Indian chemical industry: Enablers to make India a growth hub for chemicals

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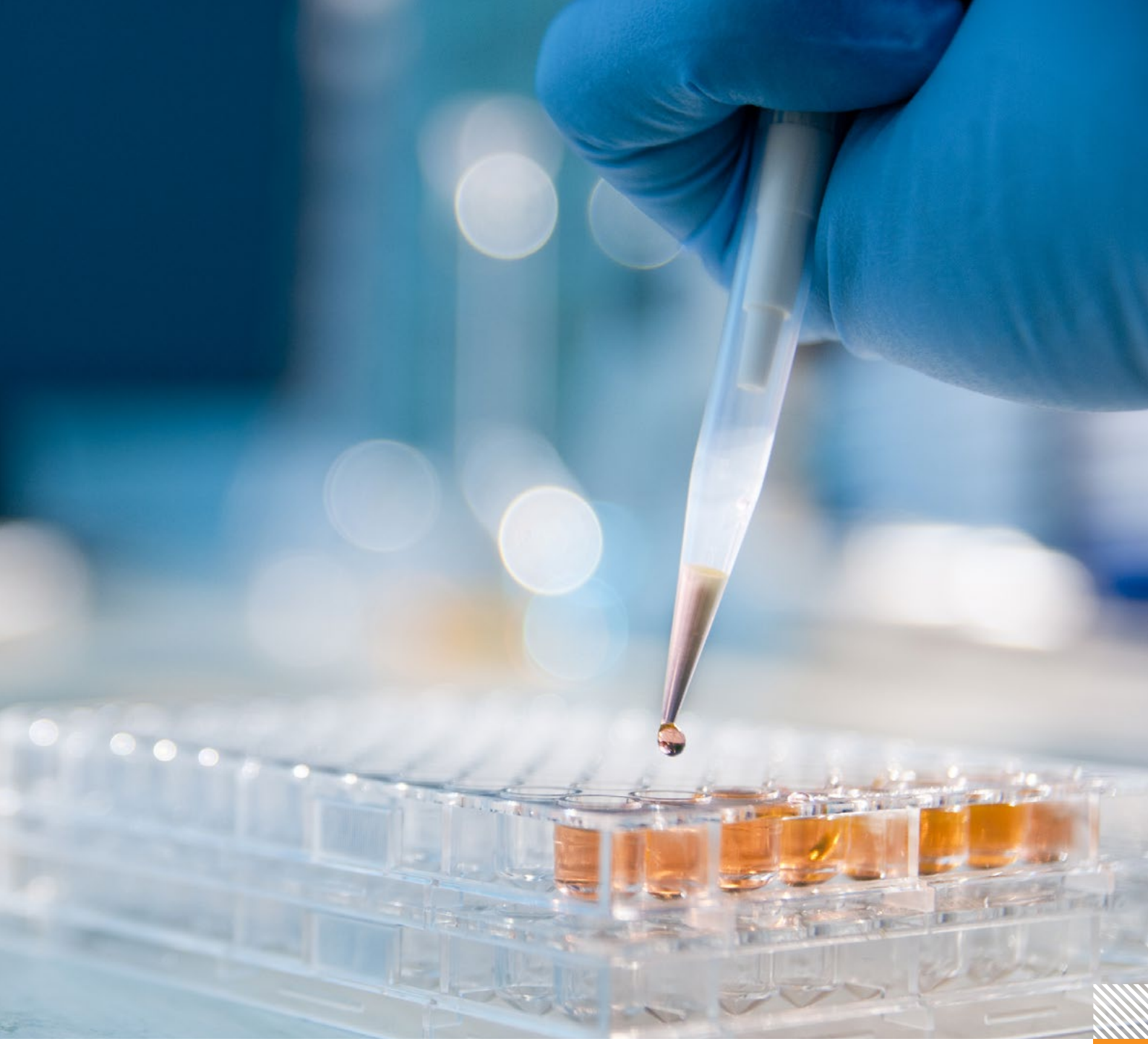

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Foreword by ASSOCHAM

Manish Singhal
Secretary General
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The Indian chemical and petrochemical sector stands at the threshold of a transformative era and is poised to emerge as a global manufacturing hub. India's speciality chemicals segment, which plays a pivotal role in various critical industries, is at the heart of this transformation.

Given the rapid growth, coupled with increasing government support, India is positioned to become a prominent figure in the global specialty chemicals value chain. The country's extensive investment in core R&D, alongside its growing manufacturing capacity, allows India to deliver high-quality products at competitive prices. The growth of India's specialty chemicals industry is aided by several market forces. With approximately 20%[1] of the total chemical market in India, the specialty chemicals sector has been a major driver of growth in India's chemical industry. Specialty chemical sector has witnessed enhanced growth due to the recent shift in global markets and global players looking for new markets along with the increase in domestic consumption.

However, the chemical industry is also at a crucial juncture in its sustainability journey. While other sectors have made considerable strides in committing to net-zero emissions, the chemical industry has a significant opportunity to bridge this gap. India, with its unique mix of government initiatives, vast talent pool and access to raw materials can lead this transition, leveraging innovation, technology and policy support. The government's commitment to improving the ease of doing business and enhancing trade competitiveness can further mitigate these challenges and offer a comprehensive environment which is conducive for the sustainable growth of the industry.

The rapid growth of the Indian specialty chemical sector in inevitable. However, companies need to be agile to adapt quickly to the evolving macroeconomic and industry landscape to ensure transformative growth in near future. Focus on customer value creation, through product differentiation, improved customer collaboration and building resilient supply chains supported by higher investment in R&D and digital landscape is vital.

Access to reliable and competitive feedstock, power, logistics infrastructure and safety standards remain critical factors. Additionally, addressing geo-economic trade challenges will be crucial in cementing India's role as a preferred destination for global investments in the specialty chemical sector.

Being an apex chamber of commerce and industry, ASSOCHAM fosters the interest of the Indian Industry. Through its National Council on Chemicals and Petrochemicals, ASSOCHAM is working with central and state governments and, advocating for affable policies which promotes industry growth and competitiveness.

The **ASSOCHAM's India speciality chemicals conclave: Enablers to make India a sustainable speciality chemicals hub** is a vital platform for discussing the roadmap to realise India's full potential as a global centre for speciality chemicals. I hope this conclave will provide a platform to bring together all the stakeholders to collaborate, innovate and adapt to the evolving landscape of the chemical industry, as we move towards achieving sustainable growth of the chemicals industry.

I wish the best to all the participants of the conclave.

1 https://www.indianchemicalnews.com/opinion/specialty-chemicals-the-next-sunshine-industry-m-p-aggarwal-promoter-sajjan-india-13822

Foreword by PwC

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Partner – Oil and Gas
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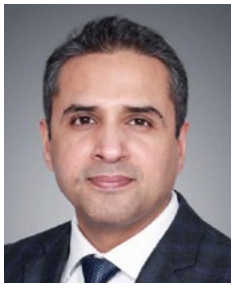

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Managing Director –
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PwC India

India's chemical and specialty chemicals industry stands at a pivotal juncture. The specialty chemical sector in India accounts for nearly 20%[2] of the total chemicals and petrochemicals market in India and plays a significant role in India's economic progress. It also helps the country in contributing to the global market by offering products across various segments including pharma intermediates and APIs, agrochemicals, construction chemicals, dyes and pigments and textile chemicals. Investments into the energy and semiconductor industries will further drive the demand for high purity specialty chemicals and gases.

India's chemical sector has set an ambitious goal to reach 1 USD trillion by 2040.[3] Achieving this goal will not only elevate the industry in India's economy but also bolster India's position in the global market. However, the Indian specialty chemicals industry constantly faces challenges related to high import dependency, price volatility of raw materials, supply chain disruptions and delivery delays resulting in tough competition from the global players. To navigate these challenges, the report discusses some of the key enablers which could help propel the Indian chemical industry forward:

- **Adaptive international trade strategy:** By leveraging trade agreements, managing export subsidies and understanding import tariffs, Indian companies can mitigate risks and seize global opportunities.
- **Building performance excellence:** Focusing on key functions such as manufacturing operations, supply chain, procurement and research and development (R&D) could help companies achieve process excellence.
- **Collaboration for innovation and skill development:** Industry-academia partnerships and emerging technologies can significantly enhance R&D capabilities and foster the holistic growth of the sector.

Together, these can provide a strategic framework for growth and help the Indian chemical industry become a key contributor in the global market.

PwC India and ASSOCHAM have developed this knowledge paper to discuss the key enablers which can make India a growth hub for chemicals. We hope that you find the report to be informative and insightful.

2 https://www.indianchemicalnews.com/opinion/specialty-chemicals-the-next-sunshine-industry-m-p-aggarwal-promoter-sajjan-india-13822

3 https://economictimes.indiatimes.com/industry/indl-goods/svs/petrochem/indias-petrochemical-sector-to-grow-over-three-fold-to-usd-1-trillion-by-2040-hardeep-puri/articleshow/115020200.cms?from=mdr

Foreword by ASSOCHAM

Sagar Kaushik
Chairman
ASSOCHAM National Council on Chemicals and Petrochemicals

India's specialty chemicals sector is the backbone of numerous industries such as pharmaceuticals, agrochemicals, textiles, electronics and renewable energy.

Over the past five years, the Indian specialty chemicals industry has witnessed revolutionary expansion due to an increase in domestic consumption, overseas opportunities and favourable government policies. The shift of the market from a low-cost chemical manufacturer to becoming an important player in the global specialty chemicals space is testimony to the industry's flexibility and resilience. Through increasing investments in innovation, sustainable production and developing a skilled workforce, the specialty chemicals market in India has the potential to reach new heights and becoming a critical part of the global chemistry supply chain.

What is particularly encouraging is how the sector is thinking about the future. There is a strong shift toward sustainable manufacturing, green chemistry and digital transformation. Across the value chain, companies are investing in cleaner technologies, better efficiency and innovative R&D not just to stay competitive but to lead responsibly.

I am sure **ASSOCHAM's India speciality chemicals conclave 2025: Enablers to make India a sustainable speciality chemicals hub** will empower the industry to address its concerns and grab various opportunities for growth, innovation and making a positive societal impact while focusing on their environmental, social and governance (ESG) goals.

This joint report by ASSOCHAM and PwC India aims to depict the latest insights, perspectives and forward-looking strategies which reflect the dynamism of the sector. The paper is the result of meaningful collaboration among stakeholders who are committed to seeing India emerge as a global hub for specialty chemicals in terms of scale, quality, sustainability and innovation.

As we come together to be a part of the India Specialty Chemicals Conclave 2025, I hope this paper will reflect our progress and a roadmap for what's ahead.

1 Introduction

1.1. Catalysing India's chemical and specialty chemical industry

The Indian chemical and specialty chemicals industry is poised for significant growth. However, the sector is facing numerous challenges pertaining to increasing commoditisation which impacts profit margins and necessitates continuous innovation to maintain competitive differentiation. Additionally, the recent reciprocal tariffs by the US have introduced new complexities, impacting cost structures and global competitiveness of Indian chemical exports. These tariffs may create a ripple effect, exacerbating supply chain disruptions and increasing input costs. Amidst these challenges, the Indian special chemicals industry ought to navigate a rapidly evolving global market, leveraging its emerging enablers to sustain its growth trajectory and enhance its resilience.

