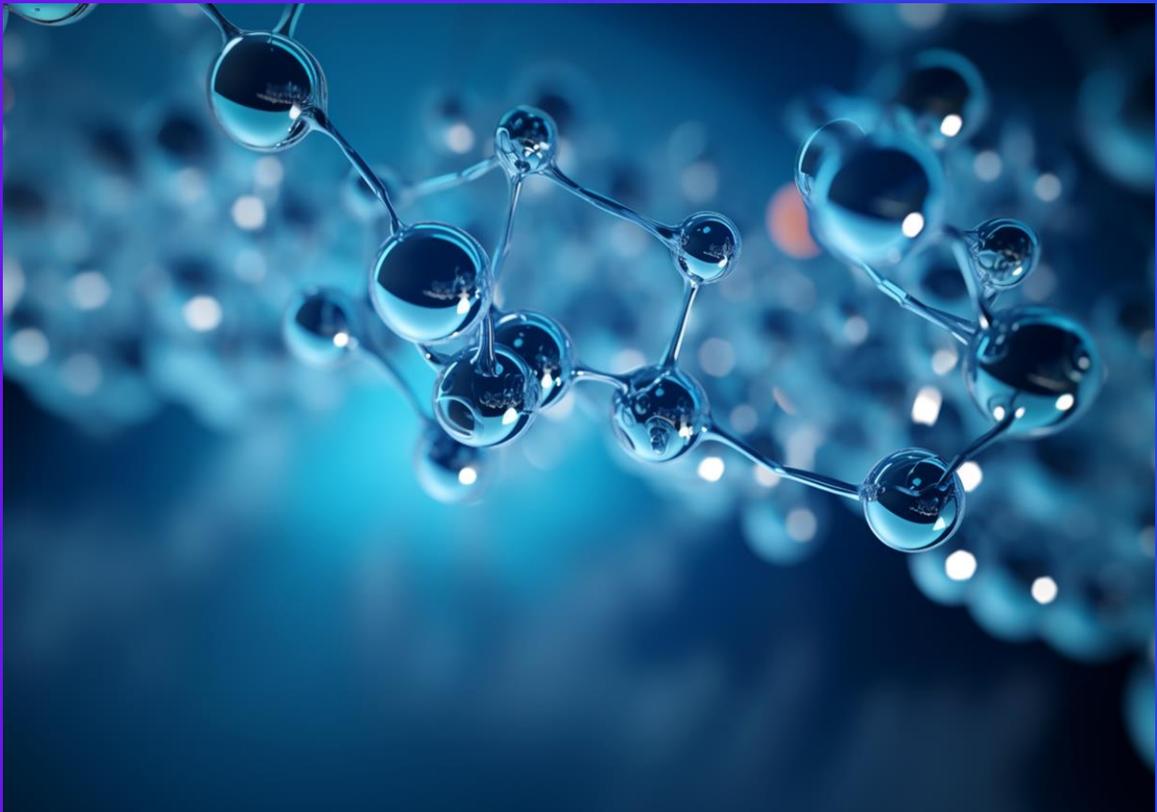




Confederation of Indian Industry

# Chemicals value chain transition

Addressing the impact of ESG,  
globalisation and innovation



January 2024

[kpmg.com/in](https://www.kpmg.com/in)

# Foreword KPMG in India



The Indian chemicals sector stands in the midst of transformative change – having to innovate in a digital landscape and strengthening its manufacturing prowess to become a global hub, all the while contending with growing sustainability imperatives. All these three aspects are challenges as well as opportunities, and in recent years, Indian chemical sector has positioned itself into one of the global leading producers occupying 6th place and with growth of ~9 per cent expected over next 5-10 years the future potential is bright.

A key driver for this growth, is the inherent increase in demand across multiple end user segments in India, be it automotive, electronics or consumer goods. These strong demand fundamentals, allied with initiatives like Make in India, and 100% FDI in the sector, positions the Indian chemical sector well to become an attractive manufacturing destination to serve domestic demand as well as global markets.

The shift towards sustainable products by consumers, is also driving focus on newer and greener products globally. This at one level provides avenues for green premiums in pricing and also with re-use and circularity in chemistry and supply-chain, enables efficient production and costing – paving the way more sustainable and profitable future. Although, the Indian chemicals sector is adopting innovative and green technologies along with digitalisation in operations, there is need for a more comprehensive and integrated approach which leverages the academia-industry-government helix to ensure the right blend of cutting-edge research, business economics and policy support in place so that the sector rejuvenates and stays relevant in the coming years.

