **Mazovian Hydrogen Valley** is structured as a regional cluster (established in April 2022) that explicitly combines value-chain development, R&D cooperation, skills and regulatory support. It also provides the umbrella for the HySPARK project[146], which focuses on hydrogen demand in airports and public transport (vehicles and testbeds), supplied via ORLEN's hydrogen hub in Włocławek. The valley's ambition is to connect hydrogen producers with technology providers and end-users across sectors, including the fertiliser and chemicals value chain. A second Valley is located in **Pomerania**, the **Amber Hydrogen Valley[147]**. This initiative is a full value chain ecosystem spanning industry, energy, transport and port infrastructure. It focuses specifically on hydrogen use linked to ports and regional logistics, and sits alongside ORLEN's (which is also the Amber Hydrogen Valley coordinator) wider decarbonisation efforts in the region[148], including renewable hydrogen projects located next to refining assets.

[144] CEFIC (2025*f*).

[145] The British Embassy in Poland (2023).

[146] Additional information on the HySPARK project could be found here. The HySPARK is a project financed under the Clean Hydrogen Partnership project, specifications available here.

[147] Additional information on the Amber Hydrogen Valley can be found here.

[148] Further information on ORLEN's hydrogen investments are available here.

In **France**, the **Grand Est Region** has positioned the **bioeconomy as a core pillar** of its development strategy, providing an example of the **reindustrialisation pathway.** It aims to become a European leader in bio-based chemistry, biotechnologies and bio-based molecules. Since 2017, the region has implemented a dedicated Bioeconomy Strategy. This is supported by substantial regional funding that leverages a distinctive territorial asset base characterised by extensive agricultural and forest biomass availability. The strategy promotes the valorisation of biomass into bio-based chemicals, materials, fuels and intermediates. This is complemented by a sector contract with COSMED (the French cosmetic association for SMEs) to accelerate industrial scale-up and reduce environmental impacts. The territorial reindustrialisation pathway for the chemical sector is based on biomass substitution, industrial biotechnology and circular feedstocks, aligned with EU climate-neutrality objectives. The regional governance mechanism coordinates agriculture, forestry and chemical industries. It also addresses key challenges for the bio-based transition, including regulatory complexity and financing gaps for scale-up and market uptake of bio-based products.

Always in **France**, the **Normandy** region provides another example of a dedicated bioeconomy framework. Its 2023–2025 **bioeconomy strategy**, co-developed by the Region, the Regional Chamber of Agriculture and the Bioeconomy for Change competitiveness cluster, was built through an "États généraux" process in May 2022 and then formalised in 2023. The roadmap is **explicitly framed around competitiveness and industrialisation**. It focuses on five priority value chains, including bio-based chemistry alongside plant proteins and new proteins, blue bioeconomy, natural fibres, and bioenergy. Operationally, it combines ecosystem-building actions such as a regional portal and actor mapping, and the preparation of a biomass resource observatory, with more targeted initiatives to structure project pipelines and raise awareness among industrial actors, including dedicated outreach to commodity chemicals and plastics value chains.

The **Brightlands Chemelot Campus,** based in the **Chemelot Industrial Park** in **Geleen, Belgium,** is one of the largest research and business parks in Europe[149]. It is an initiative of the Province of Limburg, the chemical company DSM and Maastricht University and serves as a hub for piloting and demonstrating disruptive and innovative technologies in partnership with the industrial park. The campus also hosts a **Circular Hub,** which offers cutting-edge solutions[150], from transforming waste into valuable raw materials to scaling up sustainable industrial

[149] CEFIC (2025*g*).

[150] The Chemelot Circular Hub participates in highly innovative projects also financed by Horizon Europe, such as the SYSCHEMIW. Further information available here.

infrastructure. Additionally, there is a joint venture between TNO and Maastricht University focusing specifically on the circularity and recyclability of plastic.

The **German** state of **Saxony-Anhalt** is characterised by a strong constellation of industrial and research actors in the chemical sector. This concentration of human capital, applied research capacity, and large industrial sites supports climate-friendly chemical production and investment, often through collaborations that connect feedstocks, technology development and deployment at scale. With companies such as UPM, Südzucker, Mercer and Verbio, the region has established **industrial routes for turning beech wood, sugar and other agricultural inputs or residues into chemical raw materials, creating a platform for further green transition investments**. One example is UPM's investment at Leuna, which linked a bio-based chemicals pathway by connecting regional biomass resources with industrial processing and innovation partners[151]. In parallel, the LeunaPower2MeOH project led by TotalEnergies Raffinerie Mitteldeutschland aims to decarbonise methanol production at the Leuna site by replacing fossil hydrogen in the existing methanol unit with green hydrogen[152].

Regulatory coordination and risk management

A relevant example of **regional governance addressing hazard and exposure risks** is represented by the **regional PFAS action** plans adopted in Flanders and Wallonia[153]. These plans establish a coordinated regulatory framework and policy agenda, setting out monitoring measures, risk-management actions, remediation priorities and governance arrangements to tackle PFAS contamination in a structured and territorially embedded manner.

The '**PFAS action plan: A stepping stone to tackling Substances of Very High Concern'** was adopted by the **Flemish government** in December 2022. Originally covering the period 2022-2024, it was later updated in July 2023 to extend the period of actions. It includes 52 actions, including environmental monitoring, human biomonitoring, research on analytical methods, exposure scenarios, remediation methods, setting emission and maximum concentration limit values, encouraging PFAS substitution, public information, and risk communication actions. The '**PFAS strategy to protect public health and the environment'** announced by the **Walloon government** in October 2024, sets out a list of measures to be taken at regional level, including further environmental monitoring and human biomonitoring, setting emission and maximum concentration limit values (e.g. revising drinking water parameters and limit values in sludge), encouraging PFAS substitution, public information, and risk communication actions. The **Brussels-Capital region** does not have a formal PFAS action plan. However, in 2019, the region created a **working group**

[151] Additional information on the UPM's biorefinery investment can be found here.
[152] Additional information on the TotalEnergies Raffinerie Mitteldeutschland's investment can be found here.
[153] HEAL (2025).

'Emerging contaminants – PFAS' which is tasked with collecting data on PFAS contamination in the region and proposing management approaches regarding soil and groundwater PFAS pollution.

Digitalisation for operational efficiency

An illustrative case of digital process optimisation to reduce hazard inputs and energy consumption is provided by **Finland**. The **Lotsbroverket wastewater treatment plant** in Mariehamn adopted Kemira's cutting-edge digital service to optimise its chemical pre-treatment processes[154]. This system was designed to maximise energy savings while ensuring a stable and effective wastewater treatment operation. The data-driven, automated solution from Kemira measures several key indicators in the wastewater treatment process. These include flow, turbidity, and suspended solids in the influent wastewater, along with chemical markers such as ammonium, phosphate, COD (Chemical Oxygen Demand), nitrate, and oxidation-reduction potential. The system also **monitors aeration energy consumption and biogas productio**n. Using this data, intelligent algorithms calculate the optimal chemical dosage for pre-treatment, adjusting the process in real-time to maximise efficiency and minimise waste[155]. The automated system has reduced aeration energy consumption by 6% and ferric sulphate use by 55%, leading to substantial cost savings and a reduced environmental footprint. The plant's **improved energy efficiency and chemical optimisation** demonstrate how digital solutions can drive sustainability in the wastewater treatment sector.

[154] CEFIC (2024).

[155] Further information on the wastewater treatment plant and the high innovative solutions can be found here.

4 Foresight perspective

A foresight study was conducted to complement the preceding analysis and support the development of robust policy recommendations. Presented in the following sections, before the study's overall conclusions and recommendations (chapter 5), this exercise provides strategic insights into the potential evolution of the EU chemicals industry and the resulting implications for its competitiveness. After a brief introduction to the rationale, the chapter identifies key trends and drivers expected to shape the future of the EU chemicals industry. This is followed by the foresight exercise itself, which distinguishes three potential pathways. Each pathway is formulated as a provocative scenario to stimulate out-of-the-box thinking.

4.1 Reasons for a foresight perspective for the EU chemicals industry

Strategic foresight provides a structured framework for exploring the future, fostering imaginative thinking and future-proof policy making. In a continuously changing world, foresight enables policymakers to anticipate plausible developments, identify future opportunities or challenges, and prepare for diverse scenarios. This is particularly relevant for sectors facing high levels of uncertainty, such as the EU chemicals industry. The integration of a place-based perspective adds significant value by ensuring that future-oriented strategies and policy decisions reflect territorial diversity and respect regional and local specificities in the chemicals industry (types of industries, density, etc.). Territorial foresight addresses a critical dimension often neglected or overlooked: the fact that Europe's transitions are primarily spatial. Consequently, territorial foresight examines how different changes may impact different types of territories uniquely, without favouring a single scenario, policy option or implication. The different scenarios serve as eye-openers, inspiring the exploration of alternative pathways and their implications. The following sections present a brief outlook on the future of the EU chemicals industry, with a focus on possible implications for LRAs. Drawing on diverse sources, they synthesise key trends, future challenges, uncertainties and opportunities likely to shape the sector. This is intended to support place-based decision-making.

4.2 A turning point for the 'industry of industries'

The EU chemicals industry finds itself at a turning point. Declining production, the loss of global market share, site closures and intensifying international competitiveness have put the industry under pressure. Currently, the chemicals industry is largely driven by the twin transitions. There is a robust push to decarbonise production and foster circularity, while simultaneously accelerating digitalisation across value chains. While these shifts are conceptually clear, their implementation requires substantial changes in energy supplies, feedstocks and materials, as well as the design and optimisation of processes. This transformation is occurring against a backdrop of high uncertainty, regulatory changes and shifting geopolitical dynamics that require less dependency and more resilience. In this context, this section takes a closer look at key trends and developments expected to impact the future of the chemicals industry in the coming years. This short synthesis explores possible futures for the industry in an effort to clarify the strategic questions and policy choices required for successful transition.

Energy transformations, de-fossilisation and a shift to renewables: High energy and feedstock costs exert additional pressure on European producers. Simultaneously, the green transition further intensifies the need for cleaner energy sources, while geopolitical developments necessitate greater strategic autonomy. Discussions currently centre around electrification and the hydrogen economy. In particular, replacing fossil fuels with renewable electricity, including required changes to energy-intensive processes, and integrating hydrogen as both a low-carbon energy carrier and a chemical feedstock to replace oil and gas[156]. In a world with uneven standards for decarbonisation and environmental protection, this puts additional strain on the trade-dependent chemicals industry.

Circularity and circular approaches: Circular approaches are a key trend in the chemicals industry, as they maximise the value of materials in circulation by keeping them in value chains longer through re-use and recycling into new materials. This is reflected in cradle-to-cradle models and the development of business strategies that optimise value across different lifecycles. It also encompasses chemical recycling utilising specific processes for particular types of plastics. As a result, these approaches offer long-term environmental benefits and reduce dependencies on imported raw materials[157].

Digitalisation and the role of technology: Digital technologies will continue to play a key role in research in the chemicals industry. Artificial Intelligence is used to optimise production and search for new materials[158], quantum computing enables research for new chemical compounds and the optimisation of existing materials, while digital data handling supports systems for high-fidelity data sharing[159].

Regulations, innovation and territorial readiness: The chemicals industry is also influenced by an evolving regulatory framework. This concerns, in particular,

[156] Harrandt, J., Carus, M., and vom Berg, C. (2024).
[157] CEFIC (2019).
[158] Deloitte (2025).
[159] European Commission (2023*b*).

REACH regulation[160] (Registration, Evaluation, Authorisation and restriction of Chemicals), which aims to protect human health and the environment from the risks posed by chemical substances. This regulatory framework integrates a hazard-based approach into risk-based regulations[161]. Consequently, industries are mandated to manage the risks posed by chemicals and provide comprehensive safety information on substances. Similarly, other tools, like the Carbon Border Adjustment Mechanism (CBAM)[162] aim to set a fair price on the carbon emitted during the production of carbon intensive goods entering the EU, thereby reinforcing environmental ambitions. Critical factors include the scope of product coverage and territorial readiness in terms of administrative capacity. This refers to the LRA's capacity to adapt to regulatory changes and ensure that implementation remains aligned with the evolving requirements.

Regionalisation, strategic autonomy and resilience: China is expected to account for more than half of global production by 2030[163]. With this shift in global chemical production towards Asia, the European industry is expected to focus more on its domestic market, given that approximately 70% of EU chemicals are generated within the EU. In line with the strategic autonomy objective and the aim to reduce dependencies at times of geopolitical uncertainty, a 'Europe for Europe' strategy[164] is increasingly supported.

Workforce re-skilling and education: Re-skilling and education reform are essential for the green and digital transition[165]. There is a need to reform education systems to align them with the needs of the industry and integrate practical hands-on experience and vocational training alongside theoretical knowledge. Besides education, re-skilling programmes will be necessary to enable the workforce to handle advanced technologies and low-carbon manufacturing processes.[166]

4.3 Key questions for the future

What does the future hold for the EU chemicals industry? The following subsections present three distinct future pathways. They are simplified and designed as policy-relevant exploratory tools to support reflection on the future of the EU chemicals industry, in the context of ongoing changes and priorities. The scenarios are balanced, plausible and based on observable policy-driven discussions that shape the sector today, regarding regulation, environmental sustainability, energy transformation, trade, innovation and regional capacity. Each scenario is framed as a 'what-if' question to test the consequences of

[160] See here.
[161] European Commission (2023*b*).
[162] ECRN (2024).
[163] CEFIC (2019).
[164] Deloitte (2025).
[165] European Commission (2023*b*).
[166] ECRN (2024).

possible trajectories in the future. Again, the idea is not to make predictions, nor to select or promote a preferred option, but rather to highlight relevant implications that may impact the work of policymakers and affect place-based decisions. Taken together, the three scenarios serve as a starting point for further discussion and learning, informing and identifying where additional efforts in the coordination, capacity building and policy making may be needed for a resilient and competitive EU chemicals industry.

4.3.1 What if the regulations outpace the innovation capacity and implementation across regions?

In this scenario, regulatory requirements advance and reflect the environmental, social and technological objectives; however, they do so faster than the preconditions needed for LRAs and businesses to keep up[167].

Key trends shaping this scenario
• Expansion of environmental and chemical regulations • Increasing regulatory complexity • Uneven administrative capacity of regions and businesses • Scale-up challenges for the safer and sustainable alternatives • Rising compliance costs for SMEs

What happens in this scenario? This scenario explores a future in which regulatory requirements in the EU chemicals industry develop faster than the capacity of the industry, individual businesses, and overall innovation systems to adapt. The scenario is built on existing challenges. The environmental and chemical regulations continue to expand, reflecting the necessary social and environmental objectives. However, the pace of these requirements increasingly exceeds the ability of businesses, particularly SMEs, to respond. Consequently, rather than acting as a key driver of positive change, shaping the chemicals industry future, this regulatory pressure may unintentionally accelerate industrial decline instead of the transition envisaged.

The EU continues to pursue high environmental and health protection standards in response to public health and environmental consciousness. While new restrictions require adaptations, the systems needed to implement these regulatory changes often struggle to keep pace. Notwithstanding efforts for simplification, the sheer complexity of the expected standards remains a challenge. Implementation capacity varies across LRAs, with some authorities able to provide support and guidance, while others face staff shortages and limited expertise. This disparity is mainly due to a lack of the preconditions necessary to

[167] This scenario's focus does not consider trends of energy costs and other challenging factors, since these are subject to other scenarios further below.

prepare the regions and businesses to keep up with the advancements. As a result, compliance with and implementation of new EU rules remain uneven across LRAs.

EU regulations remain a powerful force for transition; however, they are not necessarily supportive of it. Rather than steering innovation, they seem to act like a filter, determining which activities survive, change or disappear.

Taking a closer look. *Economically*, the chemicals industry is entering a phase of uncertainty as compliance costs rise, disproportionately impacting SMEs. Furthermore, as many businesses seek the support and guidance they need, investment decisions are being delayed, and permits are taking longer to obtain. Larger businesses with strong experience and expertise in the field are better positioned to cope with these changes. However, many activities are facing economic challenges not due to lack of demand, but rather because of the additional costs of compliance. This may lead to an increase in imports of certain materials. From an *environmental* perspective, the progress is mixed. There has been a decline in hazardous substances, following the stricter regulations, resulting in better environmental conditions. However, uneven enforcement of the regulations may shift production to other, non-EU regions with weaker regulatory frameworks, thereby undermining the global environmental prospects. From a *technological* outlook, innovation is currently being steered toward compliance-driven solutions, rather than broad process transformation. Technological advancements focus on circular solutions, digitalisation and process intensification to support the weaker players. When it comes to *governance*, this transition places coordination and capacity challenges at the centre of discussions. Although the environmental ambition is widely supported, the challenges in implementation are raising questions about the fairness, cohesion and effectiveness of policies. This is also increasingly reflected in *society*, which is ever more polarised, especially in those regions that are home to chemical industry clusters facing these challenges.

What does this imply for the chemicals sector? As regards the chemicals industry, this scenario results in a fragmented landscape, where the primary focus is on compliance, rather than key investment priorities. Innovation continues slowly, and traditional production processes gradually phase out without clear replacement pathways. This results in lower competitiveness, less dynamic production and greater dependency on materials from abroad.

What does this mean for the territories? The territorial impacts are clearly visible in this scenario. LRAs that demonstrate high administrative capacity and possess well-developed research ecosystems, supported by proactive public authorities that guide key players, are able to adapt more effectively and thereby mitigate the socio-economic impacts. Conversely, other LRAs face higher risks and even a decline in progress due to administrative capacity challenges, weaker innovation and skills. SMEs are particularly vulnerable in these regions, as they have fewer means of support. Consequently, the EU chemicals industry risks becoming more geographically concentrated, increasing the pressure for more EU and regional support and intervention.

Implications for place-based policies: The focus of this scenario is on the administrative burden on the chemicals industry and, particularly, the challenges arising from the higher environmental, climate and social standards set out in the EU regulations. Compared with those in non-EU countries, these standards create significant challenges to the competitiveness of the EU chemicals industry. The following analysis focuses on the implications of this specific context; other factors challenging the EU's chemicals industry are addressed under subsequent scenarios. However, due to the close relationship between the various simultaneous challenges facing the sector, some implications naturally overlap across all three scenarios.

- As all types of companies are affected by the burden, place-based policies must address a diverse range of actors, as impacts may differ depending on, for example, company size. Struggling SMEs often have access to targeted transition support, including specifically designed tools and funding. This is frequently not the case for bigger companies, which may also struggle to adapt to new regulations due to structural path dependencies that make responding to rapid change difficult. Consequently, the instruments used to address the specific challenges arising from the regulatory requirements must be differentiated by size, type of chemical production and territorial characteristics to effectively address these particular challenges.
- Despite the availability of certain tools and funding for SMEs, there is still a need for solutions to reduce the administrative burden. This is particularly critical for smaller companies, which may lack the internal capacities to manage the demands of the digital and green investment alongside administrative challenges.
- To prevent fragmentation between Member States in the provision of targeted support, an EU-wide coordination mechanism could be helpful. The importance of place-based policies and targeted location support is high across all territories, particularly for regions with less experience in the chemicals industry or those that have faced economic stagnation in recent years. Without support, these territories risk an ever-widening gap from the technological frontier, potentially triggering a downward cycle of economic development. Given that the chemicals industry is central to all manufacturing sectors, this divergence would directly contradict EU cohesion principles and objectives.

- For those segments of the chemical industry that can cope with the expected transformation, it will still be necessary to balance the higher costs associated with the transformation against the price of traditional products. This requires a thorough reflection on which products are subject to CBAM, ensuring that the mechanism is effectively enforced without imposing a burden that further compromises the competitiveness of EU companies.
- Despite the high research and development intensity of the EU chemical industry, which aims to 'internalise' EU standards in chemical products and processes, many companies face difficulties in transforming ideas and inventions into innovation – i.e. bringing them to the market. This requires support to bridge the gap between initial product and process development and marketable products and processes.

4.3.2 What if the EU fails to close the energy and feedstock cost gap, but accelerates decarbonisation, circular processes and addresses pollution?

This scenario explores a future in which the EU chemicals industry advances substantially on decarbonisation, circularity and pollution reduction. However, this is done without resolving the long-standing costs of energy and feedstocks. As a result, transition delivers environmental progress, but exerts pressure on competitiveness.