India's chemical industry is an important contributor to the country's manufacturing sector, being the sixth-largest producer worldwide and the third-largest producer in Asia. This dynamic sector contributes significantly to India's gross domestic product (GDP), playing a vital role with a 7% contribution in the country's economy. The industry encompasses a wide range of product from bulk and commodity chemicals to specialty chemicals.

Figure 1: An overview of the Indian chemical industry

Sixth-largest chemical producer in world	**Third**-largest chemical producer in Asia
Expected to grow at a CAGR of **11-12%** by 2027	**Fourth**-largest agrochemical producer in world
Share of GVA in manufacturing sector for India is **9.88%** at current prices	**>80,000** products
More than **2 million** employees	Ranks **ninth** in exports and **sixth** in imports at global level (excluding pharmaceuticals)

Source: https://www.ibef.org/industry/chemical-industry-india

1.2. Growth opportunities in Indian specialty chemicals industry

The Indian specialty chemicals market accounts for about 22%[4] of India's total chemicals and petrochemicals market which was valued at USD 220 billion in 2023.[5] The Indian specialty chemicals industry plays a pivotal role in the country's economic progress. The industry comprises multiple sub-segments like dyes and pigments, agrochemicals and textile chemicals among others, based on end-use industry application. Each sub-segment within the specialty chemicals sector is characterised by unique trends, significant investments and promising growth rates over the next five years.

Table 1: Growth opportunities in the specialty chemicals industry segments

Segment	Key trends and investment (from 2022–25)
Dyes and pigments	• **Key trends:** India is a global leader in dye manufacturing, contributing 16–18% of global dyestuff exports and supplying dyes to over 90 countries. In FY 2023–24, pigment emulsions and dyes were amongst the top five products to be exported, contributing to INR 5,831 crore and INR 4,634 crore respectively.[6] • **Investments:** Indian companies are entering into joint ventures (JV) and mergers and acquisitions (M&A) to expand portfolios – e.g. a major pigment player acquired a leading global manufacturer of pigments, and another player entered a JV with leading UK-based manufacturers of pigment colour.
Agrochemicals	• **Key trends:** India is the second-largest exporter of agrochemicals globally, with approximately 50% of its production being exported which highlights the significant role of the country's contribution in international markets.[7] • **Investments:** Indian agrochemical companies are actively acquiring and investing in AgTech startups. For instance, a major fertiliser and agrochemical producer in India has acquired a stake robotics and automation company.
Home and personal care chemicals	• **Key trends:** Due to the increase in the hygiene awareness and personal care products in metro and Tier-1 cities, the demand for the personal care specialty chemicals is growing rapidly. • **Investments:** Companies are investing heavily to expand their capacities. For instance, a home and personal care chemical player and India's leading providers of oleochemicals, surfactants, specialty chemicals are investing in capacity expansion activities.

4 https://www.indianchemicalnews.com/opinion/specialty-chemicals-the-next-sunshine-industry-m-p-aggarwal-promoter-sajjan-india-13822

5 https://economictimes.indiatimes.com/industry/indl-goods/svs/chem-/-fertilisers/indias-chemicals-market-to-hit-29-7-bn-in-2024-set-for-steady-growth-with-3-26-cagr-through-2029/articleshow/110418837.cms?from=mdr

6 IBEF report

7 Ibid.

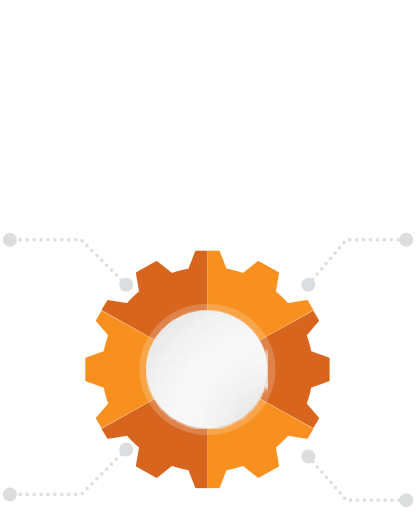
Segment	Key trends and investment (from 2022–25)
Textile chemicals	• **Key trends:** India is a top exporter of textiles and apparel, with the textile industry consuming majority of dyes. • **Investments:** Indian companies are investing to expand the manufacturing facility and one of the Indian players plans to increase its specialty chemicals capacity.
Water treatment chemicals	• **Key trends:** The water treatment chemicals market in India is experiencing significant growth due to rapid industrialisation in the country. • **Investments:** Companies are looking to diversify their portfolio into other segments. For instance, a major water treatment chemical company has invested a large sum for various expansion projects.
Construction chemicals	• **Key trends:** Indian construction chemicals include admixtures, adhesives and sealants, flooring and waterproofing agents, and protective coatings. These products enhance construction quality and durability. • **Investments:** A Germany based construction solutions company is setting up its operations in India.
Flavours and fragrances	• **Key trends:** India holds a significant market share in specific segments of natural ingredients, particularly in spice oleoresins and mint extracts within the flavours and fragrances (F&F) market. • **Investments:** Indian companies in the F&F segment are entering into JV to find synergies between different end-use industries. For instance, a German chemical company which is a major producer of F&F is planning a JV for expanding the portfolio of market-leading cosmetic active ingredients.
Others	• **Key trends:** Pharma intermediates and APIs, EV battery chemicals, electronic chemicals, polymer additives and other chemicals are growing significantly. • **Investments:** Indian companies in carbon black industry are venturing into these adjacencies to capture the market share by investments and acquisitions. For example, a carbon black company has acquired an Indian company to venture into specialty chemicals.

Source: PwC analysis

2 Key challenges

Despite its robust growth, the Indian specialty chemicals industry faces numerous challenges such as high raw material prices, supply chain disruptions, product commoditisation and a shortage of skilled talent. The figure below provides a detailed look at these challenges and how they impact the industry.

Figure 2: Challenges faced by Indian specialty chemicals industry



01

High import dependency and price volatility of raw materials in specialty chemical production

India is highly dependent on import of raw materials. This volatility impacts profitability and makes budget planning more difficult.

02

Supply chain disruptions and delivery delays

Factors like fluctuating demand, geopolitical issues or logistical inefficiencies are recurring challenges in the specialty chemicals scenario inside India. Such delays lead to production halts, cost overruns and unmet commitments.

04

Regulatory and sustainability concerns

Specialty chemicals industry in India faces complex regulatory challenges, including environmental standards and safety compliance, which hinder product development and increase operational costs.

03

Talent shortage

There is a lack of skilled technical expertise such as R&D personnel and workers with expertise in chemical processes, automation, which hampers innovation and operational efficiency.

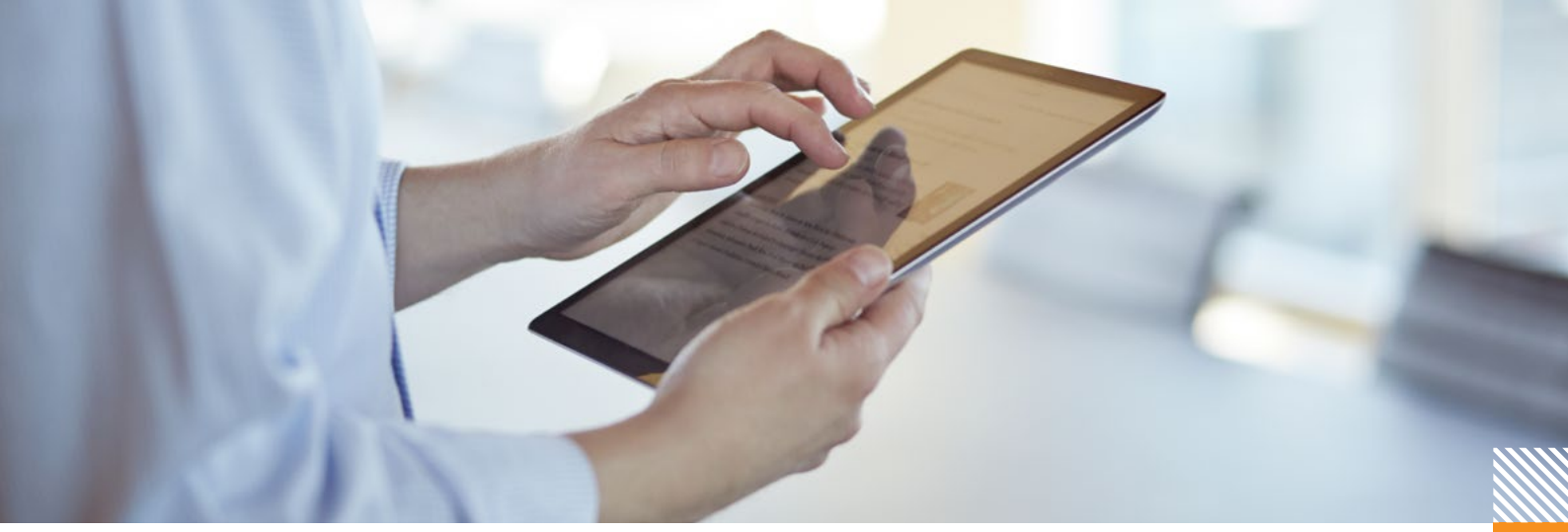
Source: PwC analysis

1. Import dependency and price volatility of raw materials

Fluctuations in global crude oil prices and logistics costs have a direct impact on input prices. For building blocks such as C1 (methanol), C2 (ethylene), C3 (propylene) and C7 (toluene), India does not have sufficient feedstock to meet its downstream requirements. The limited availability of ethylene and propylene in the merchant market forces India to rely on imports for intermediates and end products derived from these chemicals. Additionally, the pricing cycles for several chemical commodities have shortened to monthly, or even weekly intervals, posing immediate challenges to profitability and potentially altering the industry's structure in the long term.

India relies heavily on import of key raw materials, especially petrochemical intermediates, which affects the prices of specialty chemicals. Since the cost of raw materials accounts for 40% to 60% of the total price, Indian manufacturers have limited ability to control prices or handle market changes effectively. In contrast, emerging economies are mostly self-sufficient due to strong backward integration which reduces price shocks with support from government subsidies and large-scale production while developed economies like the US and countries in the EU benefit from plentiful natural resources, long-term agreements and local sourcing, helping them avoid major impacts from global price fluctuations.[8]

8 PwC analysis



2. Global supply chain disruptions

Recent global geopolitical conflicts have caused widespread supply chain disruptions, weak global demand and introduction of new trade tariffs. Despite India's strong domestic demand, there has been muted export growth, primarily due to shipping delays and input shortages during these crises.

Indian manufacturers are experiencing increasing lead times and rising freight costs, which are adversly impacting their profitability. These challenges make it difficult for them to maintain optimal financial performance and cost-effectiveness. In comparison, regions with more advanced logistical infrastructure and well-organised supply chains manage these issues more efficiently which reduces the impact of such disruptions on business operations and profitability. Similarly, some regions which have diversified sourcing strategies and strong local production capabilities have manged to minimise disruptions in trade flow.