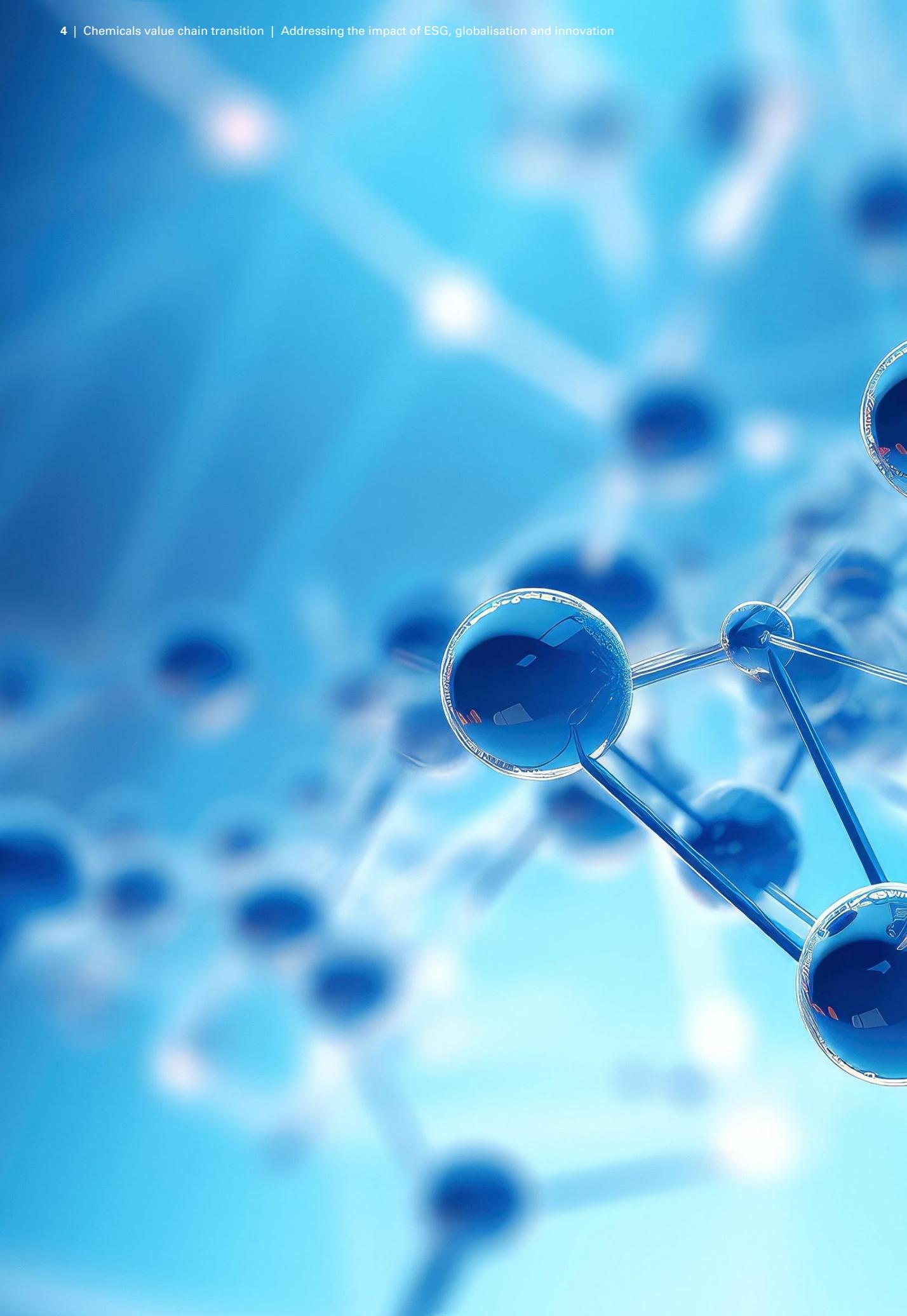
Through this joint knowledge report of CII and KPMG in India, we have tried to provide an overview of the Indian chemicals sector while focusing on the trifecta of sustainability, digitalisation, and supply chain resilience and a call to action to relevant stakeholders across the chemicals value chain.

We believe you would find this report helpful and would like to thank CII for this opportunity to partner together to make this publication a reality.



## Manas Majumdar

**Partner, Leader**  
Oil & Gas and Chemicals  
KPMG in India



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# 01 Chemical Market Landscape

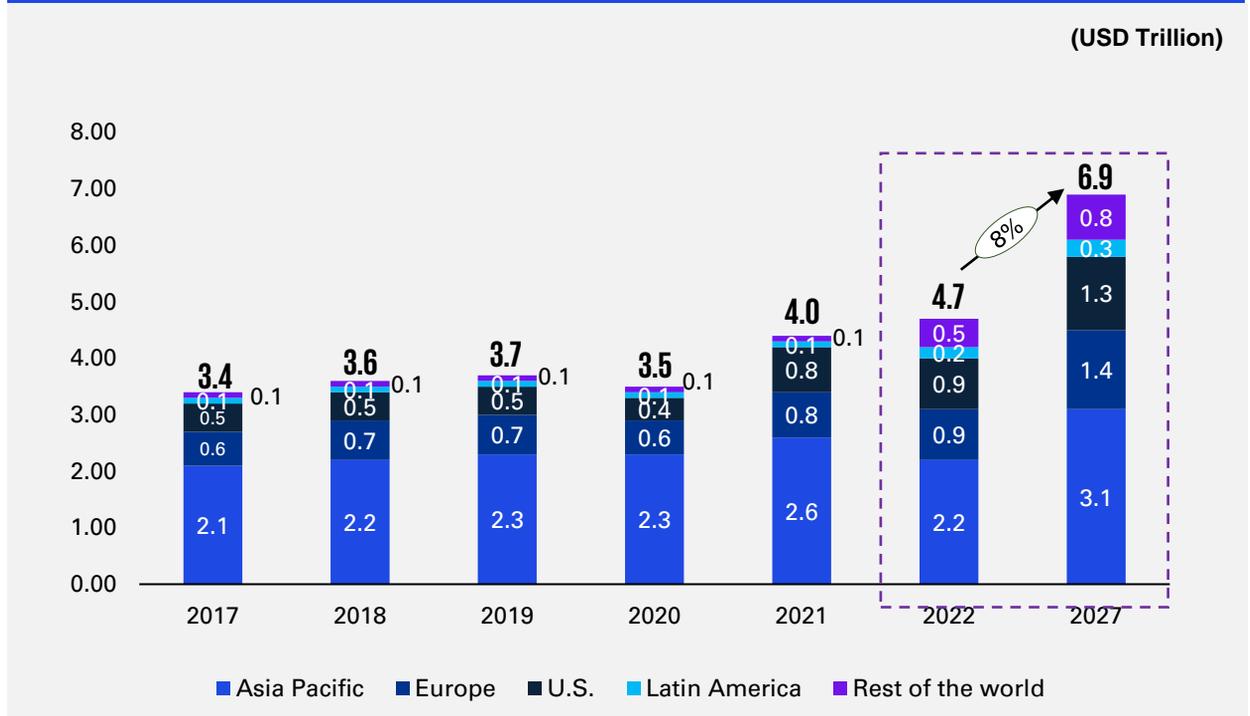
## 1.1 Overview of the Global chemicals market