Key trends shaping this scenario
• High energy prices • Strong and binding climate targets for industry • Rapid expansion of renewable energies, but at high costs • Acceleration on electrification, hydrogen, circularity • Dependence on imported feedstock

What happens in this scenario? In this scenario, climate neutrality remains a primary ambition and policy pressure to decarbonise intensifies across the EU. This drives investments in electrification, hydrogen, renewable energies and circular processes. Companies are provided support for investments in alternative energy resources and circular production processes, reducing pollution and minimising waste. Yet, while the pace of this transformation accelerates, the underlying cost structure does not improve sufficiently. Energy prices remain high and volatile, and access to affordable, sustainable feedstocks remains low. Consequently, decarbonisation progresses at a high cost and unevenly across the EU. While the transition is manageable for some producers or allows others to leapfrog older technologies, particularly new businesses in the field, many established players face increasing challenges undermining their competitiveness.

Taking a closer look. From an *economic* perspective, a cost gap persists as investments in green energy lead to additional short-term energy costs. This disparity impacts the attractiveness of the EU as a destination for investment, particularly in energy-intensive chemical production. The *environmental* outlook, however, shows marked improvement. GHG emissions are declining, and pollution levels are being reduced in many locations as circular processes become more widespread. This transition is, however, not uniform across the EU; in some cases, the solution to one problem may create others, e.g. renewable energies may result in land use conflicts, or high electricity demands on grid availability. *Technologically*, the pace of change has accelerated to support this green transition, although progress remains uneven. *Politically*, while there is a strong commitment to achieve the climate goals, there are growing concerns about competitiveness. This trend is mirrored in *society*, where support for decarbonisation and low pollution is strong because cleaner production generates local benefits and improves the local quality of life. On the other hand, in places affected by the downsizing of traditional industry, people face frequent job transitions, and social unrest is more visible.

What does this imply for the chemicals sector? As regards the implications for the chemicals sector, the transition creates a clear divide between winners and losers. Businesses engaged in high-value and low-energy intensity activities, such as speciality chemicals or advanced materials, may be in a better position to absorb the costs and comply with the regulatory requirements. However, more energy-intensive chemical production, such as basic chemical production, may face severe pressure and potentially need to relocate. Investments are heavily focused on decarbonisation, leading to the phasing out or modification of some production processes. This follows the concept of creative destruction, where traditional methods are replaced by up-to-date innovative concepts. While the sector becomes more environmentally advanced, it also becomes more vulnerable in terms of competitiveness. This vulnerability is most pronounced in specific value chains in which the EU chemicals industry already suffers from a comparative disadvantage. This implies a risk of further significant reductions in the EU chemicals industry and an increasing dependency on imported chemical products across the value chain for many other manufacturing sectors, which in turn negatively affects their competitiveness. Without sufficient import controls to ensure EU standards, or in the event of a shortage of chemical products meeting EU standards, these standards and the EU environmental objectives risk being undermined.

What does this mean for the territories? The territorial implications vary greatly across the EU. LRAs that have access to affordable, renewable energy, grids, and established industrial clusters are better positioned to master the transition. These regions are likely to attract concentrated investments in electrification, hydrogen and circular processes, and benefit from the synergies of joint efforts. Other LRAs may face regional decline, particularly those with limited renewable energy infrastructure, high energy prices, difficulties innovating and weak administrative capacity to support decarbonisation investments. The environmental outcomes also diverge depending on the chosen transition path. Pollution may decrease in some regions, while others face new environmental pressures, potentially widening regional disparities.

Implications for place-based policies: The focus of this scenario is the cost disadvantages facing the chemicals industry, primarily arising from the gap in energy costs between the EU and non-EU countries. This disparity challenges the competitiveness of the EU chemicals industry. The following implications centre around this context.

- Decarbonisation efforts and achievements should be seen as a means of enhancing competitiveness in the future. The critical challenge is to support the industry in their efforts in a way that ensures the retention of at least one critical level of activity during the transition phase, with a clear prospective for survival during this period. There is a dire need for 'transition support' in closing the energy cost gap. This requires instruments and tools to assist businesses during the transition phase until the cost disadvantages can be overcome. Potential measures include state aid, energy cost controls or other targeted support. To address the competitiveness gap created by highly subsidised products from outside the EU, a transition period with less rigid state aid rules could be a viable way forward to reduce or close the energy cost disadvantage.
- To avoid an environmental backlash from foreign imports that do not respect the EU environmental and social standards, simple but effective rules and controls are needed.
- Companies require a clear prospective for lead markets that are not undermined by heavily subsidised products (failing to meet EU standards). While state aid (based on amended rules)[168] can assist during the transition period, it is not a sufficient long-term solution for creating businesses for sustainable non-harmful chemical products. This requires (a) a stable market and regulatory conditions, and (b) additional support to balance the price difference between EU and non-compliant products. The central question remains who will pay for the price differential and how can windfall effects be avoided. The experience of South Korea in the 1970s,

[168] For the current discussion on how an amended State Aid Framework is expected to support the Clean Industrial Deal, see European Commission (2025*l*), C/2025/3602. For more information how the ETS State Aid Guidelines impact on the chemical industry and how amendments can support it, see CEFIC (2025*h*).

in particular, its industrial policy for the development of a competitive heavy industry offers inspiration for concrete policy decisions. The key to this approach is a clear pathway and rules that avoid the expectation of continuous protection. Instead, support must remain focused on the transition phases.

- Support for inter-regional cooperation (creating critical mass) can help for scaling up the necessary infrastructure investments in a coordinated effort. Such cooperation can also be used as a tool for knowledge sharing between experienced and less experienced regions in terms of their chemical industries.
- From a territorial perspective policies also need to ensure that support is not only provided to 'critical sites' but also on the development of adequate infrastructure and framework conditions in regions with a less dense chemicals industry network.
- Policies need to balance the EU objectives of competitiveness and strategic autonomy, which may require additional support in all areas necessary for strategic autonomy.

4.3.3 What if the EU pursues a 'Europe for Europe' strategy for chemicals?

In this scenario, the EU prioritises a 'Europe for Europe' strategy, focusing on re-shoring. Internal production, skills development and value creation within the chemicals sector are fundamental to the broader strategy to strengthen the strategic autonomy and long-term competitiveness of the EU. Central to this approach is a robust focus on human capital. This includes reskilling the existing workforce, attracting new talent, and providing credible transition pathways for workers and regions that cannot easily adapt.

Key trends shaping this scenario
• Growing emphasis on strategic autonomy and resilience • Re-shoring and near-shoring of selected chemical value chains • Demographic change and competition for skilled labour • High EU standards for industrial, trade, climate and skills

What happens in this scenario? In this scenario, the EU focuses on strategic autonomy, making a strategic choice to strengthen the internal industrial base and position its production towards an 'in and for Europe' policy. This should not be seen as protectionism, but rather as a coordinated effort within the EU to reduce dependencies in critical value chains, improve the resilience of the sector and rebuild its capacity to align with the high EU environmental and social standards. Demand in the sector is also shaped by sustainability, safety and long-term resilience. The focus of this scenario is on the implications for skills rather than the other framework conditions (technology adoption, infrastructure, capital investments) discussed in the previous scenarios. Thus, a defining feature is the importance of people, particularly a skilled labour force. Policymakers recognise that strategic autonomy cannot be achieved without a skilled workforce that is adept in new technologies, able to manage complexity and supportive of innovation at various scales. Consequently, particular emphasis is placed on re-skilling initiatives that target both the existing workforce and new entrants. Education systems, as well as vocational training and lifelong learning programmes, are being adapted to reflect the evolving needs of the sector. Although such initiatives are appreciated, not all workers will be able to keep up with this transition, at least not at the same pace. Therefore, social support and alternative pathways are being discussed and implemented to address disparities.

Taking a closer look. On the *economic* side, a 'Europe for Europe' strategy reshapes the cost structures of the sector. Although production costs remain high, the internal market becomes a platform for learning and exchange, helping businesses to expand. Consequently, economic performance improves gradually. As regards the *environment*, EU standards remain high and continue to shape production methods and product design. This results in cleaner processes and safer products, while circular approaches gain ever more ground. It is the careful balancing rather than the rapid transformation that helps achieve the high standards. *Technological* development is closely linked to the capacity of the workforce, particularly regarding expertise in advanced manufacturing, digital process controls, and circular technologies. The deployment of technology is also supported by skills programmes that bridge the gap between education and industry. In terms of *governance*, there is enhanced cooperation across all levels, involving the EU, Member States, LRAs and industry stakeholders. From a *societal* perspective, there is a strong focus on talent development and attraction, where re-skilling efforts play a key role. However, social tensions remain, as not all workers can be re-skilled and not every region benefits equally. There is a clear need for alternative support mechanisms for those left behind. Failing this, the resulting frustration and resistance risk challenges cohesion.

What does this imply for the chemicals sector? The chemicals industry gains more stability and strategic direction. There are more predictable demands and improved access to labour, respecting the high sustainability standards. At the same time, there is pressure to invest in workforce development and technology adoption, which makes the process more costly. Overall, the sector becomes more cohesive, but also more selective. Some activities may be prioritised and hence progress, while others are left behind. Over time, many activities in the chemical industry gain global relevance. As a result, the sector becomes globally competitive, with overall EU competitiveness increasing and a new global role is achieved.

What does this mean for the territories? The territorial implications vary significantly in this scenario. LRAs with existing industrial infrastructure and a skilled labour force, combined with administrative capacity, are better positioned to benefit from the re-shoring policy. These LRAs function as EU chemical hubs, not only for production but also for training and innovation. On the contrary, other LRAs may face more complex transitions. Not all LRAs will be able to cope with the re-skilling needs or the training of staff required to diversify their economic profiles. In these cases, Cohesion Policy, alongside national and regional support, will be necessary to provide infrastructure, social safety support and educational resources. At the same time, education systems and curricula evolve to reflect local industrial profiles. Talent attraction becomes a decisive competitive factor, reinforcing the importance of well-being, high public services and a strong regional identity.

Implications for place-based policies: This scenario takes a more holistic perspective, aiming to reshore chemical industries and develop strategic autonomy. While the challenges deriving from high energy costs and regulatory implications are felt similarly to the previous two scenarios, the corresponding policy implications remain a priority. Rather than duplicating, this section centres around additional dimensions – the need for holistic perspectives, the pursuit of strategic autonomy and the specific skills needed to achieve the anticipated transition.

- Policies favour strategic autonomy over competitive goals during the transition phase to give the companies time to improve their competitiveness based on sustainable products and processes. Clear pathways for policy to overcome the transition phase are needed, including public support for adjusted framework conditions (including infrastructure) to provide a prospective for future export competitiveness. The role of the Industrial Accelerator Act[169] which is currently under development may be decisive.
- If there is a desire to apply 'produced in Europe' criteria, it will be necessary to define simple and effective criteria that are easy to implement and control.
- Reshoring requires 'normalisation of the essence of cooperation', both for achieving scale and fully deploying human resources and skills. This is about bringing people together from different levels to discuss the challenges and opportunities, as well as fostering collaboration between the regions and industries to identify what can be done collectively. Such a strategy requires a fundamental understanding of the benefits of collaboration using the quadruple helix approach.

[169] At the moment of drafting the report, the Act's proposal is expected on 25 February 2026 (see e.g. this link).

- Regions are best placed to understand the specific needs of their industries. Consequently, they need to take a more active role in many of the aspects outlined above (see Chapter 3).
- Adjustments to the curricula in the regional education eco-systems need to be based on specific regional needs.
- Investing in skilled labour and fostering personal growth and commitment within the sector is key. This approach extends beyond the understanding of lifelong learning; it is primarily about the development of regional education ecosystems that are tailored to specific regional skills requirements. The development and adjustment of curricula (specifically in STEM, but not only) will also be crucial.

5 Conclusions and recommendations

The EU chemicals sector faces significant interconnected challenges that are weakening its global competitiveness and resilience. The most critical issue is increasing international competition, particularly from China, which has sharply reduced the EU's global market share. This decline is primarily driven by higher production costs in Europe, especially for energy, labour, regulatory compliance, and logistics. Additional barriers include complex and evolving regulatory frameworks, skills shortages, and difficulties in scaling innovation.

The sector is also under substantial pressure from the high costs associated with environmental transition and pollution remediation. While the industry plays a key role in supporting decarbonisation and circular economy objectives, the investments required for clean technologies, infrastructure, and site remediation are extremely high, particularly for SMEs, which dominate the sector and often lack financial and technical resources. To achieve the anticipated decarbonisation objectives in the EU, different mechanisms will be required to incentivise low-carbon products.

The complex situation and rapidly changing context increase the risk of plant closures, which could disrupt industrial value chains, reduce employment, and weaken regional economies, especially in areas highly dependent on chemical production. Overall, without coordinated policy support and investment, the sector faces continued restructuring and potential loss of strategic industrial capacity in the EU.

To reverse this trend and support and enhance the resilience and competitiveness of the EU chemicals industry, it is fundamental to simultaneously address the multiplicity of challenges without delay. While several actions will require time and may be undertaken as **long-term activities, they need to be initiated immediately**. The case studies and additional examples illustrated that those initiating inventions and successfully bringing innovations to market rely on multi-level and multi-sector cooperation. Thus, **improving the competitiveness of the EU chemicals industry can only succeed if all levels of governance contribute their specific capacities and responsibilities to addressing the interlocking system of multiple challenges**. Acknowledging the responsibilities of the different levels of governance, the following sections categorise the identified recommendations by level and focus particularly on place-based approaches. This includes policies with a clear place-based approach as evidenced by their bottom-up, territorially specific implementation. It also encompasses more general policy recommendations, which have a place-based dimension as they impact differently across different territories, e.g. chemical industry concentration, maturity and regional and local resources.

A few guiding principles should be kept in mind across the recommendations addressing different levels of government:

- While the recommendations focus on different ways of supporting the EU's chemical industry, they should not be misunderstood as an intention to save every company and chemical production site. Transition comes with change, and change is needed. Thus, there will be winners and losers. This will happen at the level of individual companies and regions due to changes in innovation capacities and locational factors affecting competitiveness.
- The recommendations therefore focus on achieving a framework for the sustainable survival of the chemical industry in a place-based way. This involves supporting companies during the transition phase and ensuring long-term competitiveness.
- Acknowledging the effects of changed location factors also means that the recommendations do not focus solely on regions with a significant chemical industry that are struggling under the current accumulation of challenges. In contrast, the recommendations are also relevant for regions that could gain a competitive advantage as future chemical industry sites, due to their potential access to green energy and feedstock.

5.1 Multi-level EU initiatives

- The **public–private initiative** proposed by CEFIC aims to create a public-private funding environment with adequate resources to bridge the chemicals industry's deployment gap. This could be pursued under the **ECF's Clean Transition and Industrial Decarbonisation** window, which would support demonstration projects and first-of-a-kind green industrial plants and deployment, while ensuring continuity with Horizon Europe which supports early-stage collaborative research.
- The public-private initiative could be further deployed by providing a framework for **systematically and strategically establishing regional platforms**. This would facilitate LRAs and the stakeholders in initiating their activities if no such regional platforms exist.
- Furthermore, the initiative could provide a platform to support the **development of regional roadmaps**, focusing on where different regions aim to be by 2034 and what is needed to achieve these goals. This process should involve relevant regional stakeholders, as they are best placed to understand the specific challenges and needs. Such an approach would be comprehensive and holistic, also taking into account other enabling factors (such as infrastructure, permitting, and national state aid rules) and helping to identify which types of projects are most promising.

5.2 EU level

- In implementing the Action Plan, the European Commission should establish a **strong partnership with LRAs** and encourage the development of regional **quadruple helix approaches** for the chemicals sector. To address the key challenges businesses face in developing viable cases for green chemical products, it is necessary to pursue joint efforts in developing **lead markets**.
- While the four working groups of the **Critical Chemicals Alliance** and their mandates offer a good starting point, the Alliance's work could be further reinforced by:
  - **extending the mandate of the trade defence working group** to discuss and identify solutions on how imports and trade could impact sustainability more broadly;
  - **establishing a dedicated working group on simplification** to promote a more strategic approach to simplification;
  - **creating a specific working group on human capital and skills**, encouraging place-based education and training offers (curricula); and
  - actively supporting **exchange** on different approaches in the chemical regions in order to **better channel funding** and to enhance learning from successful examples.
- To strengthen innovation capacity in the EU chemical sector, the EU should establish a dedicated **one-stop shop for R&I funding** that streamlines access for industry and LRAs, addresses the current fragmented funding landscape, and prioritises support for scaling up breakthrough technologies. This should be underpinned by a unified, cross-programme **definition of place-based innovation**, ensuring coherent implementation across EU instruments and improving outreach – particularly, but not only, to SMEs in the chemicals sector, to also acknowledge the variation in challenges across the sector.
- The EIB is a key EU stakeholder mobilising finance for sustainable development and innovation. It can thus play a key role in financing the greening of the chemicals industry through **dedicated financial instruments** within the existing fund portfolio. As a primary source of risk funding, this initiative could act as a catalyst for further investment by reducing the risk profile for investors. This approach might be suitable for leveraging private resources (including **venture capital**), providing **seed funding** for scaling up innovations, and exploring innovative financing solutions such as **green impact investments** that generate measurable positive environmental outcomes alongside financial returns.
- Building on **the experience of REACT-EU, a funding mechanism** could be envisaged **within the anticipated funding structure of the next MFF** that

offers high **flexibility** and reduced co-financing requirements for Member States and LRAs. This mechanism should allow funds to be directed **towards targeted investments** to bridge gaps between TRL levels, with a particular focus on SMEs and start-ups. Additionally, it needs to be tailored to **regional needs**.

- It is essential to ensure the **availability of EU funding** for projects supporting the decarbonisation of chemical production processes. This includes the use of renewable and low-carbon hydrogen, biomass, carbon capture, utilisation and storage (CCUS), electric crackers and large-scale heat pumps. Moreover, this funding should be **more readily accessible to LRAs with a clear roadmap for greening their (chemical) economy**.
- Acknowledging the strong links along value chains between the chemicals industry and other manufacturing sectors, these recommendations also support a broader **refinement of EU industrial policy** (including but not limited to the chemicals sector). The goal is to achieve a better balance between competitiveness and strategic autonomy, while **taking into account the diverse territorial needs of regions** and the specific needs of the affected value chains.
- To further increase strategic autonomy, the EU must establish effective and diversified **global trade agreements**. These agreements are essential to safeguard the EU chemicals industry's access to international markets and to strengthen the economic resilience of regions hosting chemical clusters. For this purpose, new markets beyond China and the USA need to be explored. Current trends in import and export shares suggest significant untapped potential with other countries around the world. The aim is to position the EU as a reliable partner in diversifying trade relations across the entire chemical industry value chain. In light of the EU's intention to introduce urgency measures under the anticipated Industrial Accelerator Act that directly affect Single Market rules, it is essential that such measures be **accompanied by robust and effective territorial impact assessments.** This is necessary to identify and mitigate potential unintended consequences across regions and ensure coherent implementation within the Single Market.
- Apart from the EU-made criteria expected in the aforementioned Act, the EU's strategic autonomy in **critical raw materials** can be strengthened by accelerating the implementation of the RESourceEU Action Plan and the Critical Raw Materials (CRM) Act. This requires expanding EU capacity for extraction, processing, and recycling CRMs; diversifying imports through strategic partnerships with reliable non-EU suppliers; and operationalising the European Critical Raw Materials Centre to coordinate joint purchasing, strategic stockpiling, and targeted investments in partnership with strategic chemical sites and LRAs.