3. Lack of skilled workforce

Specialty chemicals industry requires specialised skills and expertise. The gap between industry needs and the curriculum offered by educational institutions contribute significantly to the shortage of skilled workforce. Number of chemical engineering students are relatively low in comparison to other engineering streams in India and this talent shortage is evident from the GATE 2024 statistics. Only **13,937 students** appeared for the **Chemical Engineering** paper, in contrast to 1,23,967 candidates who took the **Computer Science and Information Technology** exam which was nearly **10 times more**.[9]

While India has a long way to overcome the scarcity of specialised educational programmes to compensate for the skills shortage, some emerging economies have significantly expanded their technical education base over the past decade. Meanwhile, developed economies are successful in attracting global talent through substantial research funding and robust collaborations between academia and industry.

4. Regulatory concerns

India recently introduced regulations with its first-ever platform ChemIndia, towards the implementation of Chemical Management and Safety Rules for tracking chemicals produced, used and imported. Despite this advancement, the applications and bureaucratic processes for these regulations are lengthy, rigorous and complex, and there is currently no provision for mutual recognition agreements with international partners. In contrast, some emerging economies have established well-organised regulatory systems requiring centralised approval for chemical ingredients. Meanwhile, developed economies have regulatory agencies such as Environmental Protection Agency (EPA) ensuring that new chemicals are reviewed for safety before entering the market.

To overcome these challenges, strategic initiatives to enhance supply chain resilience, investing in digitalisation, implementing targeted skill development programmes and reforming regulatory processes need to be introduced. The following section outlines the strategies that can directly or indirectly address these challenges, helping companies enhance their operational efficiency and maintain a competitive edge in the global market.

9 https://gate2024.iisc.ac.in/wp-content/uploads/2024/06/GATE2024StatisticalAndPerformanceReportWebVersion2.pdf, PwC analysis

3 Key enablers for India's specialty chemicals industry

To address the challenges faced by the Indian specialty chemicals industry, there are three key enablers which can drive the industry forward:

Adaptive international trade strategy

India aspires to achieve a target of USD 1 trillion merchandise exports by FY30 of which specialty chemicals will play a major part.[10] Developing adaptive international trade strategies, including leveraging trade agreements and navigating export subsidies and import tariffs, can help companies mitigate external risks and capitalise on global market opportunities. Strengthening global trade relations and adopting sustainable practices can further enhance the Indian specialty chemical, industry's competitiveness.

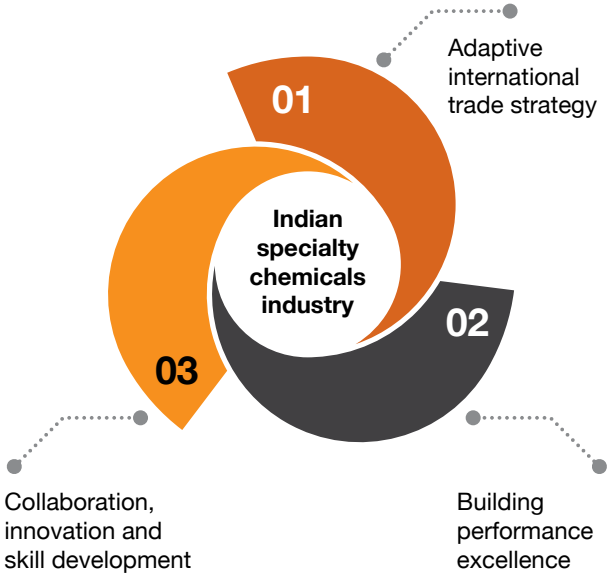
Building performance excellence

Focusing on process excellence through digital-led operations and supply chain transformation and the adoption of digital tools in other functions such as R&D can help industries achieve excellence. Building functional excellence across the organisation, especially through digital and analytics-based performance improvements, Indian specialty chemicals companies can significantly boost profitability.

Collaboration for innovation and skill development

Embracing innovative models such as industry-academia collaborations and leveraging emerging technologies, can significantly enhance R&D capabilities. These models foster a dynamic ecosystem of collaboration and innovation, enabling companies to stay ahead in a competitive market.

Figure 3: Enablers for the growth of the specialty chemicals industry in India



Source: PwC analysis

10 https://www.pwc.in/viksit.html

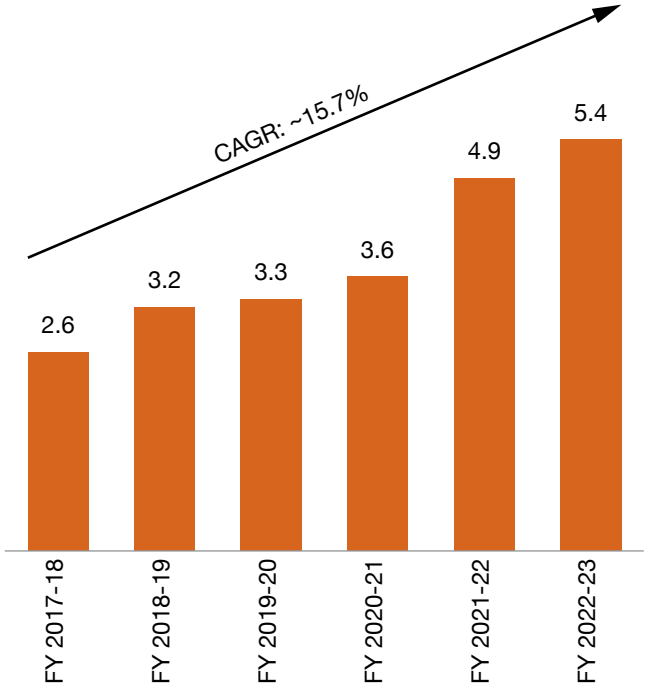
3.1. Adaptive international trade strategy

3.1.1. Export subsidies and their impact

India's aspirations to become a global hub for specialty chemicals depends on the support provided by a robust policy ecosystem. In the past, export subsidies have served as a crucial lever, enabling domestic manufacturers to compete in global markets. Over the past decade, a set of schemes – Remission of Duties and Taxes on Exported Products (RoDTEP), Export Promotion Capital Goods (EPCG) scheme and benefits for Special Economic Zones (SEZs) and export-oriented units (EOUs) have provided Indian chemical exporters with fiscal relief and logistical advantages. These schemes have aimed to offset indirect taxes, lower capital investment costs and promote scale by incentivising export-linked production.

The Indian chemical industry is expected to further grow at a CAGR of 11–12% by 2027, increasing India's share in the global specialty chemicals market from 3% currently to 4% by 2027. With specialty chemicals accounting for **more than 50% of total chemical exports from India**,[11] Indian specialty chemicals companies are expanding their capacities to cater to the rising demand from both domestic and overseas markets.

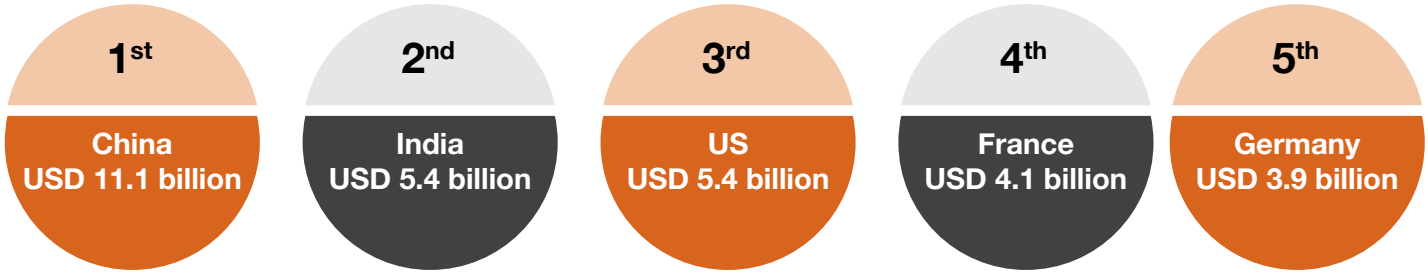
Figure 4: India agrochemical exports (USD billion)



Source: https://www.indianchemicalnews.com/chemical/indian-agrochem-exports-higher-at-us-54-billion-in-2022-23-ccfi-17516

The specialty chemicals segment, which includes high-value low-volume products such as agrochemicals, dyes and pigments, pharmaceutical intermediates have particularly benefited from these export incentives. Several Indian companies have effectively utilised these schemes to strengthen their global positioning. Among the specialty chemicals sub-segments, India has emerged as the second-largest exporter for agrochemicals in the world. Since FY 2018, in the last six years, India's export of agrochemicals has grown at a CAGR of ~16% to reach a value of USD ~5.4 billion[12] in FY 2022–23.

Figure 5: Top agrochemicals export countries (USD billion)[13]



Source: https://www.indianchemicalnews.com/chemical/india-becomes-2nd-largest-exporter-of-agrochemicals-18280

One of the most important measures for exporters has been the RoDTEP scheme, introduced in 2021. By reimbursing exporters for taxes and duties incurred during the manufacturing and distribution of exported goods, the scheme has helped specialty chemicals manufacturers maintain cost competitiveness during a time of inflated raw material prices and logistics disruptions.

The SEZ and EOU frameworks have further enhanced the operational flexibility of exporters. Companies operating within SEZ benefit from tax exemptions on raw materials and capital goods. In FY 2023–24, export-oriented agrochemical companies in India achieved significant growth in global market sales. However, they face the dual challenges of price pressure and changes in the international trade environment, making the phenomenon of weak prices a major challenge to their profitability.[14]

11 https://www.indianchemicalnews.com/assets/compendium_assets/Compendium_2024.pdf

12 https://www.indianchemicalnews.com/chemical/indian-agrochem-exports-higher-at-us-54-billion-in-2022-23-ccfi-17516

13 https://www.indianchemicalnews.com/chemical/india-becomes-2nd-largest-exporter-of-agrochemicals-18280

14 https://news.agropages.com/News/NewsDetail---51582.htm

When benchmarked against other global chemical manufacturing hubs, India's export subsidy ecosystem still has plenty of ground to cover. Emerging economies supports chemical exporters through a more integrated model which includes direct financial incentives, R&D grants, local government subsidies, and tailored export support including trade insurance and innovation linked incentives. India's export benefits tend to be generic and often miss the specific needs of the specialty chemicals segment, where companies deal with high compliance costs, complex logistics and product registration challenges in foreign markets.

This gap in strategic export support becomes even more significant when viewed in light of recent global trade developments. In 2018, the US's section 301 tariffs, for instance, reshaped the global specialty chemicals trade, with the US imposing duties with average of ~18% on a wide range of Chinese goods,[15] including agrochemicals and pharmaceutical intermediates. Initially, this presented a strategic opportunity for Indian exporters to capture market share in the US. However, as of 2 April 2025, the US has implemented a flat 26% and 34% reciprocal tariff on all Indian and Chinese exporters[16] respectively. While pharmaceutical exports have been exempted, the Indian specialty chemicals sector now faces higher effective tariffs due to the reciprocal tariffs proposed by the US. This underscores a critical need for India to not only reform its export incentives framework but also to align it with global trade and bilateral tariff structures.