The production of chemicals is one of the most significant driving forces of global economies. Historically, more than 160 million chemicals have been produced and used across various sectors out of which around 40,000 to 60,000 chemicals are classified as commercial chemicals currently in the market<sup>1</sup>. Among the overall SKUs of commercial chemicals, only around 6,000 chemicals account for more than 99 per cent<sup>2</sup> of total volumes traded, with commodity chemicals accounting for 80 per cent and the remaining 20 per cent being constituted by specialty chemicals. Across the world, major chemical manufacturing/trading hubs have developed in various countries like China, USA, India, Ireland, Saudi Arabia, Germany, and South Korea. The driving factors for these countries emergence include feedstock availability, access to labour and

utilities, low infrastructure costs, growing domestic demand for chemicals and comparatively better policy environments that foster ease of doing business.

The size of the global chemicals market was estimated to be USD 4.7 trillion in the year 2022 and is expected to grow at a CAGR of 8 percent in the next five years. With the increasing thrust towards clean energy fuels and technology innovation, the potential increase in demand for chemicals is expected to stem majorly from growth in automotive (Ex. battery chemicals) and electronics (Ex. semi-conductor chemicals) end-use industries<sup>3</sup>. While the global chemicals market will be driven by such specialty chemicals, commodity chemicals will also exhibit increased demand from end consumer segments.

Figure 2: Global market size of chemical industry<sup>1</sup>



1. IBEF Report dated August 2023

2. International Council of Chemical Association

3. The global chemicals market briefing 2023' report by the business research company & KPMG analysis

## 1.2 Overview of the Indian Chemicals Market

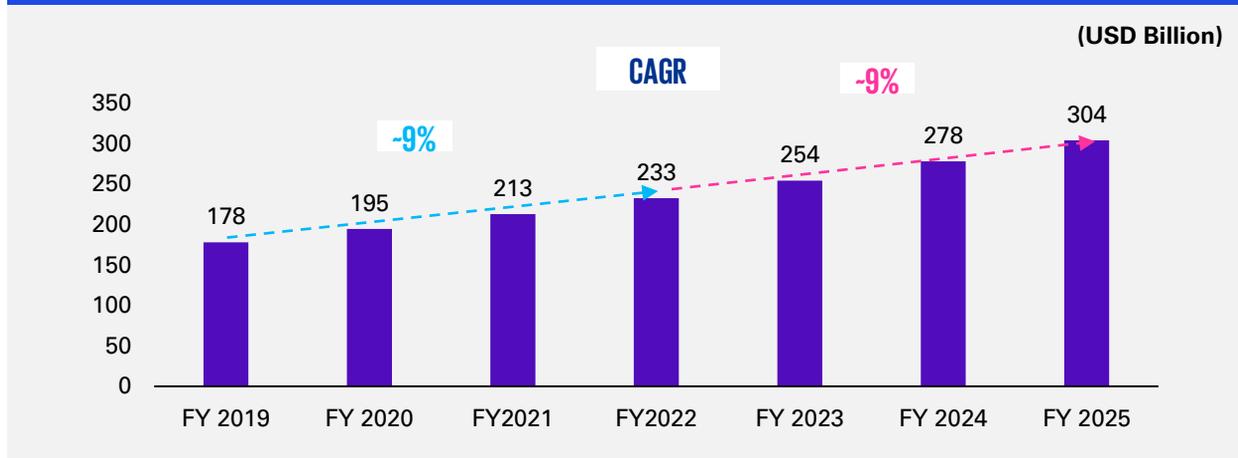
India is one of the world's leading chemical producers and exporters. India is the sixth largest producer of chemicals and the fourth largest producer of agrochemicals globally<sup>4</sup>.

The Indian Chemicals Industry is one of the most diversified among other industrial sectors covering a multitude of commercial products and comprises of both small scale as well as large scale units. With linkages to several other sectors of the economy, it enjoys a position of paramount importance. With number of

commercial products being produced currently, the Indian Chemicals Industry has emerged as a backbone of the agricultural and industrial development of India and provides building blocks for several downstream industries such as Pharmaceuticals, paints, textiles, paper, etc.

The Indian chemical industry grew from ~USD 178 billion in 2019 to ~USD 232 billion in 2022 showcasing a strong CAGR of ~ 9 per cent and is expected to continue growing at similar CAGR to reach ~USD 304 billion by 2025<sup>4</sup>.