- To address both the challenges arising from the greening of the chemical industry and the funding gap for deploying inventions, it is necessary to continue **streamlining and reviewing state aid regulations. This includes the Clean Industrial Deal State Aid Framework and ETS State Aid guidelines**, for sectors and value chains at risk of relocation. Policy adjustments should move beyond mere subsidies (in the narrow sense) to include temporary (yet reliable) **price support mechanisms** designed **to create lead markets for green chemical products**. Regulatory changes should not only consider the production costs of chemicals but also the implications of greener chemical products and their costs for downstream producers to avoid creating misleading incentives that leave EU- based green chemicals at a disadvantage.
- In **revising the ETS Directive**, the European Commission should prioritise, in cooperation with LRAs, short-term investments in decarbonisation technologies and consider redirecting ETS revenues **to finance verifiable corporate environmental and climate projects**, in order to support competitiveness and stimulate market demand for low-carbon products. ETS revenues shall also **support LRA** investments in energy infrastructure projects aimed at lowering energy prices for the sector and in the remediation of contaminated sites, thereby **helping to create concerted, targeted, place-based investments in the green transition**.
- Other regulatory reviews address the cost gap arising from the administrative burden. This calls for a streamlined, predictable regulatory framework by **simplifying REACH rules** and permitting procedures. While this is relevant for all companies, it will be felt most by SMEs.
- Complementing the Industrial Accelerator Act, further action may be required to ensure that EU social and environmental standards are upheld as far as possible. This could be achieved by **extending the CBAM to chemical products**, even for transition periods, without hampering the availability of key inputs for industrial production.
- Finally, the European Commission, together with Member States, should **adopt policies to reduce energy prices**. These reductions should avoid distorting price relations and therefore require careful consideration of eligibility criteria and beneficiaries. **In parallel, investments in grids and cross-border interconnections for energy infrastructure,** including the development and deployment of hydrogen and other renewable and low-carbon molecules, and energy storage, should be increased.

5.3 Member State level

- In line with the recommendations above on support for regional platforms, Member States should promote **effective multi-level governance.** This should encourage LRAs, universities, research institutions, and social partners to participate in initiatives and funding mechanisms that support research, innovation, and knowledge transfer, thereby strengthening local industrial clusters and ensuring that innovative chemical technologies fully reach the market.
- The analysis has illustrated the benefits of strong regional and strategic networks of chemical production sites. The potential of these **strategic regional networks**, however, is not fully realised. Strengthening these networks at major chemical production sites could accelerate the development of resilient and secure critical raw material supply chains across more regions. This requires, on the one hand, the development of place-based infrastructure aligned with the needs of the regional industry, and on the other hand, learning from existing regional strategic networks to support regions in developing such networks for and with their chemical industry.
- Apart from funding support initiated at the EU level, Member States can also integrate targeted measures within the **National Recovery and Resilience Plans** to accelerate the green and digital transformation of the chemicals industry by supporting and combining investments in sustainable production technologies, energy-efficient processes, circular chemistry and the development of safe and sustainable chemicals.
- The fragmentation of support and administrative procedures in the highly internationalised value chains of the chemical industry creates further challenges. Enhancing harmonisation across Member States through **stronger cooperation and coordination in the transposition and implementation of EU legislation** in areas such as permitting, environmental compliance, the circular economy and the reuse of waste materials, **while avoiding additional administrative burdens**, could help overcome this fragmentation.
- Permitting processes vary heavily across Member States and regions, leading to different burdens for investors and increased insecurity. Thus, **it is necessary to simplify and accelerate permitting procedures** for new chemicals and sustainable materials to boost R&D investment. While these processes must fully respect EU standards and requirements, gold-plating should be avoided to ensure all untapped potential is utilised.
- Cooperation should also involve working with other Member States to **propose and develop new IPCEI projects** in the chemicals industry, ensuring the active involvement of LRAs.

- Member States could further explore territorial approaches such as chemical parks (see case studies) alongside the other **zone-based policies** (e.g. Special Economic Zones) outlined in the OECD study on zone-based policies[170]. While the designation of chemical parks primarily falls under the competence of LRAs, there are other zone-based tools that typically fall under Member State competences and require their involvement and initiation.

5.4 LRA level

LRAs are key to the successful implementation of measures proposed at higher levels of government, since the competitiveness of the chemicals industry materialises within their territories. The following points summarise their tasks across the key roles in governance, framework conditions and funding support:

- Developing a **holistic place-based approach** to the chemical industry by establishing **strategic plans and leveraging existing regional innovation strategies (e.g. S3) that enable simultaneous transformation of the energy supply**, including the production and use of green hydrogen, expansion of the circular economy and bioeconomy, and increased use of biogenic raw materials.
- **Establishing interregional alliances and developing interregional projects** to strengthen strategic regional networks linking major chemical sites, with the aim of developing critical raw material supply chains, supporting R&D and innovation, and deploying energy infrastructure such as pipelines and related systems.
- Strengthening **territorial coordination and governance**, particularly in areas such as decarbonisation pathways and industrial ecology, where collective action at the territorial level is essential. This could include **establishing or institutionalising a regional association – or leveraging an existing entity** – to bring together representatives from across the chemical production and supply chain (including the energy sector) to improve coordination, promotion and participation in EU-funded projects.
- **Enhancing the use of existing EU funds under shared management** to support the green and digital transition, while ensuring there are mechanisms to complete **robust ex ante assessment** to inform future regional actions.
- Investing in **shared transport and logistics networks** at the cluster level to enhance the competitiveness of the chemicals sector.
- **Investing in and supporting shared infrastructure and collaborative spaces** to enhance cooperation between industry and R&D centres and

[170] OECD (2025).

institutions, fostering the development of innovative and sustainable solutions for chemical production.

- Fostering **close industrial partnerships with educational institutions and research centres** to ensure the supply of skilled labour and to design courses and training programmes that reflect industrial needs and the required skills.
- Developing **regional training programmes** to better align education and vocational training with the rapidly evolving needs of industry, with a strong **focus on STEM disciplines and digital skills**.

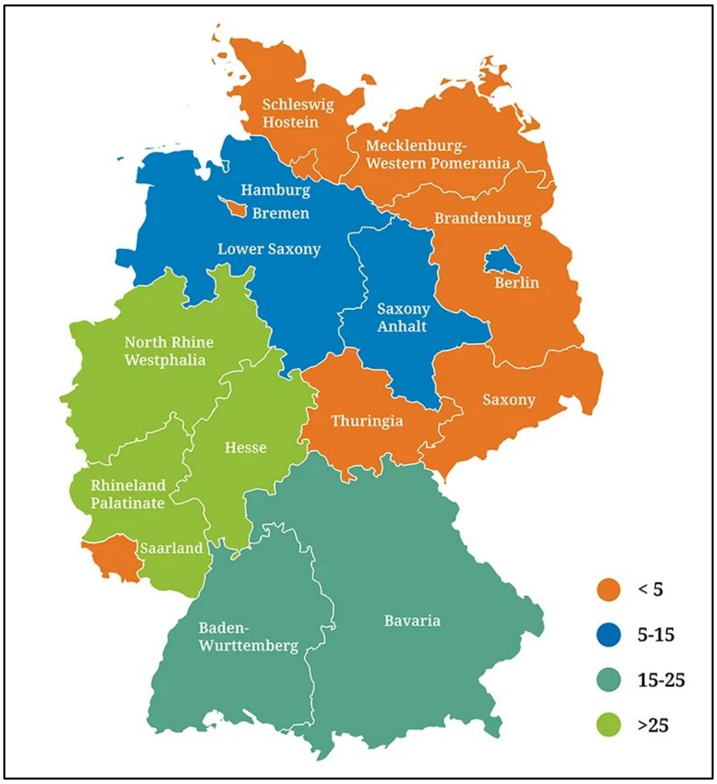
Annex I – Case studies

Chemicals industry cluster "ChemCologne" - Northrhine-Westfalia - Germany

Overview of the sector

The German chemical sector is not only the largest in any single EU Member State by value added and employment, but it is also a cornerstone of the German economy. The chemical and pharmaceutical industries together account for the third-largest sector in Germany[171]. The ChemCologne network is located in the Rhineland area of North Rhine-Westphalia[172], the German Land with the highest chemical sales in Germany (see map). Despite this regional concentration, the chemicals industry is widely distributed across the country and encompasses various segments. These include basic inorganics, petrochemicals, polymers, agrochemicals, specialities, cosmetics and pharmaceuticals[173] with different regions exhibiting varying degrees and types of specialisation.

Figure 38: Chemical sales of German Länder in EUR billion



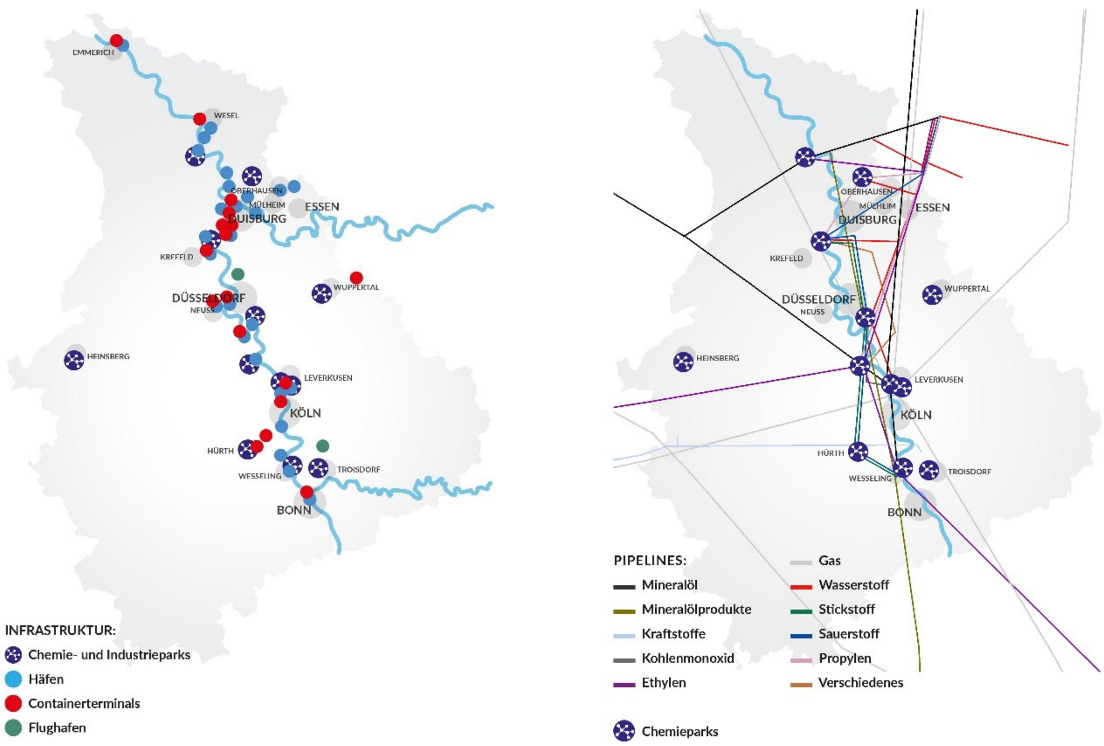
Source: CEFIC, Landscape of the European chemical industry - Germany, online.

The ChemCologne network is a long-established industrial cluster encompassing eight major chemical parks located around Cologne[174], spanning a large area of the south-west of North Rhine-Westphalia. The network represents a dense concentration of chemical production sites and related infrastructure (see figure below). With approximately 260 chemical companies and more than 70 000

[171] CEFIC, *Landscape of the European chemical industry - Germany*, online.
[172] Additional information on ChemCologne cluster could be found at the following link.
[173] CEFIC, *Landscape of the European chemical industry - Germany*, online.
[174] Additional information on the ChemCologne location could be found at the following link.

employees, accounting for roughly 70% of the North Rhine-Westphalian chemicals industry turnover in 2023, the region comprises 12 chemical and industrial parks, and is a leader in the European chemicals industry[175]. Due to its scale, it serves as a central industrial engine for North Rhine-Westphalia and beyond.

Figure 39: Overview of the ChemCologne region, chemical parks and key infrastructure



Source: www.chemcologne.de

This region's chemicals industry dates back to the 19th century, when it began producing dyes and fragrances. Lignite brought coal chemistry, and later, petroleum brought petrochemistry. During the postwar reconstruction, the industry expanded significantly with the formation of new companies and the development of the first international joint ventures. The mid-1990s marked a period of critical structural change: the previous model, in which production companies and production locations were unified, gave way to the emergence of independent service companies providing the required infrastructure and site services. This led to the **modern chemical park model currently in place, with 12 parks united by ChemCologne**[176].

[175] Rohrbach and Meys (2024).

[176] Additional information on the Rhineland chemical region could be found at the following link.

Description of the strategy

Founded in 1999, the ChemCologne association was initially an international marketing initiative to attract new businesses to the chemical parks of the region. Over time, it evolved from a branding initiative into a comprehensive network platform that today addresses challenges such as digitalisation, logistics, and decarbonisation[177].

The network covers the entire chemical value chain, but emphasises industrial customers, since 80% of the products are pre-products used in other industries, while only 20% are destined for end users. The key sectors include[178]:

- **Base chemicals**: ammonia, benzene, chlorine, ethylene, methanol, and caustic soda;
- **Plastics and polymers:** polyethylene, polypropylene, PVC, and high-tech polymer materials;
- **Speciality chemicals:** including additives, catalysts, inorganic pigments, and silicones;
- **Biologics and pharmaceuticals:** Research and commercial manufacturing of biological preparations.

Governance structure and key initiatives

The association's **governance structure is designed to integrate all regional stakeholders, including industry, intermediaries, academia, and the public sector**. This is mirrored in ChemCologne's executive board, which includes representatives from chemical companies, academia, LRAs, the chamber of commerce, the chemicals industry employers' association, and the union.[179] ChemCologne serves as a coordination platform linking around 30 chemical industry companies, approximately 40 specialised service providers, public authorities, intermediary organisations (such as the chambers of commerce) and higher-education institutions[180]. In particular, the close partnership with universities and colleges ensures alignment between industry needs and skills development and offers opportunities for practical experience during education (see box below).

Box 19: Examples of courses and educational programmes in chemicals

The Faculty of Applied Natural Sciences in Cologne – Leverkusen Campus
The Faculty of Applied Natural Sciences offers bachelor's degree programmes in pharmaceutical chemistry and technical chemistry as full-time and dual programmes. These are complemented by master's degree programmes in

[177] ChemCologne Compact (2019, 2022, and 2024).
[178] Non exhaustive list based on Rohrbach and Meys (2024). Additional information on the Chempark's website.
[179] Additional information on ChemCologne's board could be found at the following link.
[180] Additional information on the members and partners could be found at the following link.

applied chemistry and drug discovery and development. This aligns with the region's economic profile. Compared to traditional chemistry courses, the bachelor's and master's degree programmes at the Leverkusen campus provide in-depth, application-oriented knowledge. The practical focus of the applied science courses is key to their success.

Wuppertal university

The wide range of subjects offers numerous study options that respond promptly to new requirements in the professional and working world. These include subjects and subject combinations that are unique in Germany. The attractive course content is based on the latest findings from innovative cutting-edge research and is often designed to be interdisciplinary. The university offers practice-oriented study phases in cooperation with external partners.

Source: own elaboration based on the following sources: link 1 and link 2.

This governance structure enables joint strategic planning, knowledge transfer and collective investment initiatives at the regional level. In this context, the network has developed a study on pathways towards achieving climate-neutral chemical production in the Rhine Area by 2045[181]. This study provides a structured assessment of the technological options, infrastructure requirements and coordination challenges at the territorial level (see next section "Pathways to climate neutrality by 2045" for the conclusions from this study). Other key activities of the network include the various events for specific purposes and target groups [182]:

- The Chemical Forum, a regular, large-scale event for decision-makers involved in the development of the chemicals industry sector;
- An annual Cooperation Day, which facilitates exchange between industry and start-ups to enhance cooperation between science, established industry and young companies;
- On-site network meetings of members with topics selected by the member hosting the meeting;
- Intouch workshops and working groups for members dealing with specific current themes;
- Briefing events to update member companies on selected themes.

Other specified and targeted support initiatives within the ChemCologne network are:

- ChemTelligence, which initiates, supports and strengthens cooperation between different partners dealing with digitalisation, AI-technology implementation, and energy transition. Companies in the chemicals

[181] Rohrbach and Meys (2024). Additional information could be found at the following link.
[182] Additional information on ChemCologne's activities could be found at the following link.

industry can submit specific “challenges” and obtain innovative solutions from interdisciplinary teams.

- ChemMarketing is the network’s initiative for international visibility. It cooperates with both the economic development agency of North Rhine-Westphalia (NRW.GLOBAL Business) and the federal economic development agency (Germany Trade & Invest).
- ChemInvest serves as an umbrella for ChemCologne’s involvement in other platforms and working fora. Examples include the European Chemical Site Promotion Platform and a working group of the German chemicals industry association (VCI) on location marketing.

LRAs have played a central role since the ChemCologne initiative began. The Office for Economic Development of the City of Cologne was a key stakeholder in creating this initiative. LRAs provide the regulatory framework for infrastructure, investment approvals and funding. The network facilitates direct dialogue with the state government to advocate for competitive energy prices, accelerated approval processes, and the development of essential infrastructure such as hydrogen and CO2 pipelines. In this sense, LRAs are not only regulators but strategic partners in securing the region's industrial future. They provide long-term perspectives through various roles and tasks depending on their responsibilities and capacities, as illustrated in the table below.

Table 20: Typical roles of LRAs in the ChemCologne association

Authority / body	Role in the network
City governments (e.g. Cologne, Bonn, Düsseldorf)	Location promotion, infrastructure support, and public-private collaborations
Cologne regional Council	Regulatory alignment, administrative support, and coordination with state policies
Economic Development Agencies	Investment marketing, site development support
Chambers of Industry & Commerce (e.g. Cologne, Düsseldorf)	Business advocacy, networking, and connection to SMEs
State level (e.g. regional government, investment agencies)	Strategic regional economic planning, attracting foreign investment

Source: own elaboration based on the ChemCologne website.

The roles of LRAs can be summarised under five headings:

- Implementing measures for enhancing regional economic development
- Supporting strategic positioning and location marketing
- Facilitating regulatory and administrative frameworks
- Cooperating on innovation, education, and workforce development
- Integrating public interests into regional industrial strategy

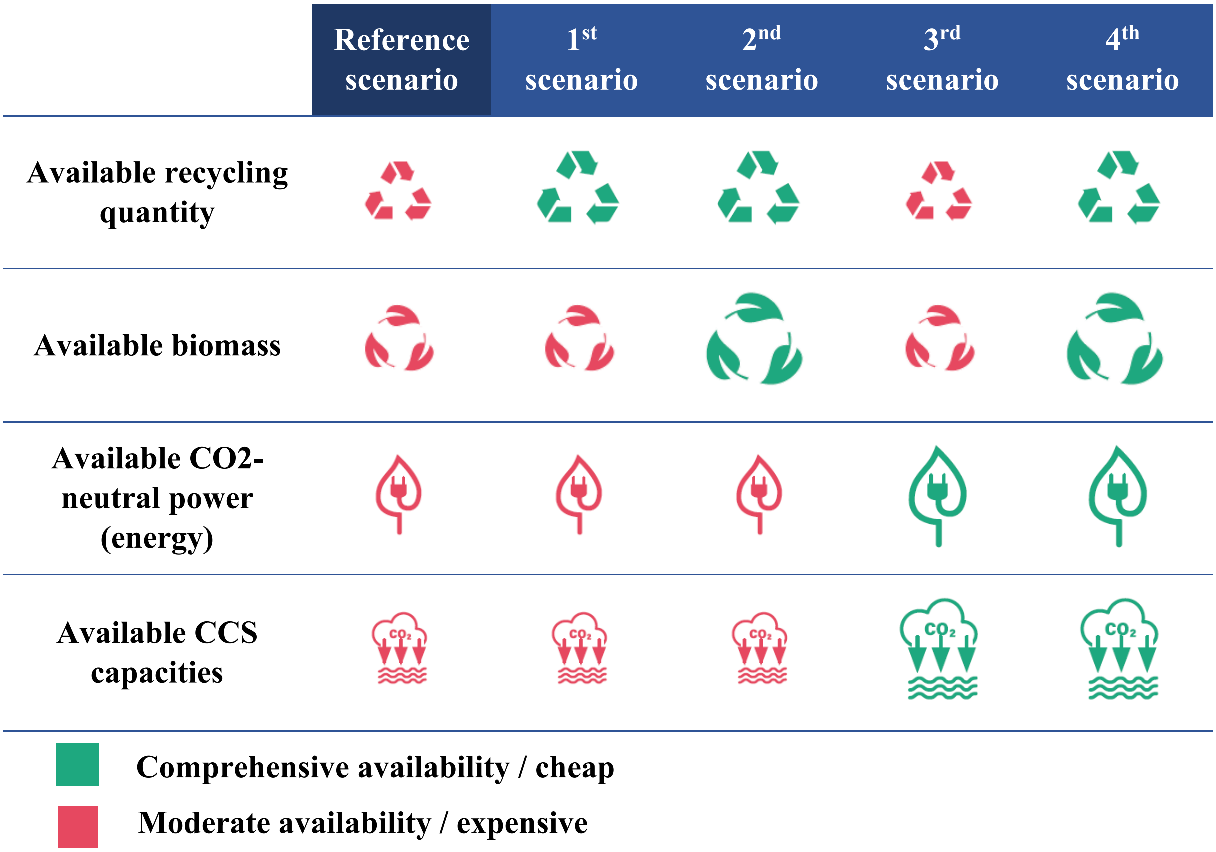
This framework provides a suitable territorial setting for place-based policymaking to support the decarbonisation and competitiveness of the chemicals industry. The following sections outline the implications of the scenario work, focusing on planned LRA activities and perspectives.