A key concern within the industry is the limited policy differentiation for specialty chemicals segments, which requires high R&D investment and sustainability compliance. Furthermore, as sustainability and ESG benchmarks gain traction in global trade, export incentives in India remain largely carbon neutral. There is an emerging opportunity to evolve these schemes to align with green export mandates, including advantages for products that meet lifecycle emission benchmarks, or are certified under organisation or the forum of large, medium and small chemical companies.

To maximise impact, India's export subsidy framework could evolve toward a more focused approach. This could include performance-linked export incentives for high value specialty products, faster digital processing of claims via a single platform, and a strategic push for export readiness among micro, small and medium enterprises (MSMEs).

Export subsidies have been instrumental in enabling India's rise in the global specialty chemicals market; however, there is still room for tapping its full potential. With global dynamics shifting towards green trade and premium product sourcing, India must recalibrate its export promotion schemes. Well-targeted, digitally accessible and sustainably aligned export incentives can help transform subsidies from a cost-offset mechanism into a growth multiplier for the Indian specialty chemicals segment.

15 https://www.uschina.org/articles/trump-announces-new-and-expansive-reciprocal-tariffs/ https://www.thehindu.com/news/international/donald-trump-announces-26-discounted-reciprocal-tariff-on-india/article69405714.ece

16 https://www.moneycontrol.com/news/business/economy/dgtr-imposes-anti-dumping-duty-on-imports-of-acetonitrile-from-china-russia-taiwan-12974428.html

3.1.2. Import tariffs and remedies

While export subsidies have played a pivotal role in enabling the Indian specialty chemicals manufacturers to compete globally, India's trade competitiveness cannot rest on outbound policy levers alone. A robust and balanced chemicals ecosystem also depends on how imports are regulated, taxed and strategically managed.

The ability of Indian companies to fulfill the growing global demand for specialty chemicals hinges on timely and cost-effective access to imported raw materials, intermediates and equipment. This makes India's import tariff structure and trade remedies an important element of the country's chemicals sector strategy. India currently maintains a differentiated tariff structure for various categories. Certain raw materials attract lower duties to support domestic manufacturing, while certain finished products are taxed higher to encourage import substitution.

The overall chemical import in India is expected to grow significantly in the next ten years. However, within the overall chemical imports, the specialty chemicals segment is expected to decrease in the coming years. While these imports often fill gaps in capacity or technology, they also expose Indian manufacturers to price pressure and supply chain risks. In some sub-segments, particularly where global competitors are supported by domestic subsidies or have lower environmental costs, Indian companies have faced significant margin reduction.

India has proactively used trade remedies such as anti-dumping duties (ADDs), countervailing duties (CVDs) and safeguard measures. These remedies have provided relief in cases involving chemicals like titanium dioxide TR-33 by imposing an anti-dumping duty of between USD 461 to USD 681/MT to protect domestic producers from lower priced imports. An anti-dumping duty was also imposed on acetonitrile[17] that is equal to the lesser margin of dumping and the margin of injury to protect the domestic manufacturers from competitive imports. Companies that have benefited from such actions have reported improved domestic sales and better pricing power post-intervention.

India's current approach towards import tariffs and trade remedies could establish a strong foundation for the sector's growth. However, looking ahead, India's import tariff and trade remedy ecosystem must evolve with strategic refinement and proactive industry engagement to support the industry's growth ambitions.

3.1.3. Global trade relationships

India is emerging as a significant player in the global specialty chemicals market, driven by its robust manufacturing capabilities and cost-competitive workforce. With increasing demand from agricultural and pharmaceutical industries among others, India is enhancing its global trade presence with an aim to capture a larger share of the specialty chemicals market. In the dynamic global trade landscape, robust and strategic trade agreements are crucial, as they open up international markets and encourage collaborative innovation. India has signed 13 free trade agreements (FTAs) in the last five years with its trading partners, including the India-Mauritius Comprehensive Economic Corporation and Partnership Agreement (CECPA),[18] India-UAE Comprehensive Partnership Agreement[19] (CEPA – in effect from May 2022), and India-Australia Economic Cooperation and Trade Agreement[20] (India Australia ECTA – in effect from 29 December 2022). At present, India is negotiating FTAs with several regions and nations.

India has actively engaged in negotiating and finalising a series of significant FTAs aimed at bolstering its trade and investment relationships across the globe. Key agreements include the Trade and Economic Partnership Agreement (TEPA) with the EFTA trade bloc and the ASEAN-India Free Trade Area (AIFTA), which have improved market access and encouraged economic cooperation with both developed and regional economies. AIFTA taps into a vast market of over 1.9 billion people with a combined GDP of USD 4.8 trillion, establishing tariff liberalisation on over 90% of products.[21] Other notable FTAs include the India-Japan Comprehensive Economic Partnership Agreement (CEPA) and the India-UAE CEPA, both designed to promote collaboration and eliminate tariffs on significant product categories including petrochemical and chemical products and pharmaceuticals among others.

Looking ahead, India's strategic focus on negotiating FTAs with the UK, Canada and the EU underscores its commitment to leveraging trade and sustainable development to foster economic growth. Projections indicate that these agreements, particularly the anticipated FTA with the UK, could significantly increase bilateral trade and contribute positively to India's GDP. Additionally, India's engagement in preferential trade agreements (PTAs) aims to lower tariffs and facilitate technology transfers, reinforcing its position as an attractive destination for foreign investment. Overall, these initiatives illustrate India's proactive approach to enhancing its role in global trade dynamics and achieving long-term economic resilience.

17 https://www.moneycontrol.com/news/business/economy/dgtr-imposes-anti-dumping-duty-on-imports-of-acetonitrile-from-china-russia-taiwan-12974428.html

18 https://www.commerce.gov.in/international-trade/trade-agreements/india-mauritius-cecpa/

19 https://www.commerce.gov.in/international-trade/trade-agreements/comprehensive-economic-partnership-agreement-between-the-government-of-the-republic-of-india-and-the-government-of-the-united-arab-emirates-uae/

20 https://www.commerce.gov.in/international-trade/trade-agreements/ind-aus-ecta/

21 https://www.aseanbriefing.com/news/aseans-free-trade-agreements-an-overview/

Figure 6: Challenges and enablers for India's global trade relationships

Challenges	Enablers
Current FTAs favour counterparties more than India: India's imports from FTA partners have grown at a much higher rate than exports as export tariffs from India are higher than those of its partnering countries.	• India is in a better position to negotiate trade agreements and revise the FTAs to ensure that they offer Indian exporters meaningful subsidies and efficient access to foreign markets, thus leveling the playing field.
India's focus on commodity and bulk chemicals: Major Indian companies have been continuously investing in commodity and bulk chemicals such as ethylene, soda, ash, aniline and phenol where there is already a surplus supply in global markets.	• By focusing R&D on innovative and downstream products, India can create a more robust chemical sector that not only meets domestic demand but also captures global markets.
Limited infrastructure capabilities: Other South-East Asian countries have better infrastructure compared to India which makes India less competitive in comparison to chemical prices from other Asian chemical manufacturers and restricts FDI inflow to India.	• Investment in infrastructure is crucial, as the current lack of chemical parks compared to neighbouring countries hampers India's ability to attract multinational companies.
Reciprocal tariffs from the US: The US has imposed 26% duty on Indian chemicals (excluding pharmaceuticals). This will raise the cost of Indian chemical exports to the US, potentially reducing the demand for specialty chemicals and intermediates.	• India can focus on leveraging the higher tariff imposed on competitors like China (54%), Taiwan (32%) and Thailand (36%) by adapting effective pricing strategies. • Negotiate on exemptions in upcoming India-US trade talks.

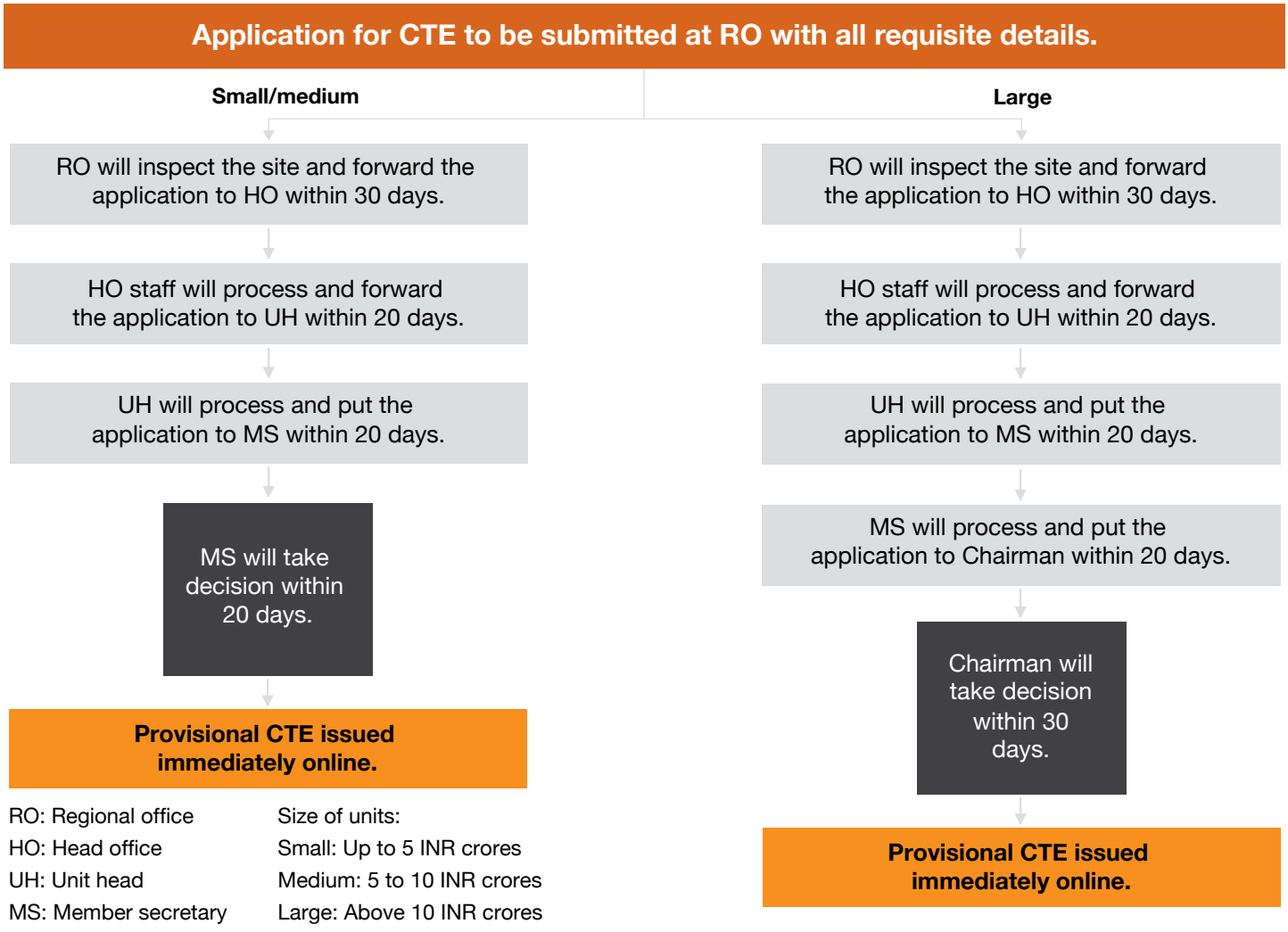
Source: PwC analysis; https://www.outlookbusiness.com/magazine/business/story/fault-in-the-formula-for-indias-chemical-sector-7020

3.1.4. Environmental regulations

Environmental regulations play a vital role in determining the competitiveness and sustainability of the specialty chemicals sector in India. As global markets increasingly move towards sustainability and traceability, aligning the country's environmental framework to clean and responsible production of specialty chemicals is critical.