Figure 2: Indian chemicals industry<sup>5</sup>



The total installed capacity for major chemicals and petrochemicals in India has grown at a CAGR of 4.5 per cent between 2018 and 2022, with a similar trend in production<sup>5</sup>. This is expected to grow further as the demand for chemical consumption increases in India, while the nation also grows further as an export hub.

Figure 3: Major chemicals and petrochemicals production - India<sup>5</sup>



4. IBEF Report dated August 2023

5. Chemical and Petrochemical Statistics at a Glance - 2022, DCPC

The rapid expansion of the various sub-sectors like bulk, specialty, petrochemicals, agrochemicals, fertilisers, etc., can be attributed to favourable government policies growing demand from multiple end-user sectors, the growing domestic customer base and changes in consumers' lifestyles. The specialty chemicals sub-sector is one of the fastest growing sub-sectors in the Indian manufacturing sector, witnessing an exponential growth in the recent years projected at a CAGR of 12 per cent from FY19 to FY25<sup>6</sup>.

To facilitate the indigenous production of chemicals, the Government of India has allowed 100 per cent FDI in the chemicals sector under the automatic route (except in the case of certain toxic chemicals). The production of most chemicals, including organic/inorganic products, dyes, and pesticides, has been de-licensed to allow ease of doing business in the segment.

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6. Chemical and Petrochemical Statistics at a Glance - 2022, DCPC



## 1.3 Key segments in chemical market

India's chemical sector encompasses most chemical product categories. However, lack of domestic resources in several categories, makes it a net importer of chemicals. With initiatives like the 'Make in India' program gaining momentum, investment, innovation, and infrastructure are set to become key focus areas for businesses in the chemical industry. Additionally, India is considering a production linked incentive scheme for chemicals and petrochemicals sector to boost domestic production and exports.

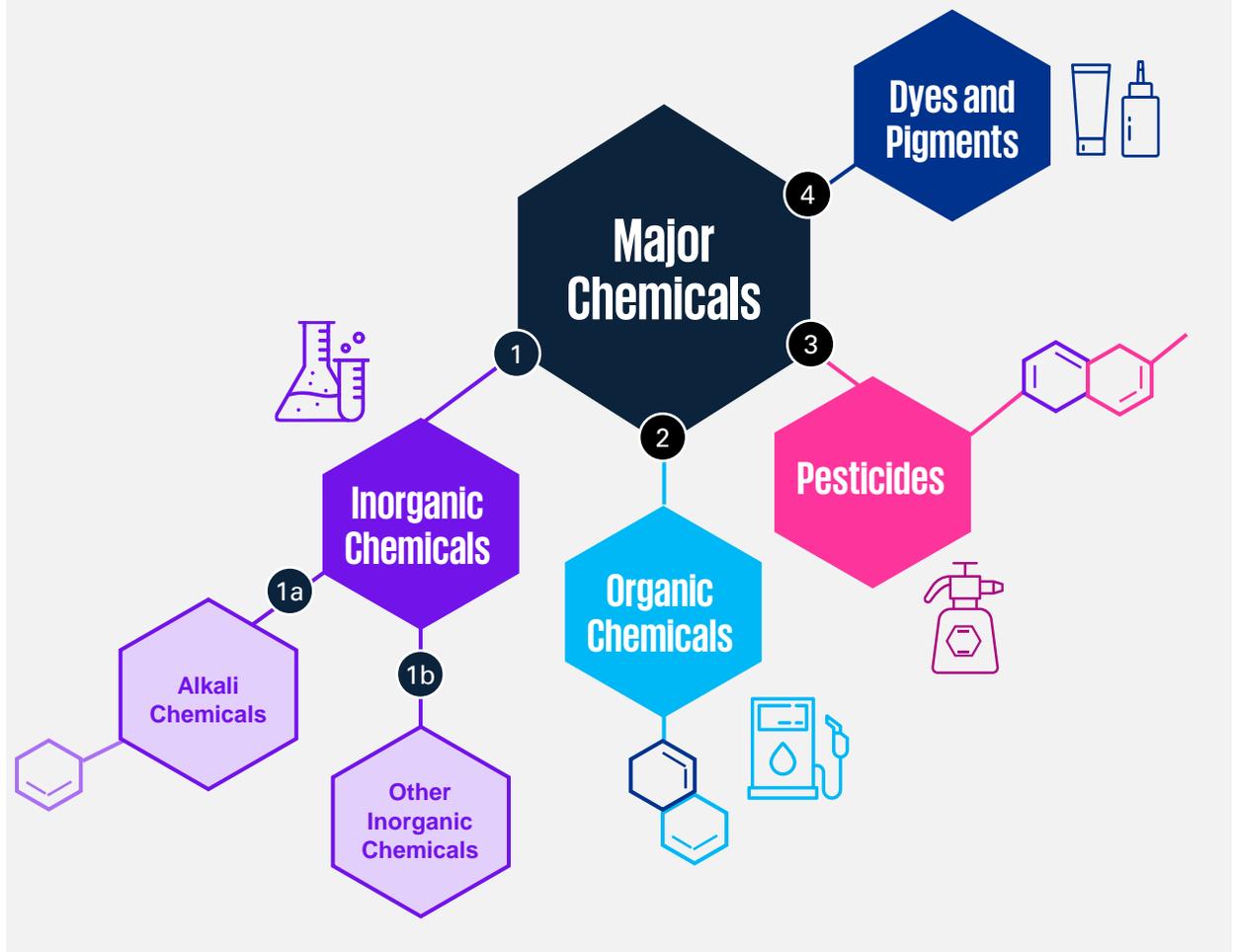
India has the opportunity and potential to become a viable alternative platform for chemicals production. The nation offers a

multitude of benefits including low-cost operations; availability of raw materials; skilled labour; and favourable government policies. The country is also set to gain from long coastlines and waterways to facilitate trade, significant import substitution opportunities, strong intellectual property protection, and a growing domestic market.