Pathway scenario to climate neutrality by 2045

To support a shared decarbonisation agenda, the network developed a scenario study on pathways to climate-neutral chemical production in the Rhine area by 2045. This study maps technology choices, infrastructure needs and indicative cost ranges under different resource-availability assumptions.

These conditions differ mainly in the availability of recycling materials, biomass, renewable energy and carbon capture storage (CCS), assuming that these technologies are generally available.

Figure 40: Scenario overview (moderate/expensive availability – red, extensive/economic availability – green)



Source: Translated reproduction based on Rohrbach and Meys (2024), p.27.

In all scenarios, neutrality is achieved by balancing residual emissions with removals, such as capturing CO_2 from the atmosphere via biomass growth or Direct Air Capture (DAC).

Table 21: What is needed to achieve climate neutrality by scenario

Scenario	Primary resource needs	Key technological focus
Reference scenario	Moderate availability of all resources	High reliance on carbon capture and utilisation (CCU) and hydrogen (over 60% of variable costs)
#1 – Comprehensive recycling	Increased recycling volume to 2.0 million tonnes; other resources remain moderate	Focus on material recycling to avoid emissions from plastic incineration and hydrogen (over 60% of variable costs)
#2 – Recycling & biomass available	Comprehensive recycling (2.0 Mt) and high biomass availability (13.9 million tonnes)	Focus on a circular carbon economy; biomass growth offsets emissions from product end-of-life
#3 – Cheap energy & CCS available	Moderate recycling/biomass but low-cost electricity (60 EUR/MWh) and high CCS capacity (12 million tonnes)	Uses CCS as a cost-effective alternative to CCU; significantly reduces absolute hydrogen demand
#4 – Comprehensive availability of resources	Comprehensive access to all resources	An optimal mix of all technologies, resulting in the lowest operating and investment costs

Source: own elaboration based on Rohrbach and Meys (2024), p.26.

Despite the differences in the alternative pathways, significant investment is necessary to ensure the competitiveness of the ChemCologne chemicals industry. Depending on resource availability and the corresponding optimised technology combinations, operating costs of EUR 9 billion to 21 billion per year and investment costs of EUR 22 billion to 39 billion are expected for the period through 2045. Therefore, "*to reduce costs and strengthen competitiveness in the Rhineland chemical region, an optimal triad of renewable energies, alternative resources and the necessary infrastructure is essential*"[183].

This analysis shows that the transformation of the chemicals industry is a joint task for industrial players, policymakers and civil society. Authorities at various levels, including LRAs, must act as strategic partners in several fields:

- In the field of **infrastructure development**, authorities responsible for planning and approving robust infrastructure are required. They need to establish networks for hydrogen and CO2 emissions, and enhance the electricity grids and storage. Furthermore, for logistics, road, rail and water routes for transporting solid raw materials such as biomass and plastic waste must be maintained and expanded.

[183] Rohrbach and Meys (2024).

- To improve the **regulatory frameworks**, LRAs also depend on higher levels of government. Above all, plastic waste needs to be recognised as a secondary raw material to facilitate its trade across the EU. Policies should favour the use of biomass and recycled materials as production inputs (rather than burning them for energy). Finally, administrative hurdles and overregulation need to be reduced at all levels, including LRAs, to shorten the time needed to implement new technologies.
- LRAs are crucial for **strategic planning and support**. This includes their role in maintaining and integrating chemical parks to ensure high efficiency in heat integration and other networks. They can also promote the deployment of currently uncompetitive technologies to improve energy efficiency, including industrial heat pumps, direct electrification, and storage capacity. Finally, as a strategic approach, consumer awareness should be enhanced to help the green chemicals industry justify higher production costs.

The need for support to scale up innovative chemical industry products is illustrated by the two examples in the box below, both of which benefit from the EU Innovation Fund. These projects are located in the ChemCologne area: one in the Wesseling Chemical Park and the other in the Cologne Airport Business Park (not a member of ChemCologne). These investments demonstrate how EU funding instruments interact with regional industrial ecosystems and how anchor projects can support wider territorial transition dynamics.

Box 20: Project examples, MoReTec and LARS

MoReTec recycling facility in Wesseling

With its proprietary cutting-edge MoReTec chemical recycling technology, LyondellBasell (LYB) returns post-consumer plastic waste to its molecular form. This is used as a feedstock for new plastic materials that offer expanded applications, including medical and food packaging. LYB has built a MoReTec advanced recycling technology demonstration plant (MoReTec-1)[184], which is the next step toward addressing the challenge of hard-to-recycle plastics at scale. This project is expected to provide LYB with the valuable operating experience and additional technological know-how that is needed to scale up and fully commercialise the MoReTec technology, which will contribute to a circular, climate-neutral economy.

LARS – large-scale integrated pre-treatment and chemical recycling plant in Cologne

The goal of the LARS project is to build a large-scale, integrated pre-treatment and chemical recycling plant. This facility will convert post-consumer plastic waste into pyrolysis oil, a sustainable substitute for naphtha, a fossil-based

[184] This project funded by the EU Innovation Fund was about to be finalised as of 31 January 2026.

feedstock utilised as a raw material in the plastic industry. In doing so, it contributes to the development of a new circular business model. This integrated concept has never been realised on such a large scale. The chosen technology, chemical recycling, enables the effective recovery of valuable raw material from plastic waste and its valorisation into new products. This aligns with the ambitious Packaging and Waste Packaging Regulation standards.

Source: own elaboration based on the European Commission Innovation fund platform (link) with additional information retrieved from the following webpage.

Lessons learnt

The example illustrates a place-based approach from several perspectives. These include integrated production (Verbundproduktion), which **ensures the supply of essential materials between companies within chemical parks,**[185] and the **joint use of infrastructure and logistics to facilitate optimisation**[186].

Other place-based features relate to the **multi-stakeholder structure**. From the perspective of public authorities, ChemCologne's multi-level governance structure is crucial. It involves state authorities from North Rhine-Westphalia, city and district councils within the network's catchment area and related intermediaries.

Furthermore, the network's **close partnership with four universities/colleges and regional training academies** supports the supply of skilled labour. This **contributes to the place-based approach** by ensuring consistency between industrial needs and skills development, while offering practical experience during education. Beyond the chemical park hubs, the network comprises chemical companies of various sizes, as well as service providers essential for efficient modern industrial production.

Finally, **the place-based approach of ChemCologne is evident not only in the use of common structures and partnership, but also in the network activities**. These are designed to address the specific needs of the various network partners. This is illustrated by the diverse range of events described above. Similarly, the complementary initiatives related to innovation, marketing, and investment are tailored to the partners' requirements.

[185] Verbundproduktion. Additional information can be found at the following link.
[186] Additional information on the infrastructure logistics can be found at the following link.

Projet de territoire Lyon Vallée de la Chimie - France

Overview of the sector

Lyon Vallée de la Chimie is a major industrial territory located in the southern part of the Lyon metropolitan area, along the Rhône corridor. Historically structured around chemical and process industries, the area today constitutes a large functional industrial zone that plays a strategic role in both the regional and national industrial landscape. Covering approximately 400 hectares, it hosts around 500 companies and provides some 14 200 direct jobs, making it one of the most significant industrial employment areas within the Metropole of Lyon (Métropole de Lyon, 2024a[187]).

At the national level, the chemicals industry is a cornerstone of the French economy. With a turnover of EUR 108.5 billion in 2023, more than 4,000 companies and around 177,000 direct employees, France is the second-largest chemical producer in Europe[188]. The sector is highly export-oriented, accounting for EUR80 billion in exports and generating a positive trade balance of EUR 18 billion.

Lyon Vallée de la Chimie is an important node within national and European chemical value chains. It is located in Auvergne–Rhône-Alpes, a region characterised by a dense network of industrial activities, research institutions and competitiveness clusters, notably AXELERA and POLYMERIS. The territory benefits from strong upstream–downstream integration, proximity to major transport and logistics infrastructure, and access to energy and utility networks critical for chemical and process industries.

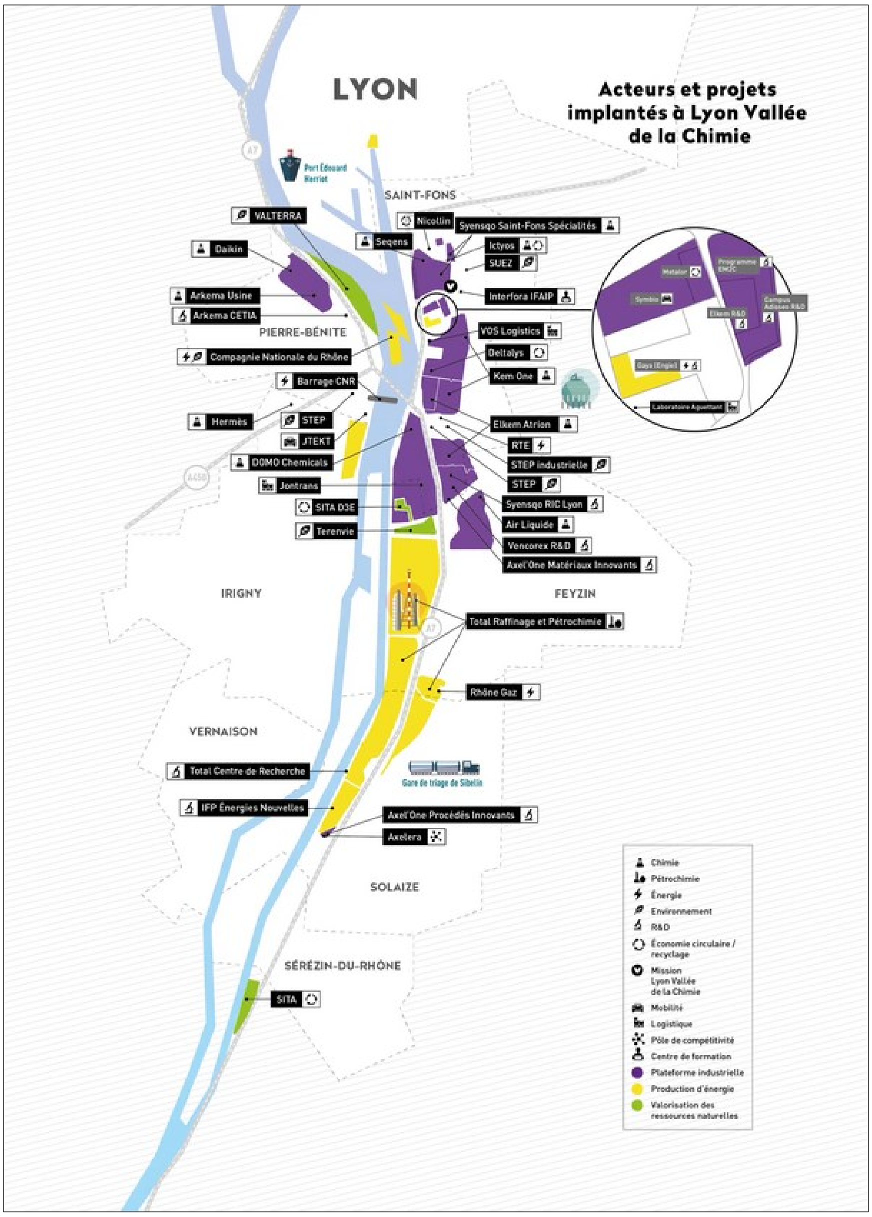
Lyon Vallée de la Chimie is a functional territory spanning several municipalities and directly connected to dense urban areas. This spatial configuration creates both opportunities and constraints. On the one hand, proximity to the Lyon metropolitan area offers access to skills, research, innovation ecosystems and multimodal infrastructure. On the other hand, it intensifies challenges related to land availability, environmental impacts, industrial risks, mobility, and coexistence between industrial activities and residential uses.

These challenges are particularly acute in a context where the chemicals industry is undergoing profound transformation. At the national level, the sector has committed to ambitious environmental objectives, including a 78–81% reduction in greenhouse gas emissions compared to 1990 levels by 2030, alongside reductions in water withdrawals and increased energy efficiency. Achieving these

[187] Métropole de Lyon (2024*a*).
[188] CEFIC, *Landscape of the Chemical Industry – France*, on-line.

targets requires substantial investment in low-carbon energy, hydrogen, electrification, carbon capture and industrial ecology, all of which have strong territorial implications.

Figure 41: Lyon vallée de la Chimie



Source: reproduced from here.

Description of the strategy

The Mission Lyon Vallée de la Chimie acts as a "territorial pilot" of the metropolitan vision. It serves as a point of entry for industrial actors, coordinates public–private cooperation, and supports the implementation of projects aligned with long-term territorial objectives.

This governance capacity reflects the **broader strategic choice by the Metropole of Lyon to address industrial transition through a place-based approach**. It frames the chemicals industry as a territorial system that integrates economic performance, environmental transition, land-use planning and social cohesion[189].

The strategy for Lyon Vallée de la Chimie is **grounded in a long-standing, place-based metropolitan industrial policy that combines spatial planning, industrial transition and collective governance**. Rather than being limited to a single programme, it has progressively taken shape through a series of complementary initiatives that together structure the territorial transformation of this major industrial area.

***From land-use transformation to industrial transition: the legacy of* L'Appel des 30 !**

A key milestone in this trajectory was *L'Appel des 30 !*, launched in 2014 by the Metropole of Lyon **in response to the combined challenges of industrial decline, land scarcity and environmental transition** in the Vallée de la Chimie. This initiative aimed to mobilise underused or obsolete industrial land in order to accommodate new productive activities aligned with ecological transition objectives[190] (Lejoux, 2023).

Through *L'Appel des 30 !*, around 80 hectares of industrial brownfields were reassigned to companies operating in green chemistry, energy and environmental technologies, marking a strategic shift towards more sustainable industrial development. The initiative relied on dedicated real estate programmes, turnkey industrial sites and the reconversion of constrained or Seveso-classified areas, notably through projects such as *Les Ateliers CleanTech*. It also involved establishing large-scale facilities, including a hydrogen fuel cell gigafactory[191]. This approach illustrates how spatial and land-use instruments were mobilised as levers of industrial transformation within the Vallée de la Chimie.

***The* Pacte pour l'Impact*: structuring a shared territorial strategy*[192]**

Building on this experience, the Metropole of Lyon formalised a broader, more integrated strategic framework through the *Pacte pour l'Impact* for Lyon Vallée de la Chimie. Adopted in 2023, the Pacte defines a shared vision and a set of collective commitments for the transformation of the territory up to 2030, bringing together public authorities, industrial firms and ecosystem actors. Around 50 public and private organisations have signed the Pacte.

The Pacte positions the chemicals industry as a territorial system, in which industrial performance, decarbonisation, land-use optimisation and relations with surrounding urban areas are tightly interlinked. It articulates three main axes of action: (1) reducing the environmental footprint of industrial activities, (2)

[189] Métropole de Lyon (2023).
[190] Lejoux P. (2023).
[191] Lejoux, P. (2023).
[192] Métropole de Lyon (2023).

increasing territorial value creation through land and infrastructure optimisation, and (3) improving the integration of industrial activities within the metropolitan environment.

Rather than operating as a funding instrument, the Pacte functions as a **coordination and alignment framework**. It enables the translation of national and European priorities, such as decarbonisation, innovation and resilience of value chains, into locally adapted actions that reflect the spatial constraints and industrial structure of Lyon Vallée de la Chimie.

Mobilising industrial actors: the role of the **Manifeste**[193]

In parallel, the Metropole of Lyon has developed **softer instruments aimed at mobilising and engaging industrial actors across the territory**. The *Manifeste pour une industrie qui se transforme et s'engage pour l'environnement*, launched in 2021, plays a key role in this respect. By 2024, nearly 500 industrial companies of all sizes and sectors had signed the Manifesto, representing around half of metropolitan industrial employment.

The Manifesto is based on voluntary commitments covering five main areas: welcoming industrial activities to the territory, reducing industrial risks, lowering the environmental and energy footprint of production, promoting employment and skills, and strengthening cooperation between industrial actors and territories. While not specific to Lyon Vallée de la Chimie, the Manifesto reinforces a shared culture of transition and cooperation among firms operating in the area and supports the implementation of additional operational initiatives such as the Pacte.

The Metropole of Lyon as facilitator and coordinator

A central feature of the strategy is the **active role played by the Metropole of Lyon as a facilitator of industrial projects**. Beyond its regulatory and planning competences, the metropolitan authority organises and animates sector-based collectives in strategic industrial fields, including chemistry, energy, environment, health, mobility and construction. These collectives bring together firms, clusters, competitiveness poles and other socio-economic actors, and are supported by dedicated "sector experts" within the metropolitan administration[194].

Through this approach, the Metropole provides project engineering, connects industrial actors to relevant partners and funding schemes, and helps overcome coordination failures that often hinder industrial transition at the local level[195]. In Lyon Vallée de la Chimie, this facilitation role has been particularly important for projects involving land reconversion, shared infrastructure, decarbonisation pathways and industrial symbiosis.

[193] Métropole de Lyon (2024*b*).
[194] Métropole de Lyon (2024*c*).
[195] Lejoux, P. (2023).

Lessons learnt

Although the strategy for Lyon Vallée de la Chimie is ongoing, several intermediate results are already evident.

- First, the strategy has delivered **tangible land-use and real-estate outcomes**, notably through the reassignment of industrial brownfields under *L'Appel des 30 !*.
- Second, it has enabled a **broad mobilisation of industrial actors**, illustrated by the *Manifeste*, signed by nearly 500 companies.
- Third, the *Pacte pour l'Impact* has **strengthened territorial coordination and governance**, particularly in areas such as decarbonisation pathways and industrial ecology, where collective action at the territorial level is essential.

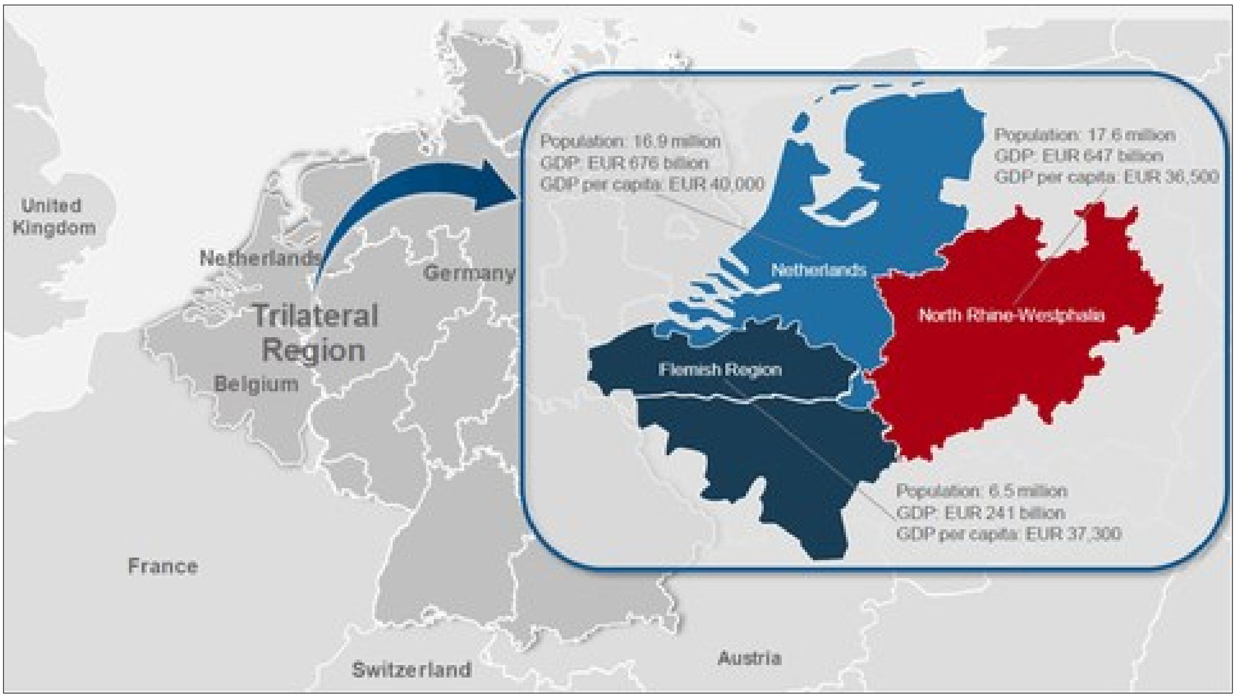
The Lyon Vallée de la Chimie case illustrates the value of **combining hard and soft policy instruments within a place-based industrial strategy**. The articulation of spatial planning, land policy and real estate development through sectoral coordination, voluntary commitments and facilitation mechanisms has generated concrete outcomes in a context of strong urban pressure. This integrated approach has made it possible to support both the greening and the long-term competitiveness of the chemicals industry, while improving its territorial integration within a metropolitan setting.