The regulatory foundation for environmental compliance in India is anchored in the Environmental (Protection) Act, 1986, which grants the Ministry of Environment, Forest and Climate Change (MoEF&CC) the authority to prescribe environmental standards. Manufacturers must also obtain Consent to Establish (CTE) and Consent to Operate (CTO) from State Pollution Control Boards (SPCBs) which assess the pollution load, effluent treatment capabilities, and proximity to sensitive zones. The Central Pollution Control Board (CPCB), in co-ordination with SPCBs, enforces regulatory compliance and emission norms.

Figure 7: Process flow to obtain Consent to Establish (CTE) approval



Source: PwC analysis

Specialty chemicals clusters in Gujarat, Maharashtra and Tamil Nadu often report varying timelines for obtaining clearances, resulting in operational uncertainty. These delays often occur due to procedural bottlenecks, despite operating in notified chemical zones. Speed to market is vital for specialty chemical manufacturers, especially those producing generic agrochemicals and pharmaceutical intermediates. When there is a delay in obtaining the Environmental Clearance report, it can hinder their ability to compete in global markets as they may miss critical windows for launching new products.

Compared to global benchmarks, India's environmental framework lacks the harmonisation and predictability seen in developed chemical hubs. In the EU, the REACH regulation mandates substance-level registration, risk assessment and safe usage guidelines.[22] Indian manufacturers often lack in-house toxicological testing infrastructure leading to dependence on costly third-party certifications. While India has made strides toward a national chemical inventory, the absence of a REACH-like centralised database and pre-registration process hampers transparency for global buyers.

22 https://echa.europa.eu/regulations/reach/understanding-reach#:~:text=REACH%20is%20a%20regulation%20of,substituted%20with%20less%20dangerous%20ones.

With rising global demand for ESG-compliant sourcing, Indian specialty manufacturers have an opportunity to integrate green chemistry principles into their production models. For example, there is growing interest from multinational buyers in biodegradable solvents, low-volatile organic compound (VOC) coatings, water-based emulsifiers and active pharma ingredients (APIs) manufactured through solvent-free synthesis. Certain specialty chemical companies in India have already positioned themselves as leaders in green formulations, with a focus on bio-based feedstocks and eco-friendly processing. Similarly, a biorefinery in India is pioneering the conversion of renewable resources into sustainable chemicals and materials while another Indian company is transforming renewable resources into specialty glycols, esters, surfactants and solvents. These examples illustrate that Indian companies are capable of aligning production with green chemistry principles when supported by policy clarity and market incentives.

India must establish environmental governance to attract greater green capital and FDIs. The Government of India can play a catalytic role by looking at the stringent environmental regulations globally as an opportunity to make Indian specialty manufacturers competitive by offering incentives such as fast-track environmental clearances for units within established chemical parks, capital subsidies for installing zero liquid discharge (ZLD) systems and tax deductions for certified green R&D initiatives. There is also scope for India to invest in shared toxicology and eco-toxicity testing labs within chemical clusters.

Environmental regulations can also become a key enabler. The road ahead lies in bringing policy intent with on-ground execution, harmonising Indian frameworks with global norms, and leveraging sustainability as a growth lever. With clear regulatory signals, infrastructure support and incentive structure, India can turn environmental compliance from a hurdle into a hallmark of competitive advantage in the global specialty chemicals space.

3.1.5. Carbon border adjustments

Building upon the role of domestic environmental regulations, a new and significant external factor influencing the global competitiveness of India's specialty chemicals sector is the rise of carbon related trade policies – particularly Carbon Border Adjustments (CBAs). These policies are set to reshape global trade in energy-intensive sectors, with specialty chemicals being one of the most exposed due to their complex processes and significant carbon footprint.

CBAs are essentially trade mechanisms designed to impose a carbon cost on imported goods based on their embedded emissions. The objective is to level the playing field between domestic industries in countries with strict carbon pricing and foreign producers which have less stringent environmental norms. By doing so, CBAs aim to prevent 'carbon leakage' – a situation where companies

relocate production to countries with lenient climate regulations. Currently, the most advanced CBA initiative globally is the European Union's Carbon Border Adjustment (CBAM)[23] which has already entered its transitional phase. CBAM currently covers sectors such as cement, steel and fertilisers, however, there are ongoing consultations to expand it to include organic chemicals and polymers – both of which are relevant for India's specialty chemical exporters. The US, Canada and the UK have also initiated exploratory work on similar carbon tariffs, with varying degrees of policy maturity.

For India's exporters, the CBAM presents a tangible risk. For example, many mid-size specialty chemicals manufacturers in Gujarat and Maharashtra operate coal-fired boilers to supply consistent energy for batch processing and solvent recovery. As a result, the embedded carbon intensity of products from these manufacturers tends to be significantly higher than similar products from EU-based firms that operate on gas or renewables. Another challenge is the limited adoption of carbon accounting and disclosure frameworks among Indian specialty chemical manufacturers. While some large players have begun reporting Scope 1 and Scope 2 emissions, a majority of small and mid-size companies lack structured carbon tracking systems. Without accurate emissions data, Indian exporters will struggle to comply with the reporting requirements of CBAM or other future carbon tariffs, thereby risking market exclusion or additional duties.

In contrast, European competitors benefit from integrated systems for carbon management, access to renewable power and economies of scale in deploying low-carbon technologies. Specialty chemical manufacturers in Europe have implemented electric steam crackers and low-carbon process routes for value-added chemicals and are also increasingly investing in green hydrogen pilots and circular chemistry platforms. Indian specialty players have begun exploring similar transitions – such as adopting green solvents, bio-based feedstock and solvent-free synthesis, however, progress remains uneven and limited to a few early adopters.

23 https://taxation-customs.ec.europa.eu/carbon-border-adjustment-mechanism_en

The shift towards carbon accountability presents an opportunity for Indian firms to convert compliance to competitiveness. Adopting digital tools for real-time carbon footprint tracking, joining carbon accounting platforms like Carbon Disclosure Project (CDP) or Science Based Targets initiative (SBTi) can help build credibility with global players. Additionally, bilateral FTAs under negotiation with the EU and the UK could include clauses around mutual recognition of carbon measurement frameworks.

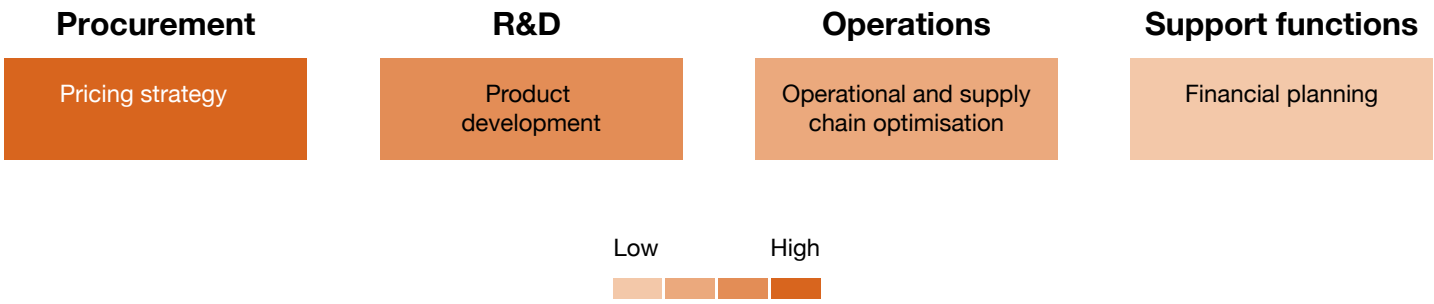
Public policy can also play a crucial role as India could launch a sector specific carbon readiness programme for specialty chemicals which includes technical support, lifecycle assessments (LCAs), capital grants for green energy infrastructure and fast-track environment clearances for units adopting carbon capture or green hydrogen.

Industry associations and export promotion councils should proactively sensitise small and medium players about the complications of CBAM and other emerging carbon measures as without timely intervention, Indian exporters risk losing ground in high-margin, regulation-heavy markets like the EU and Japan.

3.2. Building performance excellence

In the Indian specialty chemicals sector, performance excellence is key to operational efficiency, innovation and sustainable growth. Organisations in the specialty chemical industry are increasingly leveraging digital technologies to enhance process excellence. However, many struggle to meet expectations and fail to deliver anticipated value. A successful digital transformation is driven by value, guided by processes and based on data. The right approach to digital transformation targets values systematically, uses process management as a key enabler and leverages process-related data effectively. Performance excellence can be enhanced through digital intervention at the operations level by leveraging solutions such as predictive maintenance, process modelling, golden batch analytics, energy management system and digital twin.

Figure 8: Digitalisation impact in terms of cost savings

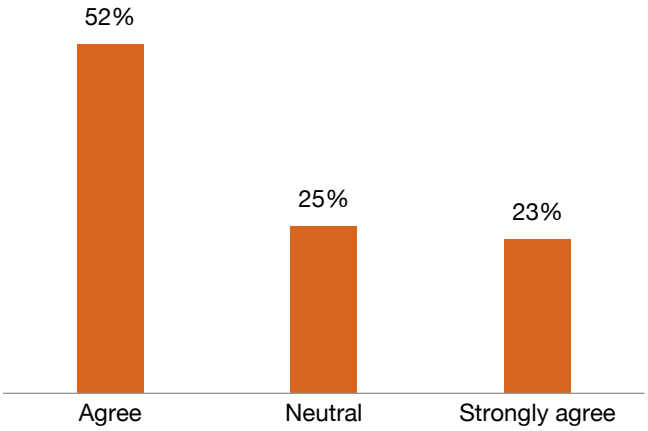


Source: PwC analysis

3.2.1. Digitisation in procurement

According to a recent survey, over 52% of supply chain leaders across various sectors strongly agree that digital transformation is essential for achieving an integrated supply chain. Additionally, more than 54% of industry leaders believe that digital transformation is crucial for enabling end-to-end supply chain partners, including suppliers, logistics and warehousing service providers, and customers.[24]

Figure 9: Digital transformation in supply chain



Source: https://www.pwc.in/assets/pdfs/publications/ceo-survey/2025/28th-annual-global-ceo-survey-india-perspective.pdf

According to PwC's 28th Annual Global CEO survey, Companies have witnessed efficiency gains and increased revenue with the help of generative AI in the last 12 months. However, 51% of Indian CEOs are positive about Generative AI's impact on business profitability, only trust remains an issue.[25]

AI tools are revolutionising procurement by predicting raw material prices, optimising strategies and managing risks through data analysis for accurate forecasts and insights. Indian specialty chemical companies have begun using ERP tool for product pricing, though predicting commoditised raw material prices remains challenging.