Major macroeconomic factors leading to a positive ecosystem and improved ease of doing business shall be key in further attracting foreign chemical manufacturers to setup in the country.

The major chemicals can be further classified broadly into the following subgroups.

Figure 4: Major chemicals subgroups



## Inorganic Chemicals



Inorganic chemicals do not consist of carbon and carbon derivatives as principal elements. Inorganic chemicals include a diverse set of compounds and are widely used in several production processes. These chemicals are vital in end-user applications like in paint, glass, automotive, paper and pulp, surfactant among others. These are further classified into alkali chemicals and other inorganic chemicals.

### 1A. Alkali chemicals

Soda ash, caustic soda and liquid chlorine are the major alkali chemicals in the industry. These base chemicals are sold in bulk, in different grades and are commonly used in large scale industrial production of other chemicals and materials. The production of alkali chemicals has increased by nearly 2 million metric tons since 2018. While its imports have decreased during the same periods, this category saw a jump in exports in 2022.

Figure 5: Alkali chemicals production trends – India<sup>7</sup>

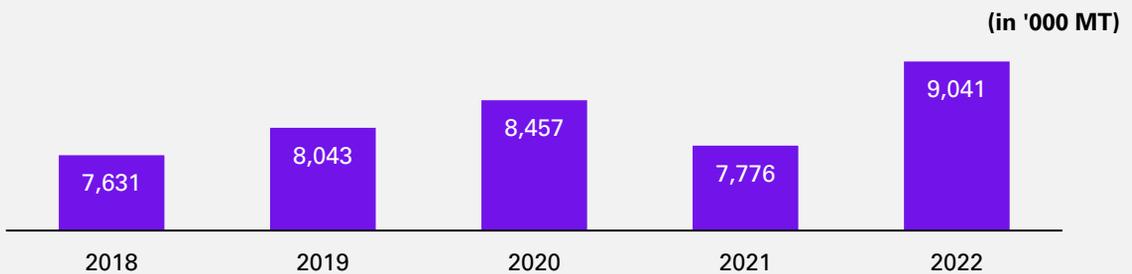
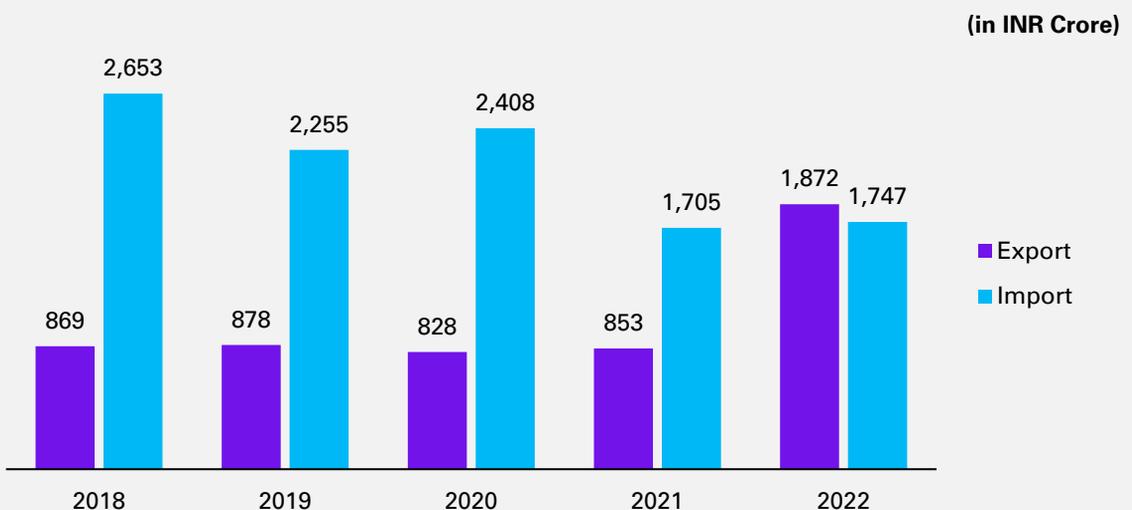