Trilateral Chemical Region – The Netherlands / Belgium / Germany

Overview of the sector

The Trilateral Chemical Region covers the cross-border area between the Netherlands, North Rhine-Westphalia in Germany and Flanders in Belgium.

Figure 42: The Trilateral Chemical Region



Source: information retrieved from the Trilateral Chemical Region's website.

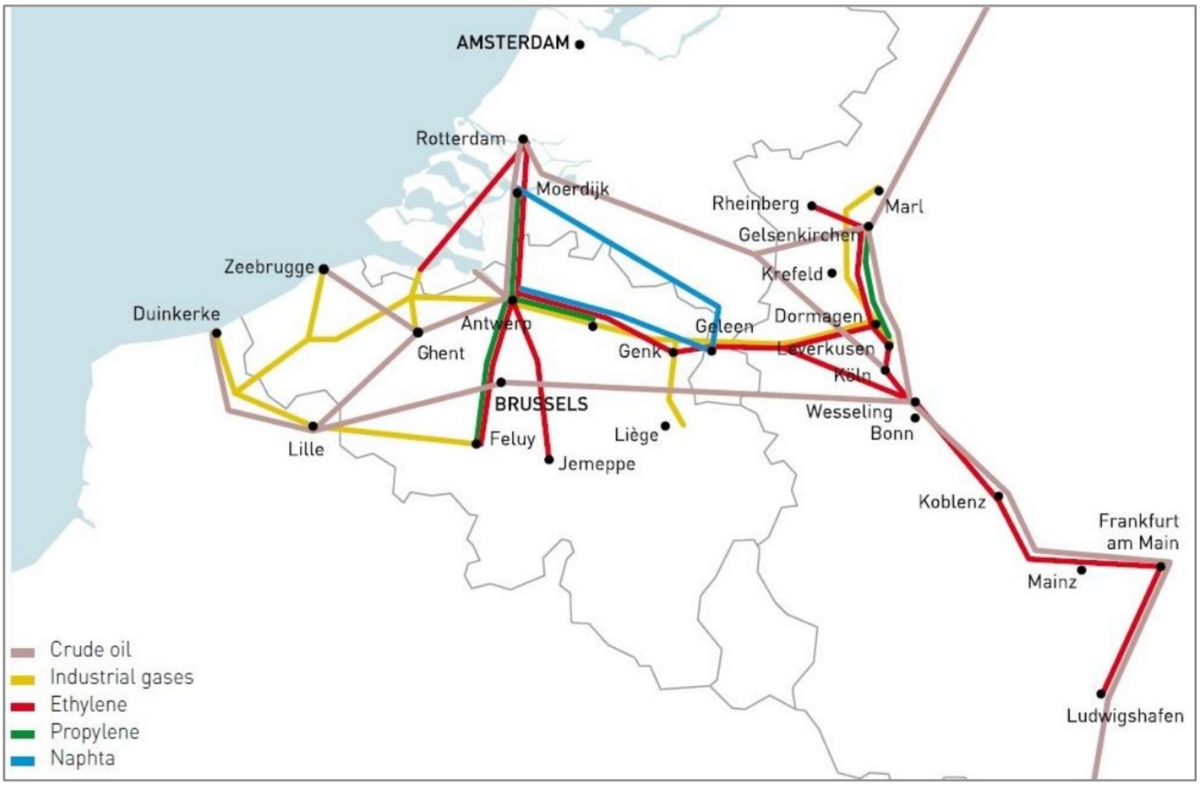
Its territory brings together neighbouring regions from three Member States with a long history of chemical industry transition. These states are among the top six chemical producers in the EU:

- The **German** chemicals industry is the largest in the EU in terms of value added and employment, and North Rhine-Westphalia is the heart of the sector (see also case study ChemCologne).[196] At the regional level, North Rhine-Westphalia ranked sixth in the EU in terms of value added in 2023, with a turnover of nearly EUR 50 billion and more than 100,000 employees[197]. The chemicals industry in North Rhine-Westphalia is dominated by the ChemCologne network chemical parks (see corresponding case study) and those in the Ruhr area[198].

[196] CEFIC, *Landscape of the Chemical Industry – Germany*, on-line.
[197] Additional North Rhine Westphalia economic data could be found at the following link.
[198] Additional information on the Ruhr area could be found at the following link.

- The chemicals industry is the second-largest industry in **the Netherlands**. Its turnover in 2022 amounted to EUR 87 billion, and it employed 45,000 people. Similar to the German chemicals industry structure based on chemical parks, the core of the chemicals industry in the Netherlands is found in five clusters: Rotterdam-Moerdijk, South Limburg/Chemelot, North Netherlands/Delfzijl/Eemshaven, Zeeland/West-Brabant and Noordzeekanaalgebied[199].
- In **Belgium**, the chemicals industry is also one of the most important industries, with an annual turnover of EUR 75 billion and nearly 100,000 employees. It is also crucial for the country's exports. The largest Belgian chemicals industry cluster is located at the port of Antwerp-Bruges in Flanders, home to several leading global chemical companies. "Lying in the centre of the Western European pipeline network, Antwerp is directly connected with all the major sub-clusters in Belgium, the Ruhr district of Germany and the Delta region in the Netherlands[200]". Other clusters are located around Ghent, Leuven, and the Mechelen area.

Figure 43: Illustration of the trilateral pipeline network



Source: Ministry of Economic Affairs, Innovation, Digitalisation and Energy, and of the State of North Rhine-Westphalia (2017), p.23.

The EU-wide importance of the chemicals industry is underpinned by the **trilateral chemical region**, which generates **almost 20% of the sector's total**

[199] CEFIC, *Landscape of the Chemical Industry – Netherlands*, on-line.
[200] CEFIC, *Landscape of the Chemical Industry – Belgium*, on-line.

turnover at EU level. Building on its Verbund structure, i.e. the close physical integration of chemical plants across the three regions, this cluster benefits from a highly efficient production structure. In terms of chemical sales per capita, the trilateral region is by far the highest-performing chemical region worldwide with approximately EUR 3,600 in sales per capita (in comparison: China, EUR 1,300; Japan, EUR 1,500; USA, EUR 2,400)[201].

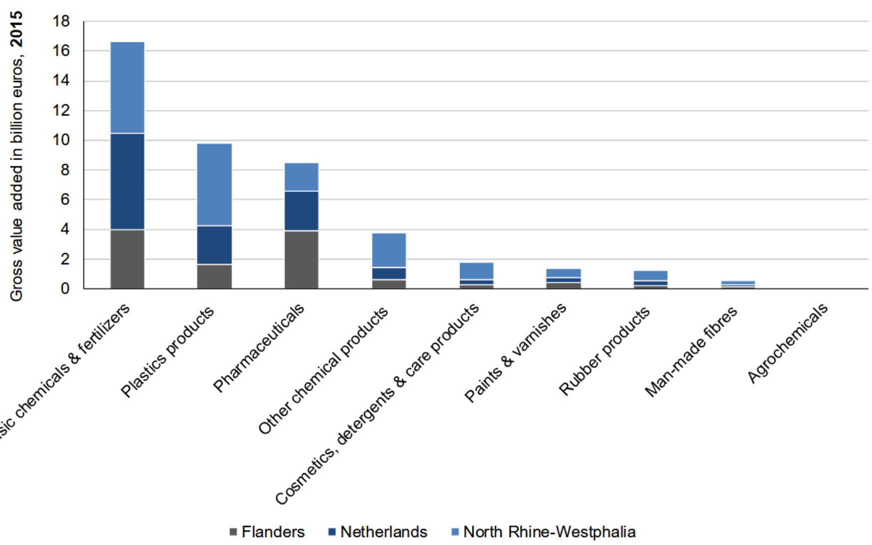
In total, **the trilateral region is a major producer of base chemicals** including ethylene, propylene, butadiene, and Benzene, Toluene, and Xylene (BTX). However, specific industrial focus varies across the three areas of the trilateral region, as illustrated in the table and figure below.

Table 22: Overview of chemicals industry sectors in the trilateral chemical region

Flanders	North Rhine-Westphalia	The Netherlands
Integrated chemicals	Speciality chemicals	Bulk chemicals
Life sciences (biotech & pharmaceuticals)	Biotech & pharmaceuticals	Petrochemicals and logistics
Plastics processing	Plastics & polymers	Refined products
Base chemicals	Base chemicals	
Shared and emerging sectors: Circular & bio-based chemicals, sustainable energy carriers for H2 and CCU, electro-chemicals		

Source: own elaboration based on the Trilateral Chemical Region's website (section "Our region" and "Innovation") and the Chemie.NRW's website.

Figure 44: Gross value added of chemical sub-sectors in the trilateral region, 2015



Source: Ministry of Economic Affairs, Innovation, Digitalisation and Energy, and of the State of North Rhine-Westphalia (2017), p.15

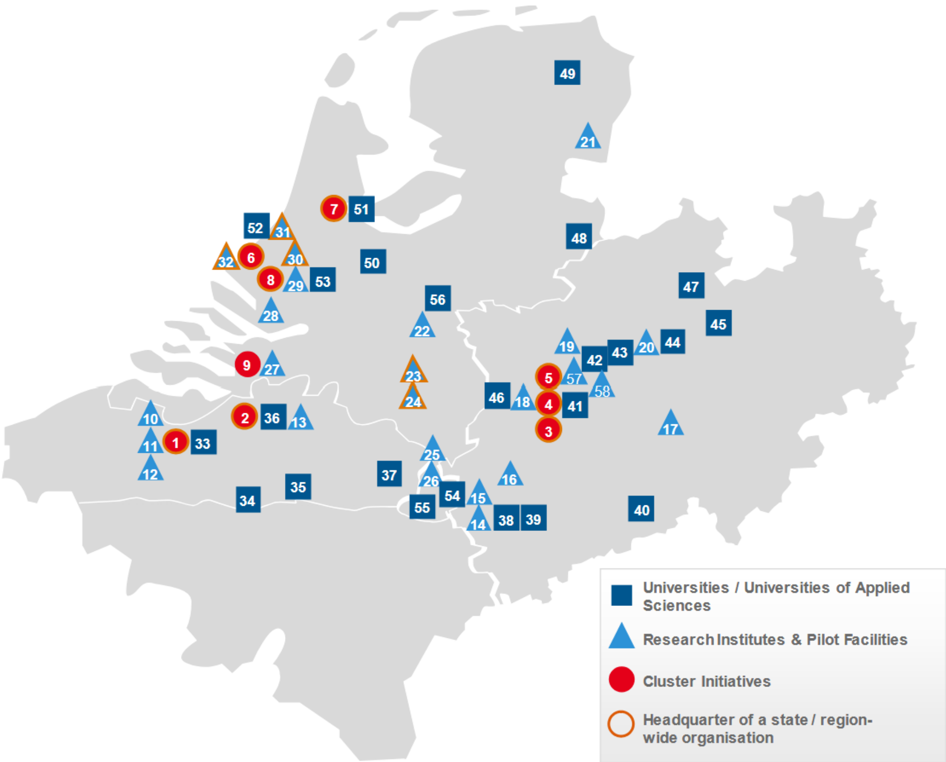
[201] Additional information on the Trilateral Chemical Region could be found at the following link.

The chemicals industry of the trilateral region is characterised by **highly integrated chemical clusters, a highly skilled workforce, strategic infrastructure and excellence in industrial and academic research**. Apart from these common strengths, the regions also share several challenges, notably especially high energy costs and an ageing workforce, which increases competition for specialists. In addition to these joint challenges, the regions also face specific challenges. For example, high labour costs are a particular concern for the chemicals industry in Flanders, while in North Rhine-Westphalia, delays in the energy transition and structural barriers remain critical for the chemical sector[202].

Description of the strategy

The Trilateral Chemical Region is a cross-border cooperation initiative in which ministries and chemical companies have cooperated since 2017. The governance structure and the region's activities are shaped by the trilateral strategy for the chemicals industry, developed in 2017 and incorporating key stakeholders from industry, academia and cluster organisations.

Figure 45: R&D landscape and cluster initiatives of the chemicals industry in the trilateral region



Source: Ministry of Economic Affairs, Innovation, Digitalisation and Energy, and of the State of North Rhine-Westphalia (2017), p.20.

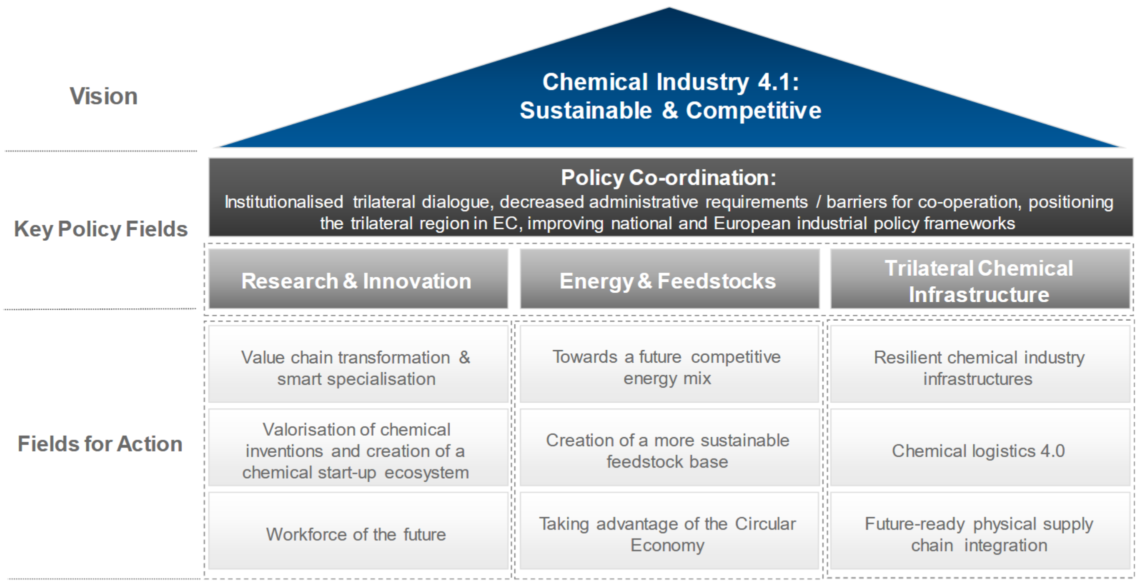
[202] Based on country profiles of CEFIC, *Landscape of the industry*, on-line articles.

This strategy aims to transition the region towards a sustainable and competitive chemicals industry cluster in 2030. It defines three main policy fields: (i) research and innovation, (ii) energy and feedstocks, and (iii) trilateral chemical infrastructure. These are complemented by a fourth horizontal field, policy coordination. With its five overarching objectives, the strategy illustrates the place-based approach taken in the trilateral region:

1. Value chain transformation: facilitate transition towards a digital, sustainable and circular chemicals industry in the trilateral region.
2. Skills and education: improve the quality and integration of trilateral education and qualification systems to develop a regional labour pool for a knowledge-based chemicals industry.
3. Energy feedstock: lower the energy costs of the trilateral region and build a level playing field for sustainable feedstocks.
4. Infrastructure and logistics: Secure critical infrastructures for the chemicals industry and advance the development of a chemical logistics system.
5. Governance: Strengthen the quality and effectiveness of trilateral policy co-ordination in cross-border areas for the chemicals industry."[203]

The strategy breaks down these objectives into specific fields of action as shown in the figure below. These are further operationalised into 21 targeted measures.

Figure 46: Working groups by policy fields and fields of action of the trilateral strategy



Source: Ministry of Economic Affairs, Innovation, Digitalisation and Energy, and of the State of North Rhine-Westphalia (2017), p.44.

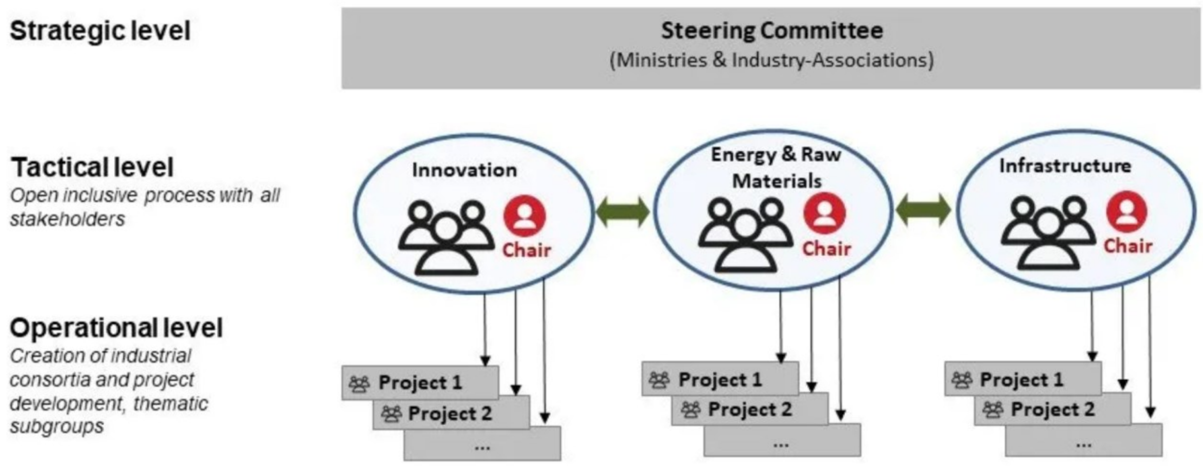
The governance of the cooperation is organised across three levels:

[203] Ministry of Economic Affairs, Innovation, Digitalisation and Energy, and of the State of North Rhine-Westphalia (2017), p.43.

- Strategic level: a steering committee consisting of ministries and industrial associations,
- Tactical/operational level: an open and inclusive process involving all stakeholders across three working groups (one per policy field, see below),

Operational/activity level: dedicated to sub-groups and concrete projects.

Figure 47: The Trilateral Region's governance structure



Source: Trilateral Chemical Region's website.

The strategy proposes **comprehensive stakeholder involvement**, distinguishing primarily between ministries, industry representatives, academia and intermediaries. Depending on the activity, it also suggests including financial intermediaries, cluster organisations, specific public agencies and infrastructure providers (e.g. energy providers, port authorities).[204]

Regarding LRAs, the governance structure focuses mainly on the ministerial level rather than on local players. Municipalities are primarily involved in information exchange and consultation processes during the planning stages of strategy activities. Apart from consultation, local authorities may be involved in activities such as participating in clusters or chemical parks (see the ChemCologne case study).

In contrast, the regional ministerial level, which represents the regions of North Rhine-Westphalia and Flanders in the trilateral region, has several roles[205]:

- As members of the steering committee, they hold overall strategic responsibility.
- They are responsible for policy coordination to reduce regulatory, financial and administrative obstacles. This includes several policy areas, such as

[204] Ministry of Economic Affairs, Innovation, Digitalisation and Energy, and of the State of North Rhine-Westphalia (2017).

[205] See different sub-pages of *Trilateral Chemical Region's* website.

spatial planning (infrastructure corridors), innovation, and energy and climate policy.

- This is closely related to their role in infrastructure development, supporting the chemicals industry regions.
- For the facilitation of research and innovation, they are, inter alia, responsible for funding and cluster support.
- Finally, the ministries act as the trilateral region's voice at the EU level. For example, advocating for the inclusion of the trilateral pipelines in the TEN-T network.