Investing in AI tools can significantly enhance forecasting accuracy, leading to substantial cost savings in procurement strategies. Dynamic pricing enables companies to quickly adapt to market fluctuations and adjust pricing strategies based on raw material costs, which constitute over 50% of the product cost. Indian specialty chemical companies are leveraging market intelligence reports to obtain 18-month forecasts on commoditised raw material prices.

Globally, large chemical companies, including joint ventures, have partnered with commodity AI platforms to forecast olefin prices such as ethylene, propylene and butadiene. Such platforms provide these companies with olefin price forecasts to support their market intelligence and enhance feedstock cost management. This integrated approach for digital transformation and AI adoption is crucial for maintaining competitiveness and achieving long-term growth in the specialty chemical industry.

Product prototype development and modelling

Developing robust scientific models of complex chemical interactions has long been a catalyst for innovation in chemistry. With advancements in computing power and software, techniques such as molecular modeling, computational fluid dynamics (CFD), and the Monte Carlo method[26] have become more feasible. Leading global chemical companies are investing in supercomputers to boost their modeling capabilities, resulting in faster product development cycles and more precise applications.

Lab automation

Many tasks in synthesis and application labs, which traditionally depended on skilled technicians, can now be automated. High-throughput screening, once primarily used in drug development and catalyst research, is now being applied to materials science. Robots can perform complex tasks such as formulating and testing paints and adhesives. This automation enables more thorough and cost-effective testing, enhancing data quality and reliability by removing the potential for human error.

24 www.pwc.in/ceosurvey2025

25 www.pwc.in/ceosurvey2025www.pwc.in/ceosurvey2025

26 Simulation model used for predictive analysis

3.2.2. Digitisation in process optimisation

Process optimisation is crucial for improving efficiency, reducing costs and enhancing product quality in the chemical industry. Two key emerging technologies which are driving this optimisation are the process level digital twin and equipment level digital twin. The majority of the global companies foresee that technologies such as digital twin solutions will have an accelerated impact on the supply chains.

Digital twins provide organisations with a virtual representation of physical assets and processes to enable real-time monitoring, simulation and optimisation.

Figure 10: Characteristics and types of digital twins (DT)

Process level DT:

Simulates entire workflows or production processes for comprehensive optimisation, capacity planning, and strategic decision-making.

Unit operation level DT:

Concentrates on unit operations, optimising equipment interactions and process control to boost efficiency and detect faults.

Equipment level DT:

Tracks critical instruments in real-time to identify problems, enhance performance, and support predictive maintenance.

Product level DT:

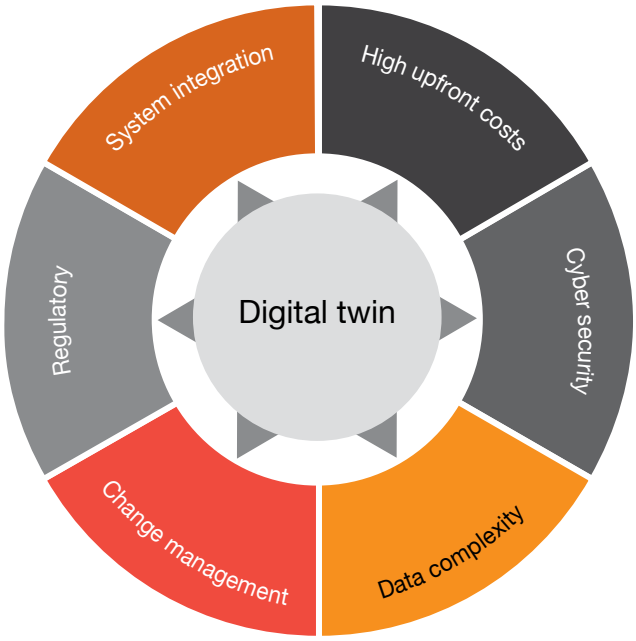
Integrates data on product properties, performs modelling and simulation of product.

Source: PwC analysis

Challenges of implementing digital twins in chemical companies

In the chemical industry, many companies have reported facing multifaceted challenges during the initial stages of adopting digital twins. However, global players have adopted certain strategies which have increased productivity and reduced costs. The implementation of digital twins in companies has followed a structured approach that begins with pilot projects. These trials allowed companies to evaluate and measure their impact on a broader scale, after which they invested in data integration using IoT sensors and analytics tools to gather real-time data. Subsequently, they have developed detailed digital models of their processes and through cross-department collaboration. Optimisation of digital twins based on performance data and user feedback leads to continuous improvement.

Figure 11: Characteristics and types of digital twin



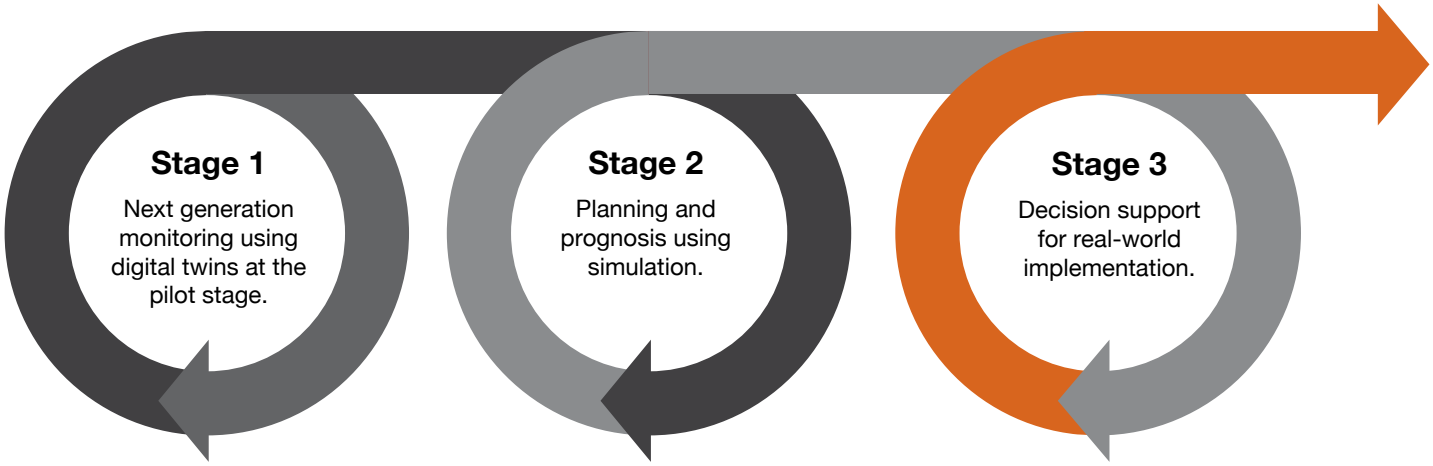
Source: PwC analysis

Case study on digital twins:

Problem statement: A large specialty chemical companies faced challenges with unplanned downtime due to equipment failure or unplanned maintenance, which was leading to significant production losses and thus increased costs and reduced profitability.

Approach:

Figure 12: Stages of digital twin adaption methodology



Source: PwC analysis

Solution:

The company implemented digital twin technology to optimise chemical plant operations. It created digital twins for key equipment's such as reactors, distillation columns and storage tanks. Initially, pilot projects were conducted in specific facilities to validate the effectiveness of the technology before scaling it across their operations.

These digital twins were developed using advanced modelling and simulation techniques, incorporating real-time data from sensors installed throughout the plant. By using advanced data analytics and IoT sensors, real-time data was collected from equipment and processes. The data was then fed into the digital twin models for continuous monitoring and adjustments.

Benefits:

Identify operational inefficiencies: Implementing digital twins in manufacturing helps allowed engineers to model various scenarios, test different parameters such as temperature and pressure and flow rates, and optimise the redesigned process for maximum efficiency and minimal environmental impact before real-world implementation.

Analyse future scenarios: By proactively detecting and averting equipment failures, companies can lower maintenance expenses and extend the operational lifespan of their machinery.

Reduce business risks: The company also leveraged digital twins to redesign its production process with a focus on reducing emissions.

3.3. Collaboration, innovation and skill development

3.3.1. Industry-academia collaboration models

Collaboration between industry and academia promotes creativity and offers specialised answers to problems, which boosts industry growth. Through shared investment in R&D, these collaborations bring academia, business and the government together to align resources and goals, leading to the development of a trained workforce and meeting real-world industry demands.

Innovation and capabilities within the sector can be enhanced by industry-academia collaboration models.[27]

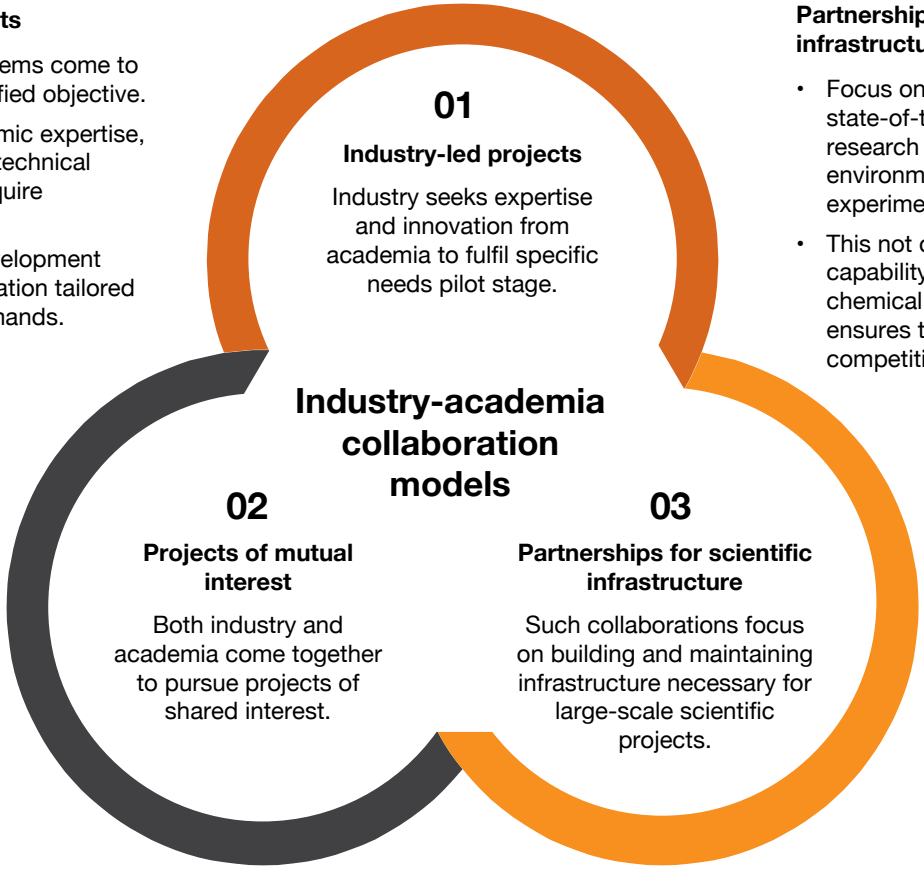
27 https://psa.gov.in/CMS/web/sites/default/files/psa_custom_files/PSA_NOVEMBER%202024%20ISSUE_04%20DECEMBER%202024%20FINAL.pdf

Figure 13: Various industry-academia collaboration models

01

Industry-driven projects

- Industry driven problems come to academia with specified objective.
- By leveraging academic expertise, companies address technical challenges which require innovative solutions.
- Helps in product development and process optimisation tailored to Indian market demands.