Figure 6: Alkali chemicals export and import trends - India<sup>7</sup>

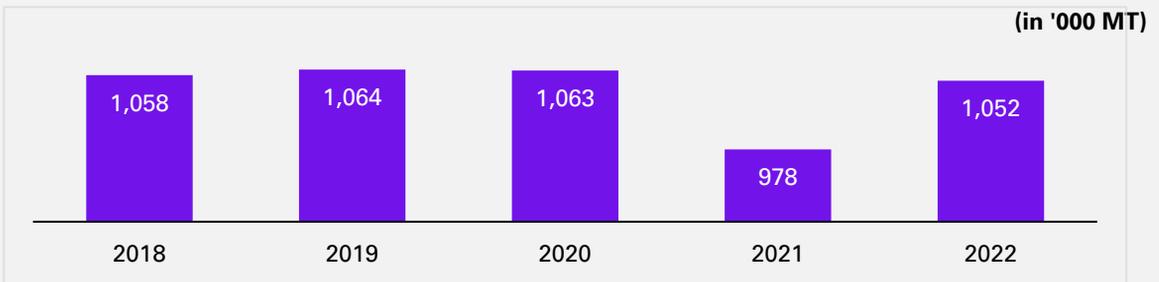


7. Chemical and Petrochemical Statistics at a Glance - 2022, DCPC

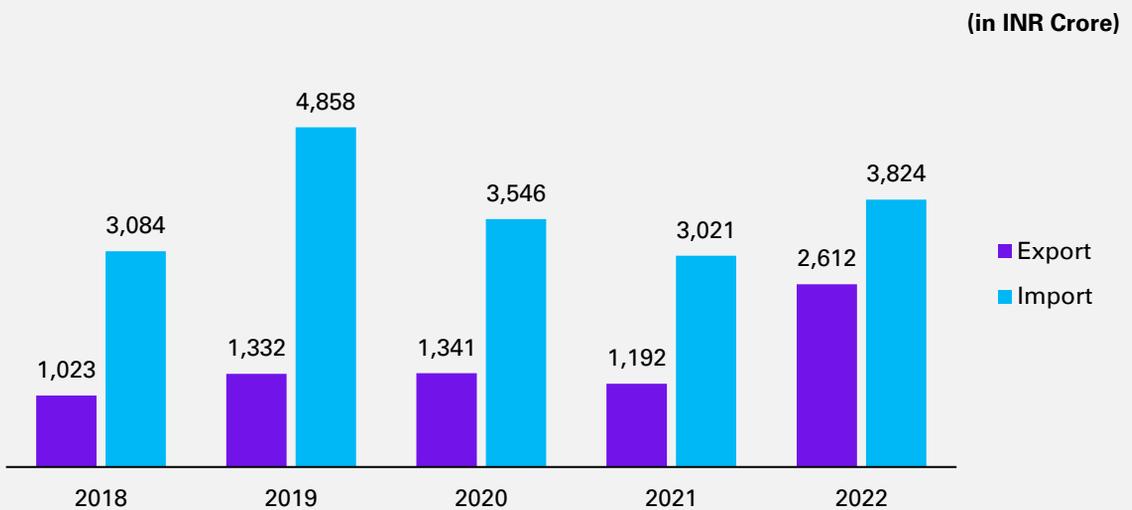
## 1B. Other inorganic chemicals

This segment includes inorganic compounds of alkali metals, precious metals, rare- earth metals, radioactive elements or of isotopes, examples of which include chemicals like aluminium fluoride, calcium carbide, potassium chlorate, sodium chlorate, titanium dioxide, red phosphorus, hydrogen peroxide, calcium carbonate, etc. These compounds find applications in bleaches, disinfectants, colouring agents, sunscreens, oxidizing agents and industrial production of other chemicals. The production trend for these chemicals has remained flat since 2018, while exports of these to other geographies have overall, increased during the same period.

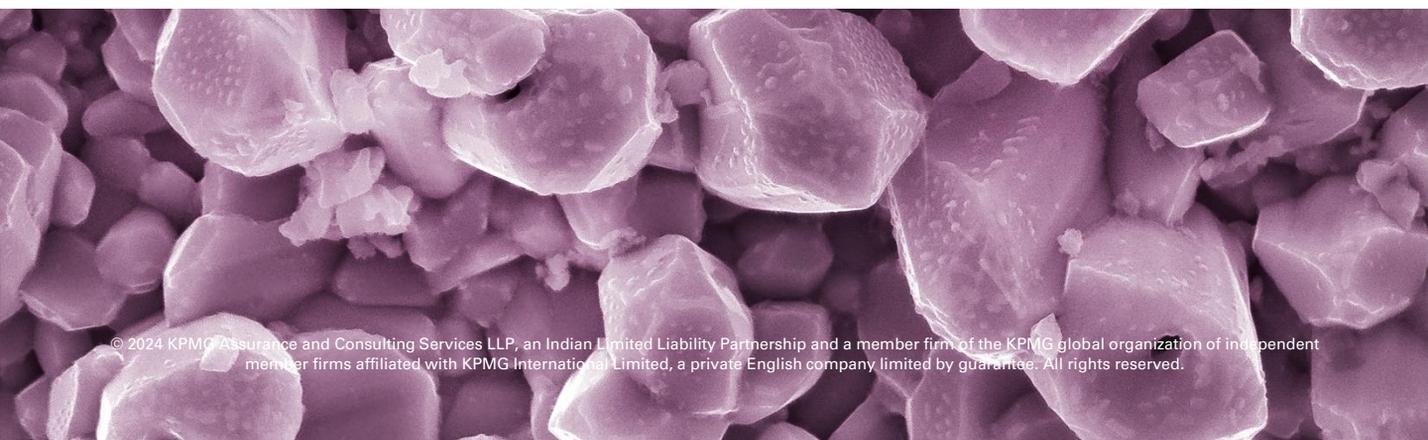
**Figure 7: Other inorganic chemicals production trends – India<sup>8</sup>**