Based on the strategic development of 2017, further milestones have been achieved. These are primarily categorised by policy area and the respective working groups and include various position papers advocating for the region's needs. Key examples include:

- The Energy working group produced a position paper on the valorisation of CCU within the EU Emissions Trading System (ETS), focusing on removing policy hurdles to allow circular solutions.
- A discussion paper was developed to highlight the relevance of inland waterway transport and to contribute to the political debate regarding its role in the region.
- A dialogue has been established with regional incubators to better support start-ups and scale-ups within the chemical sector.
- The infrastructure working group published a position paper titled "A Vision for Pipelines", which identified the critical west-east gap in the network and established a shared vision to bridge it. The group also released a paper on project ideas for interconnectivity, data exchange and digitalisation.[206]

Lessons learnt

The example illustrates a place-based approach from several perspectives, including integrated production (Verbundproduktion) and infrastructure; this implies a **strong regional connection between the different areas of the trilateral regio**n. In other words:

- the continuous, cross-border chemical industrial belt functions as an integrated economic area;
- the shared transport and logistics networks, especially pipelines and access to key seaports, physically tie production sites together;

[206] See working group specific pages on Trilateral Chemical Region's website.

- cross-regional innovation and workforce linkages leverage the geographic concentration of knowledge institutions and skilled labour; and
- notwithstanding the national borders, there are dense spatial interconnections between the three Member States.

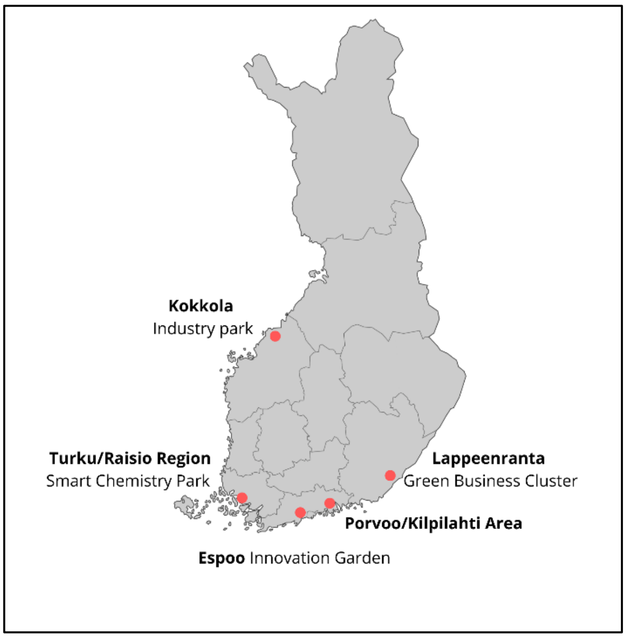
Other place-based features include the **multi-stakeholder structure**. While primary public responsibility lies with regional authorities – and national authorities in the Netherlands - local authorities and intermediaries are also considered important. The chemicals industry production and innovation system is based on an extensive network of stakeholders with complementary roles across the entire region.

The innovation garden and a green chemistry park in Espoo - Finland

Overview of the sector

Finland's chemical sector is a core industrial pillar, both in terms of output and external competitiveness and directly employed more than 13,000 people in 2023[207]. The sector is concentrated in chemical clusters in Southern and Western Finland, in Porvoo (oil refining and petrochemicals).

Figure 48: Finland's chemical clusters



Source: own elaboration.

The chemicals industry is Finland's second-largest export sector, accounting for 18.7% of total exports in 2024 (by product group)[208]. It generated total revenues of EUR 36.4 billion and exports of EUR 17.7 billion in 2022, contributing an estimated 22% of manufacturing output and 22% of total goods exports[209].

Industry sources also point to significant capital investment and ongoing upgrades in production and R&D. According to the Chemicals industry Federation of Finland, the sector invests about EUR 1 billion annually in Finland, with around EUR 450 million in R&D[210].

The industry is concentrated in a small number of major industrial areas, with dedicated infrastructure, logistic and shared utilities. These include Poorvo and the Turku area (pharmaceuticals and oil refining), as well as a high-tech chemical cluster on the west coast around Kokkola, Northern Europe's largest chemical and metal-refining industrial ecosystem[211].

Box 21: Finland's competitive innovation specialisation

> Building on its strong industrial base and export orientation, Finland has developed a clear **competitive specialisation** in sustainable chemistry, industrial biotechnology and clean hydrogen.

[207] Eurostat [nama_10_a64_e].
[208] TULL CUSTOMS (2024).
[209] CEFIC, *Landscape of the European chemical industry – Finland*, on-line.
[210] Additional information on the Finnish chemical industry could be found at the following link.
[211] CEFIC, *Landscape of the European chemical industry – Finland*, on-line.

The **sustainable biotech activity** is strongly anchored in its forest-based bioeconomy, where research and industrial piloting focus on upgrading wood-derived side streams into higher-value fibres, biochemicals and bio-based materials. This capability is visible in regional ecosystems, including the **Lappeenranta area**'s bio and circular-economy business environment and related green-industry clusters[212]. It also translates into concrete innovation platforms, such as the **Smart Chemistry Park** in Raisio (Turku region), which offers laboratory space and networks for start-ups and SMEs delivering solutions for the bioeconomy and circular economy[213]. An example of this rich, innovative environment is the **Nordic Bioproducts Group**, founded as a spin-off from **Aalto University.** The company develops lignocellulose-based biomaterials as lower-impact substitutes for fossil-based inputs and has progressed toward industrial scaling through new production capacity investments[214].

In parallel, Finland is pushing **clean hydrogen** as an emerging industrial pathway. The government has set out a national objective to become a leading European hydrogen player, aiming to produce around 10% of the EU's clean hydrogen by 2030[215]. Rapid wind power expansion is strengthening Finland's cost-competitive supply of clean electricity, thereby lowering electrolysis costs and supporting the emergence of export-oriented hydrogen and power-to-X[216] value chains.

The Espoo Innovation Garden refers to a place-based innovation ecosystem centred on the Keilaniemi-Otaniemi-Tapiola corridor in Espoo, within the Helsinki metropolitan area. It **is not a single programme, but a collaboration framework bringing together research institutions, corporate anchors, start-ups, public authorities and wider society around shared platforms for co-creation and experimentation**. The area hosts a high concentration of innovation actors, including Aalto University and the VTT Technical Research Centre of Finland[217], alongside major company headquarters and a large research community. Around 5 000 researchers and more than 25 R&D organisations operate within a compact area of approximately 5 km²[218]. This critical mass lowers coordination costs and enables repeated cycles of applied R&D, prototyping and testing with multiple partners. At the same time, the ecosystem

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[212] Additional information on the Lappeenranta's ecosystem can be found at the following link.
[213] Additional information on the Smart Chemistry Park can be found at the following link.
[214] Additional information on the Nordic Bioproducts Group can be found at the following link.
[215] Finnish Government resolution TEM/2023/14 (link).
[216] It refers to a set of technologies that convert surplus electricity generated from renewable sources into energy carriers, fuels, or feedstocks.
[217] VTT Technical Research Centre of Finland is key actor in the strategy. It operates as a bridge between scientific capabilities and industrial application.
[218] Additional information on the Espoo Innovation Garden can be found at the following link.

remains open to new entrants such as start-ups and SMEs, through shared facilities and community platforms. The City of Espoo primarily acts as a facilitator, supporting networks, shared spaces and city-as-a-testbed practices, with infrastructure investments (notably the West Metro corridor) reinforcing the ecosystem's attractiveness for knowledge-intensive activities.

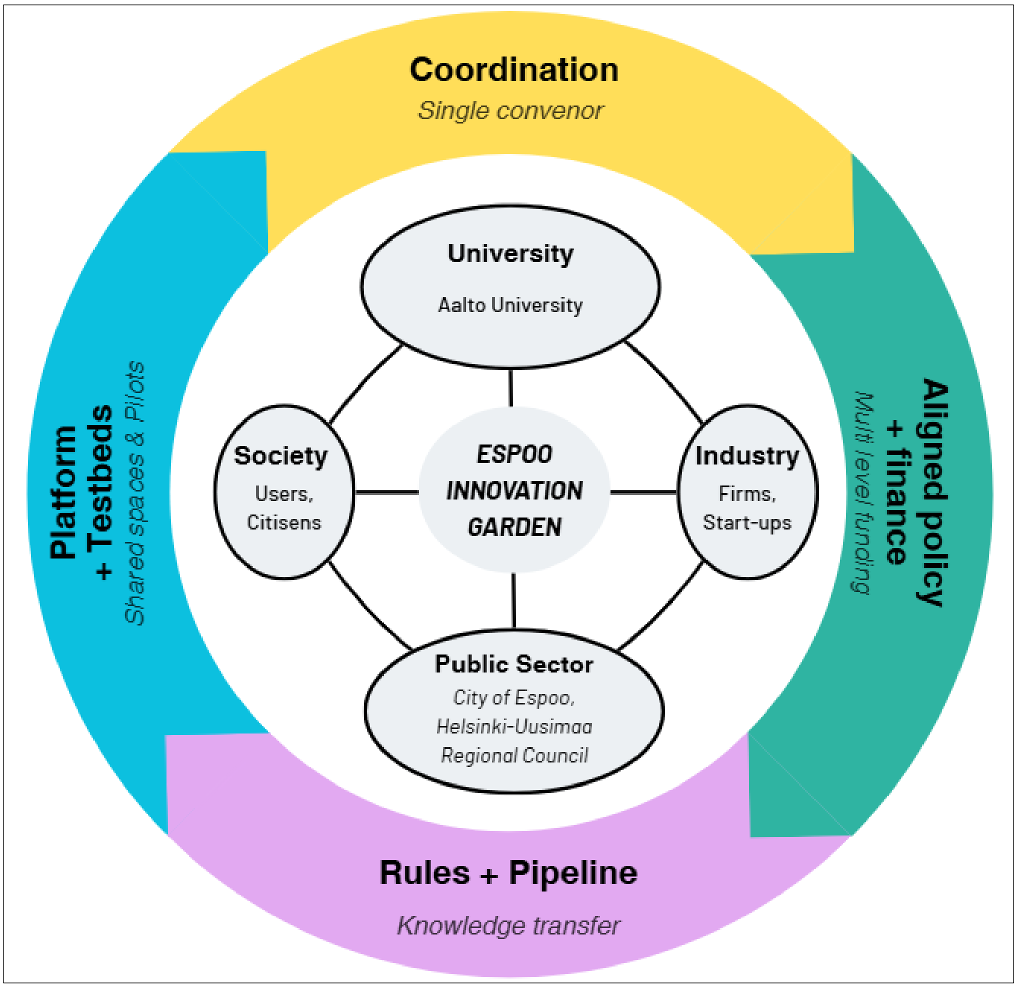
Description of the strategy

Espoo Innovation Garden

The Espoo Innovation Garden is Northern Europe's largest innovation hub. Characterised by a "Quadruple Helix" model involving collaboration among the public sector, academia, companies, and residents, it is centred around Aalto University, VTT, and major corporations such as Kone, Fortum, Neste, and Rovio. The ecosystem hosts the Startup Sauna accelerator and contributes to a high-density startup scene, promoting innovation in technology and sustainable energy. It serves as an open network connecting residents, companies, and organisations. The Espoo Innovation Garden illustrates how a dense local concentration of knowledge infrastructure, corporate anchors and public-sector coordination can be translated into a **structured collaboration model that consistently generates experimentation, co-creation and scale-up pathways, rather than one-off projects**. A JRC study[219] identified Espoo as a representative example of a place-based innovation ecosystem, understood as a local hub where groups of actors and dynamic processes jointly produce solutions to multiple challenges. A central aspect is that **local performance rests on a layered set of mutually reinforcing enablers**. National-level reforms and funding instruments create incentives for collaboration around applied innovation; regional policy frameworks provide strategic direction and a coherent financing logic; and local actors operationalise these conditions through concrete platforms, spaces and testbed practices that make collaboration routine and visible. Within this structure, Aalto University plays a central coordinating role, aligning actors around a shared direction while enabling bottom-up experimentation and learning by doing.

[219] JRC (2017).

Figure 49: Espoo Innovation Garden: quadruple-helix actors supported by enabling conditions



Source: own elaboration.

Beyond its conceptual structure, the Espoo Innovation Garden is sustained by a **clear division of roles across governance levels**. Long-term coordination between the City of Espoo and the Helsinki–Uusimaa Regional Council provides strategic continuity, while Aalto University acts as an ecosystem orchestrator, connecting firms, researchers and public actors through campus-based platforms and co-creation environments. Applied research capacity is anchored by VTT, which bridges scientific capabilities and industrial applications. This configuration is reinforced by targeted policy instruments.

- **National level** – long-term grant funding by Tekes (now Business Finland) de-risks collaborative projects, while structural reforms (notably the University Act 2010 and Intellectual policy rules for externally funded research) strengthen universities' capacity to engage in technology transfer and start-up formation;
- **Regional level** – the Helsinki–Uusimaa Regional Programme and the 2014–2020 RIS3 provide strategic direction and a financing logic focused

on priority domains such as Urban Cleantech, Human Health Tech and Digitalising Industry;

- **Local level** – the City of Espoo operationalises the ecosystem through shared spaces, targeted financial support and city-as-a-testbed practices, particularly in smart and clean technology domains.

EriCa Green Chemistry Park: a chemistry-focused place-based implementation within the Espoo ecosystem

Within the Espoo Innovation Garden, the EriCa Green Chemistry Park is a newly completed research and innovation facility located in Espoo's Finnoo district. It was completed and handed over to users in autumn 2025, operating as a **place-based innovation infrastructure** combining large-scale shared laboratories with flexible office and coworking space **to lower entry barriers** for firms, start-ups and research teams working on green chemistry and process innovation. In total, it provides approximately 21 000 m² of space, including over 10 000 m² of laboratories and around 2 500 m² of offices and coworking area. From an operational perspective, the combination of laboratory infrastructure and shared spaces supports different stages of R&D, promoting knowledge dissemination and interaction.

The establishment of the EriCa Green Chemistry Park is the result of a **collaborative investment and development partnership.** Kemira, the main industrial anchor, is a firm specialised in sustainable chemical solutions for water-intensive industries and has operated a research centre in the area since the early 1970s. Other stakeholders include A. Ahlström Real Estate Ltd, the Church Pension Fund and Aktia Life Insurance. This partnership combines industrial anchoring with long-term investment in innovation infrastructure[220]. Additionally, Crazy Town Oy, serves as the community and workspace operator, linking hundreds of firms, researchers and start-ups to Espoo's wider innovation ecosystem.

Beyond the physical infrastructure, EriCa functions as an organised collaboration platform through structured innovation support activities. Its main programme, the **EriCa Reactor**, recently launched to start, with the first cohort, between March and August 2026[221], further operationalises collaboration by bringing start-ups, scale-ups, spin-offs and early-stage innovators together with industry leaders, investors and business developers to address chemistry-relevant challenges (clean water, circularity, decarbonisation, digitalisation). The EriCa Reactor runs in cohorts, with each cohort dedicated to a specific theme: accelerating decarbonization; enabling circularity and material recovery; replacing fossil-based raw materials; ensuring clean water; and advancing industry digitalisation.

[220] Additional information can be found at the following link.

[221] Additional information about EriCa Reactor can be found at the following link.

Lessons learnt

While Finland's chemicals industry is concentrated in a small number of major industrial areas, the country's competitiveness also depends on how effectively it translates research capacity into industrial upgrading, new materials and process innovation, and scale-up pathways that can diffuse across sectors. In this respect, the Espoo Innovation Garden is a relevant example of how place-based innovation policy can institutionalise collaboration among universities, firms and public authorities. This is evident in domains closely connected to chemistry, such as clean technologies, circular solutions and bio-based innovation. Moreover, the EriCa Green Chemistry Park provides a complementary perspective on the Espoo innovation ecosystem, showing how a place-based innovation policy is translated into **sector-specific infrastructure and collaboration models**, with a direct focus on green and sustainable chemistry.

The Espoo experience shows that **place-based support for chemistry is cumulative and long-term**. Chemistry ecosystems are built through decades of investment in research capacity, stable institutions and trust-based relationships, rather than through short programme cycles. This means that the full "Innovation Garden" model is difficult to replicate quickly in territories with weaker research infrastructure or limited industrial R&D. However, individual components are transferable and can be introduced progressively. These include shared laboratory facilities, industry-linked acceleration formats and city-as-a-testbed practices.

Policy frameworks that ensure continuity across programming periods and enable step-by-step adoption of specific instruments are more suitable than attempts at full replication.

Moreover, **sector-specific assets work best when anchored in a wider innovation environment**. EriCa illustrates that dedicated chemistry infrastructure becomes more effective when it is embedded in a broader metropolitan ecosystem where universities, applied research organisations, firms and public authorities are already densely connected. In Espoo, repeated interaction and co-creation are enabled by proximity and an established culture of collaboration, so the sector-specific hub reinforces an existing system rather than creating one from scratch.

This points to prioritising chemistry-focused hubs that build on existing territorial strengths and are embedded in wider innovation environments, rather than developing standalone facilities

However, **shared infrastructure lowers entry barriers, but is not sufficient for scaling**. Large-scale shared laboratories and flexible workspaces, such as those in EriCa, reduce entry barriers for start-ups, spin-offs and research teams and support early-stage experimentation alongside industrial anchors. Yet, these platforms do not automatically address later-stage constraints, including scale-up finance, industrial deployment, market uptake and regulatory requirements.

Effective scaling requires combining place-based infrastructure and collaboration platforms with complementary national and EU-level instruments that support scale-up finance, industrial deployment and a predictable regulatory environment

Finally, **orchestration capacity matters more than formal control**. The Espoo case underscores the fact that durable collaboration often depends on the convening and facilitation functions provided by universities, cities and intermediaries that make cooperation routine without relying on top-down steering. Alignment across governance levels, including national funding and reforms, regional strategies and local facilitation, can provide the continuity and predictability needed in research- and capital-intensive sectors such as chemicals. Hence, investing in stable intermediary functions, such as platform management, matchmaking and applied research interfaces, is one of the most feasible elements for other regions to adopt incrementally.

Lombardy Green Chemistry Association - Italy[222]

Overview of the sector

Italy's chemical activities are geographically dispersed across the country yet they show a pronounced spatial concentration in Northern Italy, which accounts for 78% of total sector employment. This concentration is reflected in the geography of the main chemical hubs: of the 20 major hubs nationwide, 13 are located in the North.

At the EU level, Italy is a major player, with chemical production valued at about EUR 65 billion in 2024 (around 10% of EU production). The country also boasts a large domestic downstream market for chemical use (over EUR 77 billion). At the national level, the sector includes more than 2 800 firms employing over 113 000 highly qualified workers. Its broader employment footprint is estimated at over 327 000 jobs including indirect effects.

Within this national context**, Lombardy represents the most significant regional anchor in the Italian chemicals industry**. While the region accounts for around 24% of Italian industrial employment, it hosts 30.5% of the country's local chemical units and over 45,000 chemical employees (more than 40% of national chemical employment). In 2023, it recorded approximately EUR 27 billion in turnover. Lombardy is among the top five chemical regions in Europe in terms of both the number of employees and specialisation.

Figure 50: geographical distribution of the main Italian chemical hubs

Source: reproduced from Federchimica (2025b).

Lombardy stands out for its **concentration of biotech activities.** Regional industrial strategies explicitly include green chemistry and biorefining as key sectors in the regional economy, identifying industrial biotechnology as an enabling advanced technology that underpins the region's economic pathway[223]. Of the 5,869 biotech firms in Italy (as of 2024), 47% are located in Northern Italy,

[222] Information on LGCA's structure, working arrangements and activities was kindly provided by the Lombardy Green Chemistry Association. Additional information can be found at the following link.

[223] Biotech and chemicals sit on the same value chain because industrial biotechnology is often a route to make chemical products. In practice, biotech uses biological systems (microbes, enzymes, biocatalysts) as production technologies to transform biomass, waste streams, or simple feedstocks into higher-value molecules that are fully "chemical" outputs (for example ingredients, intermediates, and functional materials). This is why biotech is frequently described as a cross-cutting technology that applies from health to agriculture, from energy to chemistry.

with Lombardy accounting for 16% of the national total[224]. The region also leads in economic weight: Lombardy is the top Italian region by biotech turnover, at approximately EUR 18 billion, or 33% of the national total. A similar pattern emerges for employment, with Lombardy ranking first for biotech employment, accounting for 28,337 employees (28% of the Italian total). Furthermore, Lombardy hosts the largest share (27%) of biotech start-ups and innovative firms[225].