03

Partnerships for scientific infrastructure

- Focus on establishing state-of-the-art laboratories and research facilities, fostering an environment ripe for experimentation and discovery.
- This not only enhances the capability of the specialty chemical industry but also ensures that it remains competitive on a global scale.

02

Projects of mutual interest

- Collaborative projects between academia and industry to enhance both educational and practical outcomes.
- For students: Provide valuable hands-on experience, allowing them to apply theoretical knowledge in real-world settings.
- For industries: Benefit from fresh perspectives and innovative ideas.
- This collaboration cultivates a talent pool which is better prepared to meet industry needs, while also enabling companies to identify potential future employees who are well-versed in the latest developments and trends in the sector.

Source: https://psa.gov.in/CMS/web/sites/default/files/psa_custom_files/PSA_NOVEMBER%202024%20ISSUE_04%20DECEMBER%202024%20FINAL.pdf

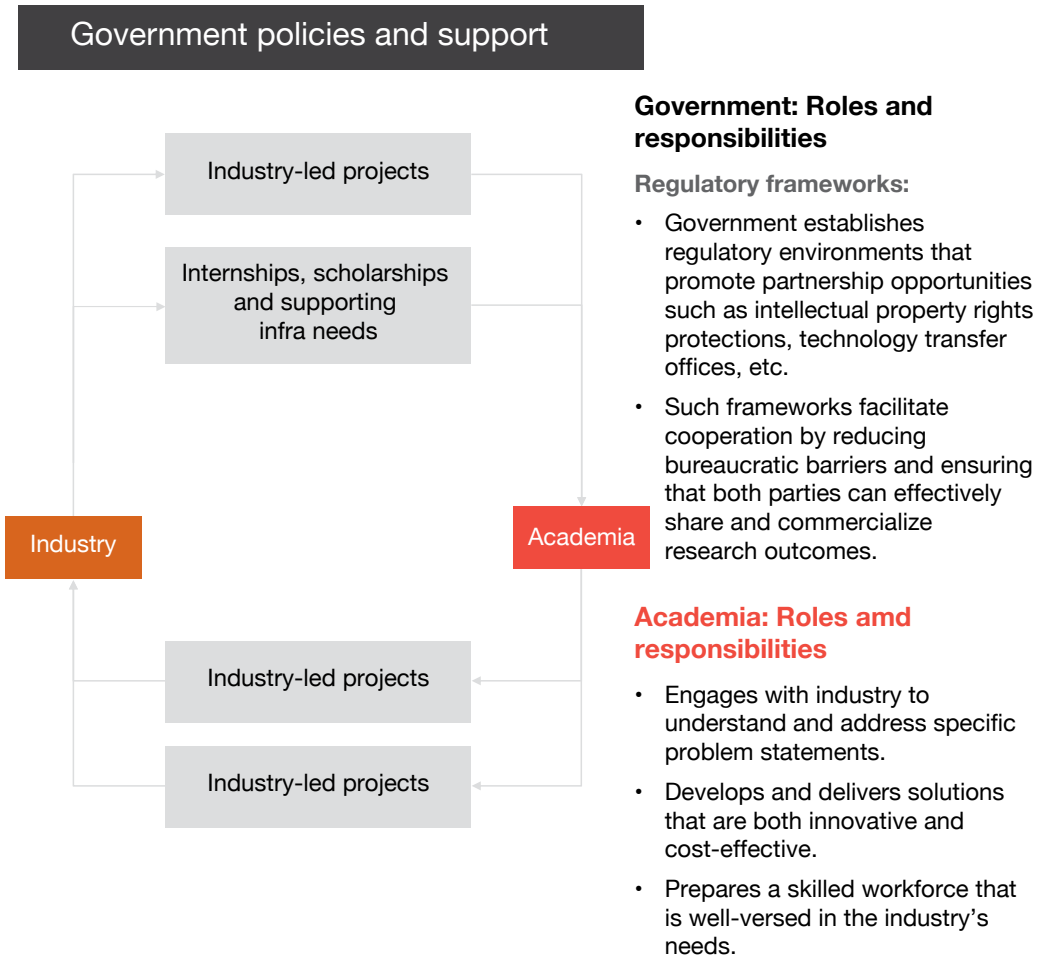
Industry-academia collaboration ecosystem

The delicate balance between industry and academia is critical for the sustained growth of the specialty chemicals sector in India. As a result, the performance and responsiveness of each component of this ecosystem are related to the functionality of the other components.

- The government creates a favourable environment for companies that present academia with evolving challenges, encouraging researchers to come up with innovative ideas.
- This collaboration improves applied learning in which academics create useful solutions to increase productivity and save expenses.
- Industries support this relationship by providing scholarships and internships, enhancing students' education with practical experience and modernising technological lab facilities in educational institutions. As a result, a skilled workforce develops with graduates who are ready to satisfy industrial demands.[28]

28 https://psa.gov.in/CMS/web/sites/default/files/psa_custom_files/PSA_NOVEMBER%202024%20ISSUE_04%20DECEMBER%202024%20FINAL.pdf

Figure 14: Industry-academia collaboration ecosystem: Balance is the key



Source: https://psa.gov.in/CMS/web/sites/default/files/psa_custom_files/PSA_NOVEMBER%202024%20ISSUE_04%20DECEMBER%202024%20FINAL.pdf

Apart from providing funding, incentives and formulating regulatory frameworks, the government plays a crucial role by launching various initiatives to foster seamless collaboration and instilling a culture of innovation within the industry-academia ecosystem. A few such initiatives targeted at the chemical industry are as follows:

Anusandhan National Research Foundation (ANRF):[29]

- ANRF was established by the Anusandhan National Research Foundation Act of 2023 to enhance research and innovation across India's educational and research institutions.
- ANRF aims to foster collaboration among industry, academia, government departments, and research institutions, facilitating active participation from industries and state governments in the scientific research landscape.

Technology Collaboration Portal (TCL) and ChemIndia Portal:[30]

- The Technology Collaboration Portal (TCL) showcases over 1,000 industries and 40 institutions, highlighting advanced technologies from research institutions. It allows industries to access innovations and submit custom technology development requests.
- ChemIndia is a new data-sharing portal that will enhance policy decisions by collecting and analysing industry data, enabling targeted resource allocation and support for the sector.

Apart from these initiatives, the Department of Chemicals and Petrochemicals (DCPC) has also approved the formation of five new centre of excellence (CoEs) which will aim to support MSMEs in research and innovation through technological advancement and collaboration.

29 https://dst.gov.in/anusandhan-national-research-foundation-anrf

30 https://republicnewsindia.com/new-development-initiatives-for-chemical-industry-unveiled/

Industry-academia collaboration: Risks and challenges

Collaboration between industry and educational institutions is the most efficient approach to bridge the gap between industry and academia. These projects are typically led by academia wherein they approach manufacturers on potential collaboration opportunities; however, the most effective method would be for industry players to approach educational institutions on specialised R&D collaboration requirements. Risks and challenges in the industry-academia collaboration for specialty chemicals industry majorly arise in the complex process technology and niche product segment which leads to delayed and poor quality outcomes.

A key factor in the expansion of India's specialised chemicals industry is the intricacies of the relationship between industry and academia. Any disruption can lead to a chain reaction of challenges that could hinder innovation, lower workforce quality and raise operating costs. To protect this ecosystem and guarantee the industry's continuous progress, it is crucial to set up strong communication channels, uphold mutual support and make sure that the objectives are similar for both academia and industry.

Figure 15: Industry-led projects model and associated risks

Source: PwC analysis

Figure 16: Challenges and enablers of industry-academia collaborations

	Challenges	Enablers
Difference in objectives and timeline	• Different objectives and timelines of academic institutions and industry partners. • In academic research, emphasis is often placed on theoretical advancements and publication of findings, In contrast, the industry is generally concerned with maximising market value.	• Establish clear communication and alignment of objectives from the outset. • Develop shared goals that emphasise translational research that has immediate commercial potential.
Intellectual property (IP) issues	• Conflicts over ownership of discoveries. • Corporate partners usually desire exclusive rights to commercialise these breakthroughs, academic institutions want to maintain control so they can use their findings for more research or teaching.	• Establishing thorough IP agreements at the beginning of a relationship. • Well-balanced framework that protects the interests of industry and academia while encouraging innovation.
Funding limitations	• Specialty chemical businesses are less interested in smaller colleges or those in less industrialised areas, which could lead to unequal chances for collaboration. • Industries are hesitant to fund early-stage research that does not have immediate commercial potential.	• Establishing thorough IP agreements at the beginning of a relationship. • Well-balanced framework that protects the interests of industry and academia while encouraging innovation.
Lack of skilled workforce	• Academia experiences a lack of support from industry in the form of insufficient internships, scholarships or technical infrastructure. • Limitation in practical skills and real-world insights necessary to navigate the complexities of the specialty chemicals sector.	• Initiative for collaboration of common interest and required skills. • Government initiative for specialised skill centres.

Source: PwC analysis

Case study: A non-profit regional technology transfer organisation's (RTTO) role in fostering industry-academia collaboration

A non-profit RTTO supported by the Government of India, is focused on promoting collaborations between industry and research-intensive institutions to facilitate knowledge transfer and technological advancement. This organisation promotes the exchange and transaction of science and engineering-based technology ideas to boost commercialisation initiatives. The organisation seeks to improve collaborations between research institutions and businesses to facilitate the commercialisation of innovative ideas by bridging the gap between technology innovators and commercialisation companies.

Key services offered:

1. Technology transfer and commercialisation support:

Helps technology commercialisation organisations and innovators with agreements, negotiations and transaction structuring. This helps bridge the gap between academic research outputs and market-ready technologies.

2. Industry-academia collaboration:

The programme has a strong focus on connecting industry seekers with technology providers. By creating a pool of technological solutions and industry requirements, the organisation facilitates knowledge sharing and collaborative problem-solving, designed to meet the specific industry needs.

3. Intellectual property services:

Provides comprehensive IP support services, which include patent filing, assistance during the prosecution stage, and post-grant support. It offers a safety net by protecting inventions, allowing both parties to collaborate without worrying about losing money to intellectual property theft.

4. Dedicated programme for connecting the industry with the available solution providers:

Through a structured programme, this organisation helps curate/articulate the problem statement by understanding the challenge faced by the industry. This problem statement is then posed to the available solution providers (academia, research institutes and innovators). The organisation also helps in drafting the agreement between the two parties, aligning on goals/objectives of the projects and ensuring that the outcome of the project is delivered within the agreed-upon timeline.