**Figure 8: Other Inorganic chemicals export and import trends – India<sup>8</sup>**



8. Chemical and Petrochemical Statistics at a Glance - 2022, DCPC



## Organic Chemicals



Organic chemicals are compounds containing carbon atoms, bonded with hydrogen atoms, along with functional group elements like oxygen, Sulphur, Nitrogen and other elements (such as metals and halogens). These are vital in many industries like pharmaceuticals, textiles, automobiles, and construction. Organic chemicals can be further classified into petrochemicals and other organic chemicals. The applications of organic compounds that do not use petroleum as feedstock, like aniline, alkyl amines, methanol and its derivatives, formaldehyde, acetic acid and phenol are also very significant industrially. They are used in manufacturing drugs like paracetamol, dyes for textiles, polyurethanes, resins, paper towels. They are also important raw materials for automobiles and surfactants. While the domestic production of organic chemicals has increased from 1,799 kilo tonnes in 2018 to 1,953 kilo tonnes in 2022, at a CAGR of 2.1 per cent, India has been increasingly dependent on foreign markets to meet its demands. The trend in the nation's organic chemicals imports for the year 2022 reflect this clearly, since India approximately doubled the number of imports, compared to 2021 volumes. Overall imports too have almost doubled since the volumes in 2018<sup>9</sup>.

Figure 9: Organic chemicals production trends – India<sup>9</sup>

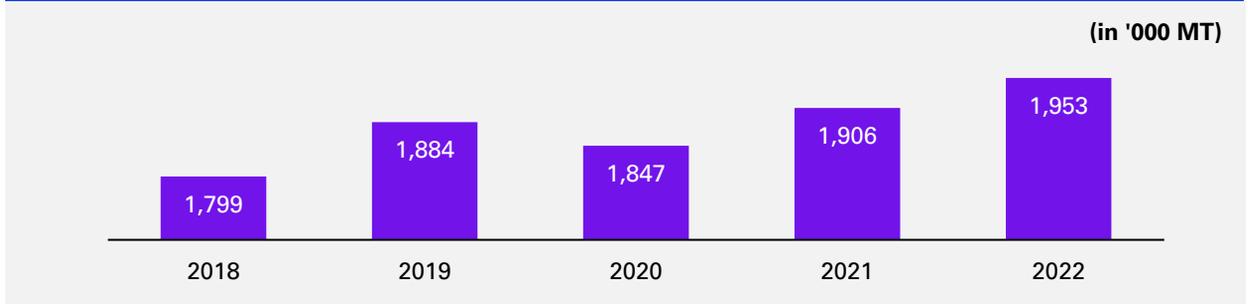
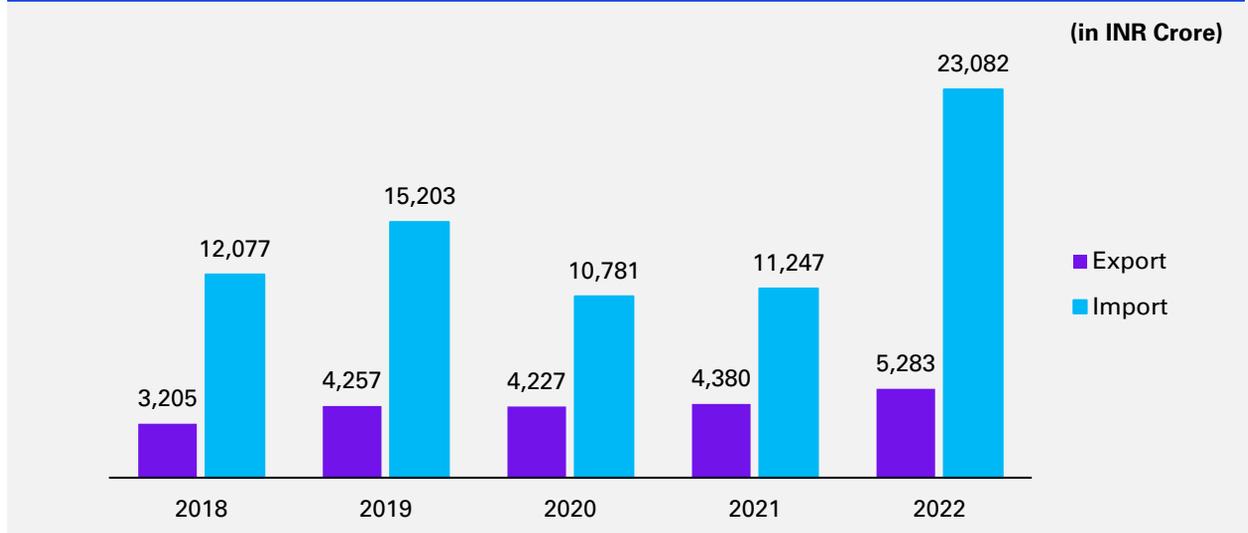


Figure 10: Organic chemicals export and import trends – India<sup>9</sup>



9. Chemical and Petrochemical Statistics at a Glance - 2022, DCPC

## Pesticides



Chemical agents are also manufactured to produce pesticides which are used to destroy control and repel pests on a large scale. Pesticides include a wide range of products spanning insecticides, herbicides, fungicides, rodenticides, nematocides, and molluscicides.