Biotechnology, as a key enabling sector for Lombardy's chemicals industry and its transition towards greener production models, is explicitly considered in the regional strategic planning and policy priorities. Chemistry is treated as a domain in which further investment can generate high territorial value. This positioning is, in fact, formalised in **Lombardy's Smart Specialisation Strategy (S3) 2021-2027**[226], which identifies chemistry as a priority area for innovation and industrial development. Rather than being confined to a single silo, the sector is embedded across two of the S3 Innovation Ecosystems - Advanced Manufacturing and Sustainability - signalling a dual policy objective: strengthening industrial competitiveness while accelerating the transition towards cleaner processes and products.

Despite the comparative advantages, the regional chemicals sector faces several challenges. A key constraint remains the transfer of green chemistry and bio-based solutions from laboratory development to market uptake and industrial scale-up[227]. Firms also face structural pressures that shape investment decisions and the pace of transition, including high energy costs, regulatory complexity linked to the implementation of environmental standards, skill shortages (notably in sustainability, digitalisation and scaling up), and the need to secure continuous access to sustainable, low-impact feedstocks. The adoption of green technologies is often hindered by high upfront investment costs, uncertainty over returns, and infrastructure gaps. In this context, regional platforms and initiatives can help de-risk investments, strengthen capabilities and partnerships, and accelerate the scaling of viable solutions.

Description of the strategy

To support the creation of a dedicated intermediary for green chemistry and the bioeconomy, Regione Lombardia promoted the establishment of the **Lombardy**

[224] Federchimica Assobiotec (2025).

[225] Innovative startups in Italy are those defined pursuant by Legislative Decree 179/2012, as amended by Law No. 193/2024.

[226] Regional Government of Lombardy (Giunta Regionale), Deliberazione n. XI/4155 (2020), as subsequently updated by Deliberazione n. XII/1430 (2023).

[227] Federchimica (2025*c*).

Green Chemistry Association (LGCA) in 2013 within the framework of the regional technological clusters recognised by the S3 2007-2013[228].

LGCA was founded as a non-profit association by a group of founding organisations, including Consorzio Italbiotec, Innovhub SSI, Politecnico di Milano and the University of Milan, to provide a structured platform for collaboration between research and industry. The Region supported both the launch and the subsequent consolidation of the cluster, which was formally recognised in 2016[229].

In line with this approach, **LGCA was designed to address coordination gaps between research and industry**, to valorise Lombardy's scientific excellence, to support companies in the shift towards more sustainable and circular production pathways, and to strengthen the regional chemical industry's competitiveness in a European context geared toward sustainability. In this context, LGCA's mission is to **promote green chemistry and the circular bioeconomy as drivers of competitiveness and sustainable development** for Lombardy, through activities focused on sustainable chemistry, biorefineries, biomass valorisation, technology transfer, European planning, training, and dissemination. Since the regional chemical cluster connects universities, research centres, and businesses, serving as a stable collaboration platform facilitating the intersection of industrial needs and scientific expertise, and supporting the path from innovation to industrial application, LGCA helps both companies and research actors by lowering coordination costs, supporting capability building and translating shared needs into project roadmaps and partnerships. Within this framework**, LGCA also acts as a technical and strategic reference point for Regione Lombardia** on policies and initiatives related to green chemistry and the circular bioeconomy. It supports implementation of the S3 by coordinating public and private actors around shared priorities.

LGCA's governance structure

LGCA includes 49 partners, of which 5 are associations and consortia, 9 universities and research centres, and 35 companies. LGCA's activities are organised around the cluster's three strategic areas: **sustainable chemistry**, **biorefineries**, and the **bioeconomy of the future**. Across these areas, LGCA supports both technological and organisational solutions, including cleaner production pathways, the development of bio-based value chains, and next-generation bioprocesses.

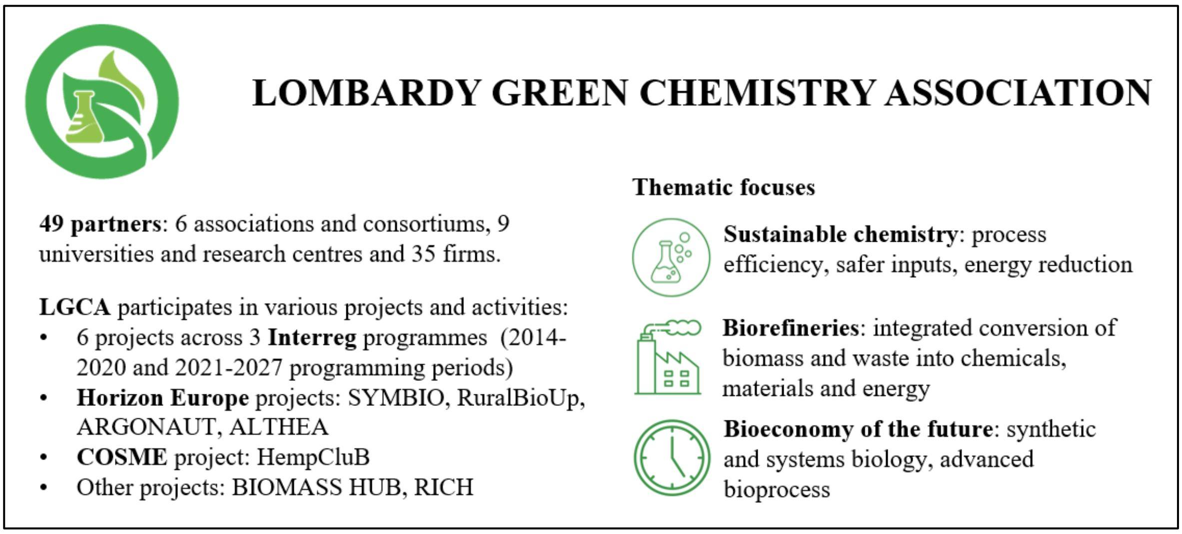
LGCA has a **multilevel governance structure to ensure representativeness and strategic coherence.** The General Assembly, composed of all members,

[228] In 2009 nine Lombardian technological clusters were created by the Region: aerospace, agrifood, mobility, green chemistry, energy, advanced manufacturing, life sciences, technologies for smart communities, technologies for life environments. Each of them is related to a specific S3 Lombardy strategy.

[229] Lombardy Regional decree no. 543/2016.

defines strategic directions and approves the work programme; the Board, representative of the various membership categories (founders, large firms, SMEs, research organisations and associations), oversees implementation and operational management; and the President ensures coordination and institutional representation. Regione Lombardia plays a central role in guiding and securing institutional recognition for the cluster, ensuring alignment with the S3 and other regional policies for innovation and sustainability. Other associated stakeholders – businesses, universities, research centres, and consortia – actively contribute to defining priorities and implementing initiatives, making LGCA a stable platform for connecting research, industry, and the local community. Priority themes and projects are therefore selected through a structured process that combines firms' expressed needs, emerging technological trajectories, regional and national transition priorities and funding opportunities. These are translated into technological and project roadmaps that span the full value chain, from research to industrial scale-up.

Figure 51: LGCA's partners and key thematic focuses



Source: own elaboration based on information retrieved from the LGCA website (link).

LGCA's key activities

LGCA provides concrete support to the chemical sector through an integrated set of tools: supply chain networking and dialogue, knowledge transfer and capacity building services, support for European project planning, guidance on funding opportunities, and internationalisation initiatives. Thanks to this support, the cluster operates in synergy with other national and European clusters and networks, positioning itself as a hub between Lombardy and the EU bioeconomy ecosystems.

Bioeconomy Dialogues[230] is an LGCA flagship initiative launched in 2018 as an annual conference and matchmaking format to foster discussion, cooperation, and

[230] Additional information on the Bioeconomy Dialogues can be found at the following link.

the development of concrete solutions in the circular bioeconomy. The target audience includes industrial companies, universities, research centres, startups, public institutions, investors, and technology and service providers. The format's added value lies in its cross-sector focus, its focus on applied solutions, and its ability to generate operational outputs such as roadmaps, working groups, and shared projects, aligned with regional and European strategies. Bioeconomy Dialogues address emerging issues and translate them into concrete opportunities for industry, acting as a bridge between research, business, and policy. By bringing together industry, research organisations, and public institutions around priority themes in circular bioeconomy and green chemistry, the initiative provides a recurring mechanism for identifying needs, aligning capabilities, and initiating collaborations. The format typically combines institutional opening sessions, strategic keynotes, technical sessions, roundtables and dedicated networking and matchmaking moments, with an emphasis on applied solutions and follow-up trajectories. Over time, it has mobilised more than 500 operators[231] through networking and matchmaking activities, supporting the formation of partnerships and the development of follow-up project trajectories.

Beyond the regional dimension within its cluster-led cooperation, LGCA also acts as an **interregional coordination node**, linking Lombardy's ecosystem to wider EU networks and cooperation platforms. For instance, since 2016, LGCA has served as technical coordinator of the **Vanguard Initiative's Bioeconomy Pilot**[232], which connects industry and academia across EU regions to support the scaling and deployment of pilot plants and bio-based innovations. The pilot is reported to have mobilised more than EUR 70 million in public-private investments. Moreover, Regione Lombardia signed a cooperation agreement in Barcelona in November 2025 with Catalonia[233]. The agreement foresees joint working groups involving regional administrations, industry associations and innovation actors, as well as two annual bilateral meetings alternating between Milan and Barcelona. Shared priorities are identified each year, such as training, research, sustainability and coordinated action towards EU institutions. Its interregional role is complemented by LGCA's **participation in EU-funded collaborative project**s, where it contributes either as a coordinator or as a project partner, translating strategic priorities into operational tools, pilots and cross-border learning mechanisms. This role is supported by LGCA's internal capacity in European project design and partnership-building, which can help member organisations identify relevant calls, form consortia and prepare project proposals, particularly where SMEs have limited internal resources for EU project participation.

[231] Confindustria Lombardia (2024).

[232] The VI brings together 35 regions interested interregional cooperations connecting regional strengths to European priorities. Additional information could be found at the following link.

[233] Additional information on the cooperation between Lombardy and Catalonia can be found at the following link.

Box 22: Examples of EU-funded projects involving LGCA

SYMBIO, a **Horizon Europe project** coordinated by LGCA (EUR 1.3 million)[234], develops practical tools and methods to help regions build bio-based business models that are circular by design and based on industrial symbiosis, where one actor's by-products, residues or energy become inputs for another. The approach is being tested in 12 pilot regions across six EU countries (Italy, Austria, Slovenia, Croatia, Spain and Belgium). A key added value is its AI-enabled interregional modelling, which helps identify scalable, repeatable exchange patterns beyond one-off partnerships, creating a shared collaboration space that supports efficiency gains and accelerates the diffusion of sustainable practices across regional industrial ecosystems.

In DIVERSE[235] (*Integration of bioDIVERSity conservation within bioEnergy production for a low-carbon energy mix in the Alpine region*), LGCA participates as a partner within a **transnational cooperation project co-financed by Interreg Alpine Space 2021-2027**. DIVERSE addresses trade-offs between bioenergy production and biodiversity conservation, supporting Alpine regions in integrating EU sustainability and biodiversity criteria into bioenergy policies and practices. It develops and tests two bioenergy value chains based on agricultural and forestry residues through Focus Labs and an open dialogue approach that links local biomass availability, end use and sustainable value creation. The overall budget is EUR 2,809,781.

Other EU and interregional projects[236] include initiatives that generate replicable tools and stable networks (for example, RuralBioUp and ARDIA-Net), strengthen "living lab" approaches and value-chain activation in the Alpine macro-region (for example, Forest EcoValue), and support bioeconomy community and market development through cluster-to-cluster cooperation (such as the HempClub project).

Lessons learnt

Over time, LGCA has significantly contributed to the growth of green chemistry in Lombardy, strengthening the regional ecosystem, increasing business

[234] Additional information about the SYMBIO project can be found at the following link.
[235] Additional information about the DIVERSE project can be found at the following link.
[236] Additional information on the projects implemented by LGCA can be found at the following link.

participation in EU projects, and promoting new bio-based supply chains. Through its activities, **the cluster has played a key role in improving the chemical sector's competitiveness and resilience**, while supporting regional companies in transitioning to more sustainable and innovative production models.

The LGCA is an important **policy coordination initiative that connects actors across the chemical value chain and supports innovation and green investments**. Its experience shows that cooperation among private, local and regional actors is key to enhancing the competitiveness, resilience and low-carbon transition of the chemicals industry. This approach combines an overview of the regional chemical structure with a focus on policy instruments. As a regional coordination platform, the LGCA plays a **key role in facilitating dialogue between actors** and supporting sustainability transitions, innovation and internationalisation. It also facilitates participation in interregional projects linked to smart specialisation and green chemistry.

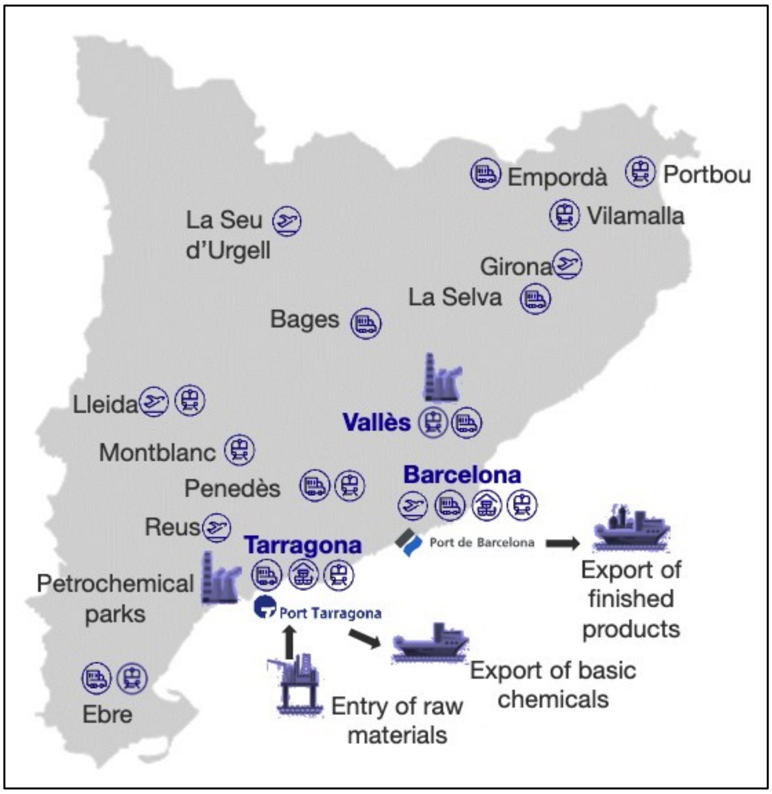
To fully seize the opportunities offered by chemistry and biochemistry for regional development, in line with EU initiatives such as the European Chemicals Industry Action Plan and the Critical Chemicals Alliance, it is essential to strengthen support for industrial scale-ups, energy infrastructure, and market-enabling tools for sustainable products. In this context, the support provided by LGCA is **instrumental in continuing investment in skills, innovation, and public-private cooperation. These efforts** enhance the role of regions as drivers of Europe's industrial transition and consolidate Lombardy’s position as a hub of excellence in green chemistry and the bioeconomy.

ChemMed in Tarragona - Spain

Overview of the sector

Spain's chemicals industry is a major national sector, accounting for 6.1% of GDP, and generating EUR 82.5 billion in turnover in 2023. It employs approximately 233,000 people directly and supports a further 792,000 indirect jobs[237]. Production is geographically concentrated, with Catalonia accounting for 41.4% of the national chemical output, making it Spain's leading chemical hub and a leading European destination for foreign investment in chemicals and plastics[238]. Catalonia hosts three major chemical hubs that leverage the region's highly developed intermodal logistics hub.

Figure 52: The intermodal logistics and the three chemical clusters in Catalonia



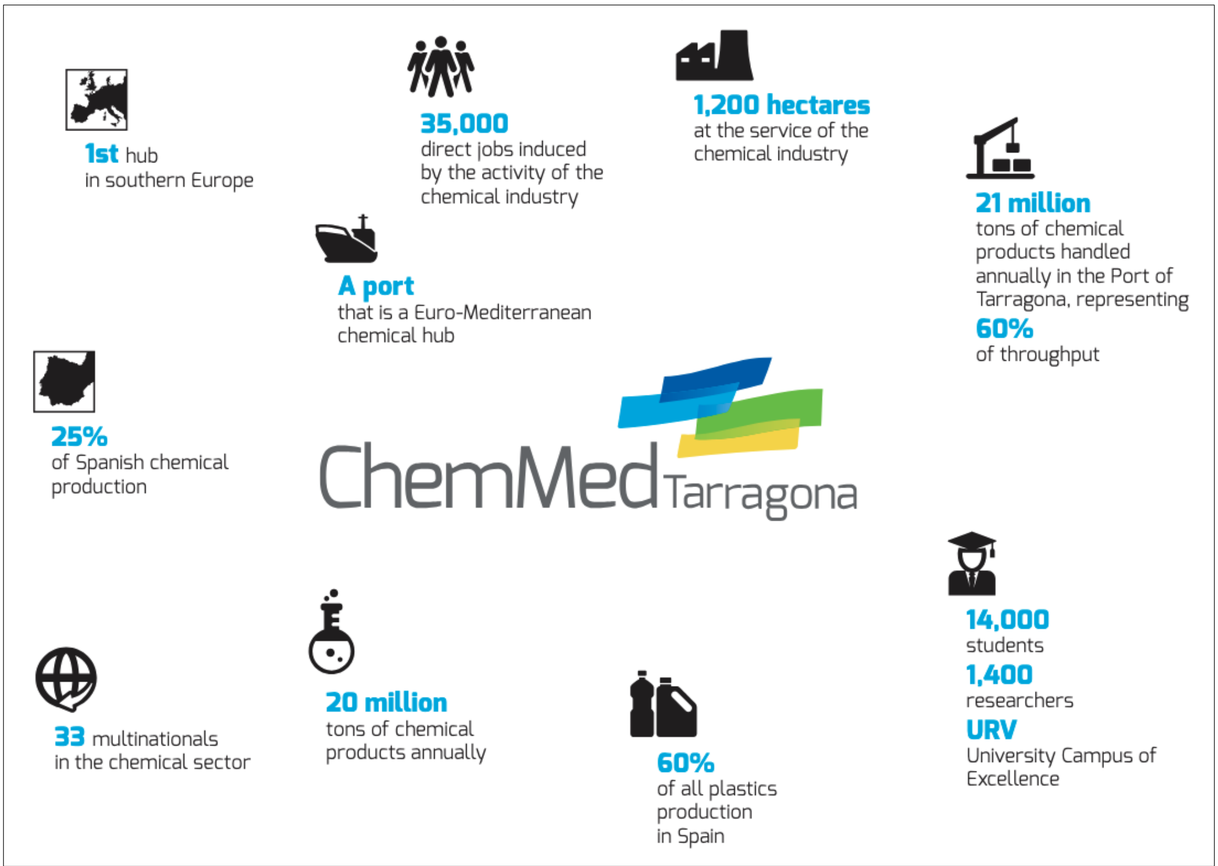
Source: *Reproduced from ACCIÓ (2023), p.23*

The region is, in fact, home to two of the Mediterranean's main ports (Barcelona and Tarragona), as well as high-speed train stations and several airports. These are dedicated to different segments of the chemicals industry and provide services to chemical companies. The three major chemical hubs include Tarragona, which is primarily engaged in the production of basic chemical products, petrochemicals, and polymers; Vallès which focuses on the production of specialised chemical products, detergents, paints, and fertilizers; and Barcelona, which, in addition to being the capital and a hub for corporate headquarters and sales offices, hosts intermediate chemical production plants for cosmetics, personal hygiene products, and pharmaceuticals.

[237] CEFIC, *Landscape of the European Chemical Industry – Spain*, on-line.
[238] More information available here.

Tarragona has one of the largest petrochemical clusters in Southern Europe, ChemMed Tarragona, producing around 25% of Spain's chemical output[239]. The site produces approximately 21 million tonnes of chemical products annually and provides approximately 35,000 jobs directly related to the activities of the chemicals industry. It facilitates the import and export of chemical materials across the Mediterranean and North Africa, and concentrates partners and potential suppliers within the chemical, energy and resource sectors. **The cluster brings together 34 member companies and is anchored by the Port of Tarragona**, which spans across 1 200 hectares, handling roughly 21 million tonnes of chemical products per year, and accounting for about 60% of Spain's plastics production. It also offers several hectares of available land for further industrial investment. Owing to the cluster activities, 67,8% of the Port of Tarragona's business comes from the petrochemical sector, while the chemicals industry accounts for 53.2% of all regional exports.