3.3.2. Skill development

According to the India Skills Report 2023,[31] the growing skill gap among India's youth poses a serious obstacle to the country's economic development. The report reveals that only 48.7% of graduates are considered employable, which highlights a significant gap between educational programmes and market demands. Part of the reason for this mismatch is the lack of cooperation between academics and industry, which leads to curricula that do not give students the skills they need to succeed in the modern workforce.[32]

Despite various initiatives, the situation remains concerning. According to the National Skill Development Corporation, as of 2022, a mere 4.69% of India's workforce received formal skill training.[33] Compounding the issue is the inadequate funding, with education allocated only 2.9% of the GDP in Union Budget 2023-24,[34] which is insufficient to address the nation's training needs comprehensively.

In the last few years, the government has introduced various skill development programmes in the chemical sector to address the skill gap. For instance, chemical engineers can receive specialised training from the Institute of Pesticide Formulation Technology (IPFT)[35] in analysis safety and operations. In light of the growing integration between the chemical and rubber industries, the Rubber Chemical and Petrochemical Skill Development Council (RCPSDC)[36] works to fill skill gaps in these fields. Innovative skills and entrepreneurship are the main objectives of the CSIR-National Chemical Laboratory (NCL[37]) Skill Development Program. Chemical engineering students can also receive industry-focused training at the Chem Skill Development Centre (CSDC). When taken as a whole, these initiatives can improve India's workforce and position the country as a leader in chemical technology.

The specialty chemicals industry requires a blend of technical, sustainability and digital skills as part of its talent strategy. Academia must update the curriculum based on industry requirements.

Figure 17: Important themes for specialty chemical industry and academia

Sustainability expertise	
Key skills	LCA, green chemistry, circular economy
Roles	Sustainability managers, R&D specialists

Advanced formulation and product development	
Key skills	Formulation development, analytical chemistry
Roles	Product development scientists,chemists

Data-driven problem solving	
Key skills	Data analytics and AI models
Roles	Process engineers, data scientists

Energy efficiency and process optimisation	
Key skills	Lean/Six Sigma, renewable integration
Roles	Process engineers, sustainability analysts

Regulatory knowledge and compliance management	
Key skills	Global regulation and compliance familiarity
Roles	Regulatory affairs specialists, compliance managers

Soft skills: Collaboration and communication	
Key skills	Stakeholder engagement, technical communication
Roles	Marketing lead, communications specialist

Source: PwC analysis

In the specialty chemicals industry, where a wide range of applications are needed for specialised product requirements, formulations and new product development are essential processes. Frequent interaction with customers is required so that products are tailored to their requirements, underscoring the need for a workforce with the necessary skills. Including formulation and product development-based courses in the academic curricula will equip students with the expertise required to thrive in this dynamic industry, ultimately boosting innovation and competitiveness.

31 https://www.financialexpress.com/jobs-career/education-bridging-skills-gap-crucial-role-of-industry-academia-collaboration-in-indias-workforce-development-3583081/

32 https://www.financialexpress.com/jobs-career/education-bridging-skills-gap-crucial-role-of-industry-academia-collaboration-in-indias-workforce-development-3583081/

33 https://www.financialexpress.com/jobs-career/education-bridging-skills-gap-crucial-role-of-industry-academia-collaboration-in-indias-workforce-development-3583081/#:~:text=As%20of%202022%2C%20a%20mere,the%20National%20Skill%20Development%20Corporation.&text=18%3A17%20IST-,Bridging%20Skills%20Gap%3A%20Crucial%20role%20of%20industry%2Dacademia,collaboration%20in%20India's%20workforce%20development.

34 https://bestcolleges.indiatoday.in/news-detail/budget-2024-the-educational-angle#:~:text=By%20Dr.&text=When%20it%20comes%20to%20last,higher%20than%20the%20previous%20year.

35 https://www.indianchemicalcouncil.com/skill-development-courses.htm

36 https://rcpsdc.in/gens

37 https://www.ncl-india.org/files/sdp/default.aspx

Case study:

A European chemical industry consortium is dedicated to enhancing regional development plans in Europe's chemical areas. One of its main goals is to keep the chemical sector competitive by encouraging collaboration among regional players. This cooperation entails expressing shared objectives to European institutions and participating in chemical policy talks.

To identify and address skill gaps in the chemical industry, the consortium undertakes several initiatives:

1. **Assessment of skill issues and future skill needs:** Examines focus areas such as regional chemical industry characteristics, skills problems, training providers and existing solutions to skills issues.
2. **Encouragement of science and industry graduates:** Encourages graduates to pursue careers in science and industry, thereby addressing any existing skill shortages.
3. **Exchange of best practices:** Promotes exchange of best practices on learning systems related to the chemical industry, which can lead to the joint development of training projects tailored to the needs of the sector.

Through these strategies, the consortium plays a crucial role in addressing skill gaps in the European chemical industry, ensuring that the sector remains competitive in a rapidly changing environment.

To improve industry-academia collaboration and ensure relevant skills are developed in the future workforce, there is an urgent need for not-for-profit third-party players, which focuses entirely on bridging the gap between the specialty chemical industry and academia. Major activities conducted by such a player could include:

1. **Focused collaborative initiatives:**

Establish innovation challenges or competitions that encourage partnerships between chemical researchers in academic settings and specialty chemicals manufacturers. By targeting specific problems within the industry, focused matchmaking can lead to higher-quality collaborations.

2. **Joint R&D projects:**

Facilitate joint research projects where academia can work alongside industry to develop new and more sustainable specialty chemicals. These projects should focus on addressing industry-specific challenges such as environmental compliance or developing new formulations.

3. **Workshops and training programmes:**

Organise workshops geared towards educating academic researchers about the needs and challenges faced by the specialty chemicals industry. Engaging industry professionals in these workshops can provide valuable insights and foster a culture of collaboration.

4. **Intellectual property (IP) management services:**

Provide specialised workshops on IP management tailored for both researchers and industry players in the specialty chemicals sector. By addressing the nuances of chemical patents and formulations, stakeholders could be encouraged to share their innovations more openly.

Provide targeted support in IP management, focusing on the creation, protection and commercialisation of innovations in specialty chemicals, ensuring that academicians understand the commercial implications of their research.

5. **Creating innovation hubs/consortiums:**

Develop innovation centres that focus strictly on specialty chemicals, where both academic researchers and industry experts can come together to collaborate on innovative technologies. These hubs can be equipped with shared resources for R&D.

Collaboration, innovation and skill development are key enablers for the growth of the specialty chemicals industry in India. Not-for-profit third-party organisations will play a crucial role in addressing skill gaps, fostering innovation and facilitating technology transfer. With the demand for specialty chemicals for customised applications increasing, the need for application development/R&D/formulation development centres will grow. To cope up with this rising demand, the industry as well as academia and the government will play an important role in building a culture of innovation through skill development and forward-looking initiatives like ANRF.

4 Conclusion: Strategic actions for India's specialty chemical industry

The specialty chemicals industry in India is on the brink of significant growth and transformation. With advancements in digitalisation, automation and high-performance computing, the industry is set to achieve higher efficiency and innovation. The key enablers discussed below could address the challenges faced by the Indian specialty chemicals industry, resulting in a faster development cycle.

Adaptive international trade strategy

Government

Implement safeguarding duties and provide incentives to attract supply chains to India. Develop green regulations to ensure sustainable practices. Strengthening global trade relations and adopting sustainable practices can further enhance the industry's competitiveness.

Industry

Focus on becoming cost-competitive in trade by optimising supply chains and leveraging export subsidies. Adopt sustainable practices to meet global standards. Advanced technologies can also help in improving export performance as well as the quality of exported products, making Indian products competitive on the global stage.

Academia

Conduct research on international trade policies and their impact on the specialty chemicals industry. Provide insights and recommendations to the government and industry.

Building performance excellence

Digital transformation in supply chains

Invest in AI technologies – prioritise the adoption of AI in key areas of the supply chain, such as procurement, to be more price competitive and increase profit margins.

Digitisation in R&D

Enhance data integration – use advanced digital modelling techniques and analytical tools to accelerate the development of new product formulations. This will help overcome the commoditisation of specialty products and maintain competitiveness with global players.

Process optimisation

Pilot projects – allocate resources for pilot projects to evaluate advanced digital technologies like digital twins. This will help validate their effectiveness before scaling them across operations, enabling plants to transition from single product focused to multipurpose facilities.

Collaboration, innovation and skill development

Enhance academia-industry collaboration

Set up a triple helix of industry-academia-government forums and engage a third party specifically focused on bridging the gap between the three entities within the specialty chemicals industry ecosystem.

Innovation hubs

Establish dedicated innovation centres where academia and industry can collaborate and explore new technologies and sustainable practices in specialty chemicals, leveraging shared resources for R&D.

Skill development

Industry and academia must work together to ensure that the educational programmes/curricula are in line with industry needs, particularly by integrating courses that focus on formulation and product development, alongside technical, sustainability and digital skills.

The Indian chemicals industry has the potential to become the world's leading chemicals hub. To achieve this potential, the industry needs to adapt to evolving market dynamics, implement strategic trade policies, build business excellence across processes and systems, and institutionalise regional collaborations and clusters of skill development in order to become globally competitive. The combined efforts of the government, industry and academia will be crucial in driving sustainable growth and ensuring the industry's long-term success.

About ASSOCHAM

The Associated Chambers of Commerce & Industry of India (ASSOCHAM) is the country's oldest apex chamber. It brings in actionable insights to strengthen the Indian ecosystem, leveraging its network of more than 4,50,000 members, of which MSMEs represent a large segment. With a strong presence in states and key cities globally, ASSOCHAM also has more than 400 associations, federations and regional chambers in its fold.

Aligned with the vision of creating a New India, ASSOCHAM works as a conduit between the industry and the Government. The Chamber is an agile and forward looking institution, leading various initiatives to enhance the global competitiveness of the Indian industry, while strengthening the domestic ecosystem.

With more than 100 national and regional sector councils, ASSOCHAM is an impactful representative of the Indian industry. These Councils are led by well-known industry leaders, academicians, economists and independent professionals. The Chamber focuses on aligning critical needs and interests of the industry with the growth aspirations of the nation.

ASSOCHAM is driving four strategic priorities – sustainability, empowerment, entrepreneurship and digitisation. The Chamber believes that affirmative action in these areas would help drive an inclusive and sustainable socio-economic growth for the country.

ASSOCHAM is working hand in hand with the government, regulators and national and international think tanks to contribute to the policy making process and share vital feedback on implementation of decisions of far-reaching consequences. In line with its focus on being future-ready, the Chamber is building a strong network of knowledge architects. Thus, ASSOCHAM is all set to redefine the dynamics of growth and development in the technology-driven 'Knowledge-based economy. The Chamber aims to empower stakeholders in the Indian economy by inculcating knowledge that will be the catalyst of growth in the dynamic global environment.

The Chamber also supports civil society through citizenship programmes, to drive inclusive development. ASSOCHAM's member network leads initiatives in various segments such as empowerment, healthcare, education and skilling, hygiene, affirmative action, road safety, livelihood, life skills and sustainability, to name a few.

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ASSOCHAM
Ideate · Innovate · Impact

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