Figure 53: The ChemMed Tarragona cluster in figures



Source: reproduced from the ChemMed (2024), p.9.

Description of the strategy

The ChemMed Tarragona cluster (Mediterranean Chemical Cluster) was established in 2014 as a transversal group led by the Chemical Business

[239] ChemMed (2024).

Association of Tarragona (AEQT) and its six associates, the Port of Tarragona and AITASA[240]. In total, **the cluster brings together around thirty production companies and some one hundred support and service businesses**. It also includes approximately thirty public and private organisations, including administrations, universities and research centres[241], as well as socio-economic entities (Chambers of Commerce, Cepta, Pimec, trade unions). ChemMed Tarragona, therefore, serves as a collaborative forum for the entire Camp de Tarragona and its six key institutional stakeholders. By integrating industrial, logistics, academic and research functions, it aims to position the petrochemical industry as a strategic pillar for the territory's progress and development.

Of particular interest is **the cluster's multi-level governance structure, which includes representation from national, regional and local authorities.** This includes the Spanish government, the Government of Catalonia, the Tarragona Regional Council, and the 13 municipalities connected with the region's chemicals industry. Through coordinated governance and shared infrastructure, the cluster creates favourable conditions for investment, particularly in relation to decarbonisation and circular economy initiatives[242].

Infrastructure and investment readiness

The investment attractiveness of ChemMed Tarragona is underpinned by its consolidated framework of shared services and industrial infrastructure[243]. These facilities are designed to serve multiple operators within the cluster and facilitate new industrial settlements.

One enabling factor is the **availability of common utilities and industrial connectivity**. Cluster operators benefit from integrated water and steam distribution systems, as well as from pipeline infrastructure that connects companies to one another and to port facilities, supporting efficient flows of inputs and outputs. The cluster ecosystem also provides a range of shared services for employees and operational continuity, including catering and workplace services, as well as dedicated arrangements for health surveillance and safety management.

Safety and emergency response capacity constitute an additional component of investment readiness. The cluster features specialised safety and emergency services, including a dedicated fire brigade and chemical safety parks, intended to strengthen prevention, preparedness, and response capacity in an industrial context characterised by complex risk profiles.

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[240] Additional information about the Chemical Business Association of Tarragona could be found at the following link.

[241] Rovira i Virgili University, a Campus of International Excellence; CTQ (Centre for Chemical Technology), ICIQ (Catalan Institute for Chemical Research), as well as specialised dual-track vocational training institutes.

[242] Additional information on decarbonisation and circularity initiatives can be found at the following link.

[243] Additional information on ChemMed infrastructures can be found at the following link.

A second enabling factor is the **integration of logistics and land availability**. The Port of Tarragona plays a central role in the cluster's value chain, with chemical products accounting for a substantial share of throughput. The cluster also reports the availability of around 350 hectares for new industrial investment, providing scope for expansion and new project pipelines. In addition, the development of the Logistics Activity Zone (ZAL), covering around 100 hectares with road and rail connections, strengthens intermodality and improves access to container terminals. This infrastructure supports a range of logistics and distribution activities linked to chemical and downstream production.

Strategic orientation and transition priorities

The cluster's strategic orientation is articulated in the ChemMed strategic plan 2024-2027[244], which aims to strengthen the cluster's position and its capacity to deliver collective benefits to the territory. The strategy is structured around four pillars: image and reputation, regional development, climate neutrality, and institutional relations.

Two pillars are particularly relevant for the cluster's investment narrative. The regional development pillar focuses on promoting growth, resilience, and cohesion among associated companies based in the region; this includes identifying investment opportunities, supporting synergies, and reinforcing collective assets. The institutional relations pillar complements this by strengthening the cluster's intermediary function between firms and institutions, while facilitating knowledge transfer and coordination related to climate-neutrality objectives.

Key initiatives

Several initiatives have been implemented through a collaborative approach in areas such as safety, sustainability and training. For instance, the **joint management of industrial wastewater** demonstrates how local chemical companies have cooperated to leverage synergies. Through AITASA, the chemical sector manages a 44 km network of industrial wastewater and a 14 km network of chlorinated water, facilitating the growing use of recycled water. Moreover, companies in the sector have jointly built a **sewage outlet pipe**, improving discharge management. This system includes a network of indicators providing real-time monitoring and a comprehensive analysis of the marine environment. Additionally, Dixquimics Rack is a **shared pipeline** connecting various petrochemical companies to one another and the Port of Tarragona, ensuring efficient and fluid movement of raw materials and products. This piping infrastructure has increased the competitiveness of Tarragona's industrial parks by enhancing their safety and lowering their environmental impact through a

[244] ChemMed and CoEnable Consulting (2023).

considerable reduction in road transport. Finally, the **Chemical Safety Parks** are corporate fire departments, jointly established by the chemical companies, and trained and specialised to respond to chemical emergencies.

Recent investment activity in ChemMed Cluster Tarragona illustrates how a chemical cluster can **attract large-scale industrial investment while supporting green objectives.** In 2025, Repsol announced a EUR 150 million investment in its Tarragona chemical complex[245]. This initiative will support a new operational cycle for the site, focusing on CO_2 emission reduction, circularity and digitalisation, thereby aligning existing industrial assets with longer-term transition objectives.

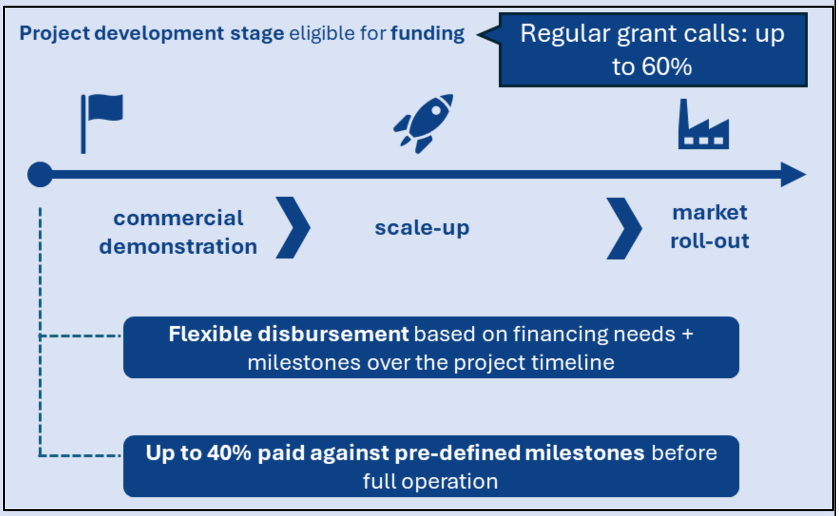
The cluster has also attracted substantial investment in hydrogen-related infrastructure[246]. In 2022, a EUR 230 million project was announced involving Messer, Repsol, and IQOXE for the design and construction of Spain's largest electrolyser, with an initial capacity of 150 MW.

In addition, product-level upgrading has been supported through investments such as Repsol's 2022 initiative[247] in advanced polyethylene production, which allocated EUR 35 million to manufacturing cross-linkable polyethylene for cable insulation applications.

Box 23: Innovation Fund as a key EU instrument to support decarbonisation

The Innovation Fund is a key EU instrument that supports decarbonisation projects in energy-intensive industries, including chemicals, by backing the commercial demonstration and scale-up of highly innovative clean technologies that deliver substantial greenhouse gas reductions. The Fund is financed by revenues from auctioning allowances under the EU Emissions Trading System, with estimated resources of around EUR 40 billion

Figure 54: Key features of the EU Innovation fund



Note: it is also possible to participate under competitive bidding procedure (auctions), applicants bid for the minimum support required; the framework allows support up to 100% of relevant costs, with payments defined by the auction design.

[245] Information on Respol's investment in the Terragon complex is available at the following link.
[246] Information on hydrogen investments is available at the following link.
[247] Information on Respol's product-level upgrading investment is available at the following link.

over 2020-2030. Support is awarded at the EU level through regular calls for proposals (grants) and, increasingly, competitive bidding procedures (auctions), with implementation handled by CINEA on behalf of the European Commission. The Fund also contributes to blending with other EU instruments, notably via the EU-Catalyst partnership under InvestEU, and it offers Project Development Assistance delivered by the EIB.

Within this cluster, and building on its shared infrastructure, logistics capacity and coordinated governance, Repsol, in partnership with Enerkem, is implementing the Ecoplanta Molecular Solutions project, supported by the EU Innovation Fund.[248]

The Ecoplanta Molecular Solutions project will convert around 400,000 tonnes non-recyclable municipal solid waste into approximately 240,000 tonnes of renewable methanol per year. The initiative is a clear example of direct Union finding aligned with local needs, as it addresses both circular economy and energy transition objectives[249]. The project combines an EU grant of EUR 106.4 million with substantial private investment of EUR 800 million and is expected to deliver 3.4 MtCO_2e in emission reductions over its first ten years.

Lessons learnt

From a place-based perspective, the ChemMed Cluster illustrates how **cluster-level coordination with national, regional and local authorities can reduce transaction costs for companies,** strengthen the visibility of the industrial location, and create a structured interface between firms and institutions. This combination is particularly relevant when investment decisions depend not only on firm-level competitiveness but also on access to infrastructure.

This case study illustrates how **effective cluster governance and shared infrastructure can attract and enable large-scale green industrial investments**. The cluster's governance capacity plays a key role in channelling investments, identifying opportunities, promoting the region as an industrial location, connecting with potential investors, and supporting the settlement of companies interested in investing in the chemical sector. This is consistent with the logic of place-based industrial organisation, where investment attraction is supported not only through individual projects but also through the collective structuring of enabling conditions.

The ChemMed Cluster is also a **concrete example of how EU de-risking finance**, through the Innovation Fund, can complement private CAPEX to support first-of-a-kind circular and low-carbon technologies within an established industrial ecosystem. As such, it offers transferable lessons for regions seeking to

[248] World Economic Forum (2025), *Ecoplanta: A first-of-a-kind (FOAK) waste-to-methanol project (Repsol)*, online.
[249] European Commission (2022) and Repsol (2025).

align place-based industrial strategies with EU-level financial instruments to accelerate the green transition.

Annex II – Survey results

This stakeholder survey should be interpreted as a qualitative snapshot rather than a statistically robust instrument. The number of responses is limited (14 organisations), and not all respondents answered every question, so the findings cannot be used to quantitatively infer sector-wide trends. Nevertheless, the survey provides useful directional evidence on recurring concerns, perceived pressures, and policy expectations among chemical-sector stakeholders across different EU contexts.

The respondents include:

- **9 business associations** (including two public entities representing the chemical sector) and **4 private companies**.
- Business associations represent **national perspectives** from **Estonia**, **Czech Republic**, **Italy, the Netherlands**, **Portugal**, **Romania** and **Sweden** plus **two region-specific associations** focused on the **Ústí region** in the Czech Republic and the **Sicily region** in Italy.
- Companies are based in **France, Germany**, **Italy**, and **the Netherlands**.
- **1 regional authority** from **France** (Région Grand Est).

Overview of the sector

Respondents were asked to rate challenges on a 1–5 scale (5 = most important). Responses converge more on competitiveness- and transition-related pressures, especially cost factors. The highest-rated challenges (>4) are:

- increasing prices of key inputs, especially energy and related feedstocks (mean rating: 4.8/5);
- high costs of adapting production processes to sustainability requirements, including investment needs, technological changes, and compliance-related adjustments (4.7/5);
- international competitive pressure from non-EU producers and global markets (4.6/5).

Further perceived challenges relate to the pressure to comply with EU regulations (4.3/5), to the difficulties in accessing or entering new markets (3.9/5) and to the high costs of adopting and implementing new technologies (3.8/5)[250]. The weak cooperation/networking with research institutes and universities has the lowest rate (2.4/5). Four respondents identified other significant challenges (5/5): 'lack of demand for European made sustainable products', 'lack of protection of

[250] Other answers include: Lack of financial resources for investment: (3.5); Lack of support from the EU (3.5); Lack of public support from regional or national government (3.3); Lack or unavailability of skilled workers (3.2); Lack of supply chain resilience (3.1); Unavailability of critical raw materials and feedstock (2.8).

European producers', 'cost of ETS' and 'bureaucracy and administrative burdens'.

Respondents were also asked which challenges have increased the most in recent years. The price, cost and competitiveness pressures are most frequently cited as having intensified over the last five years.

Knowledge of existing national/regional strategies

When asked about the existence of regional/national strategies, five respondents indicated 'yes', six indicated 'no', and three 'I don't know'. Four cited examples of public national/regional initiatives targeting chemical sector and related industrial transformation needs are:

• **Germany**: the GRW Sonderprogramm "Raffineriestandorte und Häfen", described as supporting specific refinery and port locations affected by the EU embargo on Russian crude oil. It provides grant funding for company investments, infrastructure, and non-investment measures aimed at enhancing site competitiveness and supporting transformation.

• **Czech Republic (Ústí region):** reference to the S3 (Smart Specialisation Strategy) and the Just Transition transformation plan, explicitly targeting the chemical sector at the regional level. Within the Czech RIS3/S3 framework, the Ústí nad Labem regional RIS3 explicitly includes organic and inorganic chemistry as a thematic priority area (CZNACE 20.x) and refers to an established regional chemical-industry platform.

• **France (Normandy region):** the regional strategic bioeconomy roadmap (Stratégie Bioéconomie Normande, 2023–2025) sets out a coordinated action programme to develop five priority value chains, including bio-based chemistry, alongside plant proteins, natural fibres, the blue bioeconomy, and bioenergy. It builds on territorial diagnostics and a stakeholder consultation process ("États généraux") carried out in 2022. The roadmap combines coordination measures (a regional portal, mapping of actors, and a planned biomass observatory to track resources) with more operational actions to help projects move from concept to implementation, including building partnerships, structuring project pipelines, and supporting industrial scale-up in the region.

• **Italy:** reference to the recent European Commission approval (December 2025) of a EUR 1.5 billion Italian State aid scheme to support strategic investments that expand manufacturing capacity for clean technologies (cleantech), in line with the objectives of the Clean Industrial Deal. The scheme, co-financed by the Recovery and Resilience Fund, was approved under the Clean Industrial Deal State Aid Framework (CISAF), adopted on 25 June 2025. It aims to support investments in the production of net-zero technologies and their main components, as listed in Annex II of the CISAF. Aid will be provided in the form of grants, subsidised loans, or a combination of both. The measure will be available to companies across Italy and will run until 31 December 2030.

What stakeholders expect from strategies or public support for the chemical sector

When asked what a strategy, plan, or public support framework should deliver, responses converge around a “competitiveness-first transition” logic. Answers include:

• **A coordinated, long-term competitiveness framework** for a focused and aligned public–private approach to preserve competitiveness and avoid relocations, with the explicit objective of maintaining chemical production at the national level and within the EU.

• Requests for **financial and legislative support** to meet compliance and transition requirements. Mentioned instruments include tax credits and investment incentives, alongside training, industrial relations, and innovation support measures.

• Support for **decarbonisation, R&D and innovation, and workforce development** (training and capacity-building). The need for skills policies is mentioned again later in an answer as a “missing piece” at EU level.

Views on the EU Chemical Industry Action Plan

Ten out twelve respondents were aware that the European Commission launched the Action Plan in July 2025. Respondents scored each pillar of Action Plan separately on a 1–5 scale (5 = highest importance). This captures the absolute perceived relevance of each pillar and allows respondents to rate multiple pillars as equally important.

• **Affordable energy and decarbonisation:** swift implementation of measures to reduce high energy and feedstock costs (4.4/5).

• **Lead markets and innovation:** fiscal incentives and tax measures to boost demand for clean chemicals (4.2/5).

Close behind, respondents also emphasise:

• **Reducing compliance costs and administrative burden:** the sixth simplification omnibus, while maintaining health and environmental protection (3.9/5).

• **Resilience and a level playing field:** establishing a Critical Chemical Alliance and using trade defence instruments (3.8/5).

The action rated as least important relative to others concerns PFAS actions (3.1/5).

Respondents then ranked the pillars from highest to lowest priority, taking current sector challenges into account. This captures relative priorities, highlighting which actions stakeholders would prioritise if sequencing or resource allocation were required. The ranking again most frequently places affordable energy first, followed by resilience and a level playing field, and then lead markets and innovation. Simplification to reduce compliance and administrative burden follows, while PFAS actions are ranked last.

What stakeholders see as missing from the Action Plan

The main responses from stakeholders, when asked what they consider missing from the Action Plan, are as follows.

• **Deeper regulatory simplification and implementation consistency** – Stakeholders call for the simplification of REACH and the Classification, Labelling and Packaging (CLP) Regulation, and raise concerns about EU-only strictness in hazard classification approaches. There are also calls to address the ETS and carbon leakage sooner, as well as concerns that CBAM is not fit for purpose for exporters.

• **Skills** – A clearer and stronger reference to skills within the Action Plan is requested, covering reskilling and upskilling, as well as new skills needed for the green transition.

• **An EU-wide "level playing field" approach, especially regarding State aid** – A major concern is that many measures are implemented at Member State level, which can create distortions through different degrees of "gold-plating" in transposition and very different State aid capacities across countries.

One respondent illustrates this disparity by citing examples of very large compensation schemes in larger economies compared with far smaller support in countries with more limited public budgets, stressing that energy can account for 40–60% of OPEX in parts of the sector. The request is for stronger EU-level rules and caps (or a more harmonised approach) to avoid discretionary national divergences that distort competition within the Single Market.

Critical Chemical Alliance: expected influence

When asked about the influence that the Critical Chemical Alliance should have, stakeholders broadly expect it to play a meaningful role in delivering swift, concrete action to protect critical clusters and preserve EU production, potentially strengthening the sector's bargaining position. At the same time, it is emphasised that it should not create new distortions between countries or within the sector. It should act as an enabling instrument focused on competitiveness, resilience, and innovation, rather than adding constraints.

EU funding mechanisms: perceived effectiveness and what needs to change

Respondents were asked to assess how current EU funding mechanisms are effective in supporting the competitiveness and sustainability of the chemical sector. The average response indicates that effectiveness is relatively low (2.3/5). When asked to explain the reasons, the following points were highlighted:

• **Insufficient funding volume** and a lack of earmarked calls tailored to chemical competitiveness needs.

• **High complexity**, slow procedures, and heavy conditionality and administrative burden.

• **A mismatch with sector characteristics**: chemical investments are often CAPEX-intensive, energy-intensive, long-cycle, and concentrated in large sites and companies, and therefore often do not fit funding eligibility patterns designed around SMEs.

• **Unequal availability of State aid across Member States**, reinforcing level playing field concerns.

One respondent underlined that **EU funding mechanisms are currently highly effective at supporting innovation and de-risking, but they struggle to address industrial scale-up and high operational costs**. EU funds are well suited to financing new machinery and capital investments, but they do little to offset the high costs of energy and feedstocks. Moreover, for the respondent, funding for critical raw materials and chemical precursors is fragmented across too many directorates, reducing its overall impact. In addition, only a small proportion of cohesion policy funds provided as loans is being reinvested into new projects, and the expected "multiplier effect" is lower than originally planned.

One respondent considered EU **funding to be highly effective**, stressing in particular that these mechanisms typically require transnational collaboration between businesses, research centres, universities and public authorities. Such **collaborations accelerate development by pooling skills, infrastructure and financial resources**. They also strengthen the integration of the European market, contributing to more resilient, competitive and sustainable industrial ecosystems.

When respondents were asked how to improve the effectiveness of EU support, the two most frequent suggestions were to simplify access to EU financial support and to strengthen coordination between EU, national, and regional or local institutions. Several respondents also called for increased funding volumes and greater flexibility in State aid rules. One respondent underlined the need to increase the involvement of sector stakeholders in EU policy design. Another respondent added that stronger competitiveness outcomes would result from prioritising research and innovation enablers over additional regulatory layers. In this view, a simpler and more predictable framework, aligned with better regulation principles, would improve investment conditions, while stressing that the integrity of the Single Market should remain a core EU priority.

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ISBN 978-92-895-4018-6
DOI:10.2863/0619354

QG-01-26-004-EN-N

Publications Office
of the European Union

European Committee
of the Regions

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