Figure 11: Pesticide production trends – India<sup>10</sup>

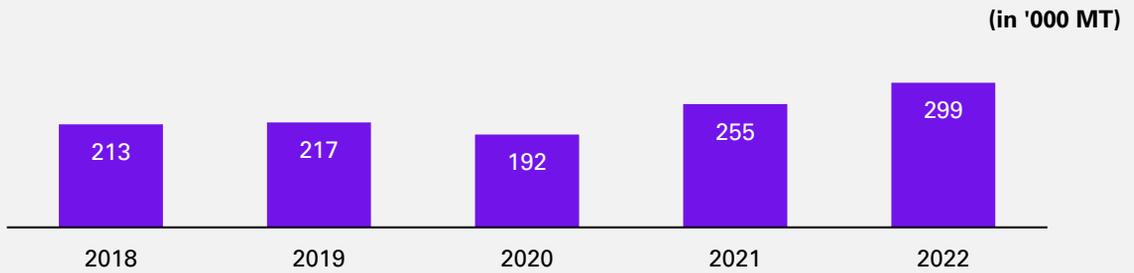
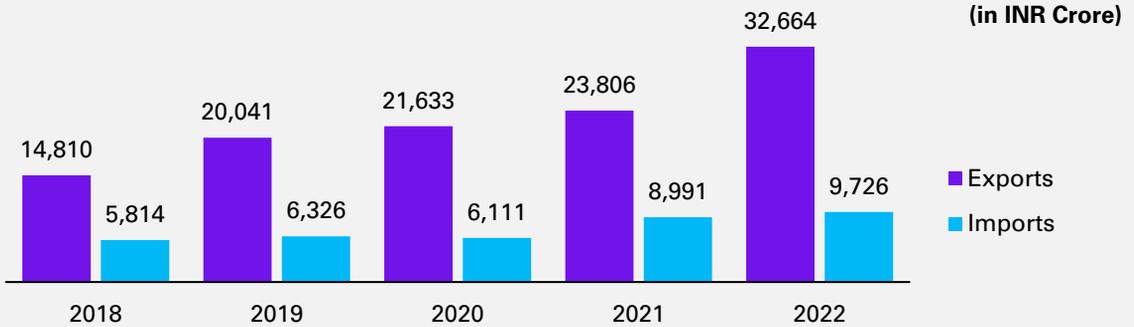


Figure 12: Pesticides export and import trends – India<sup>10</sup>



While the production of pesticides has increased by nearly 50 per cent since 2018, the exports of pesticides have more than doubled in terms of sales value. The scale of pesticides usage has seen a significant increase, with their growth driven by populations, several government initiatives and an increase in exports.

10. Chemical and Petrochemical Statistics at a Glance - 2022, DCPC



## Dyes & pigments



Dyes and pigments are colouring compounds that are required in a wide range of industries like textiles, cosmetics, paints and coatings and several others. Azo dyes, disperse dyes, oil soluble dyes and reactive dyes are a few of the several types of dyes produced for varied applications. Increased purchasing power of consumers and their changing lifestyle and the rising infrastructure activities across India are major growth drivers. While the trend in production has remained flat, dyes and pigments have been increasingly exported since 2018, following growing demand in global markets.

Figure 13: Dyes and pigments production trends - India<sup>11</sup>

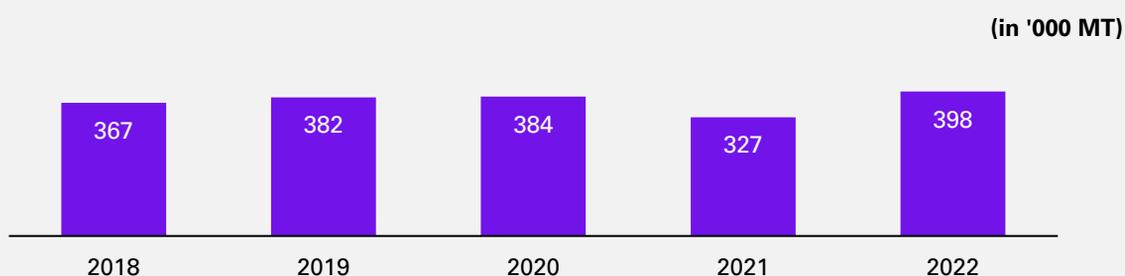
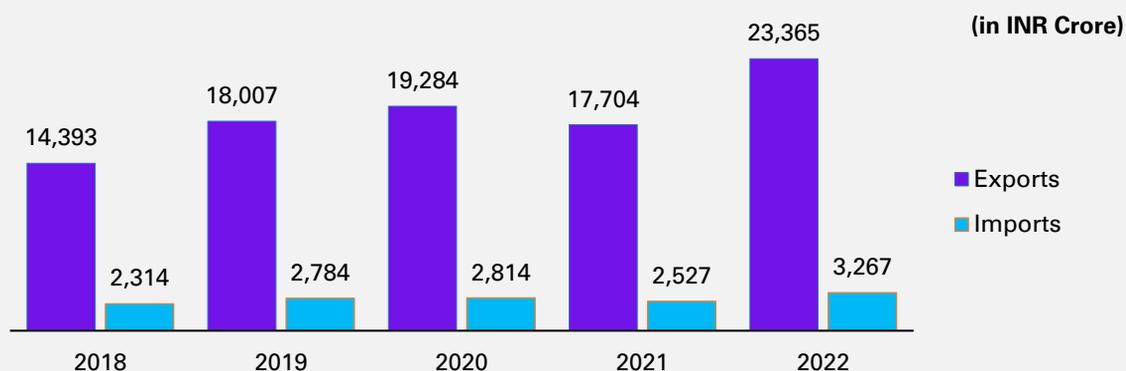


Figure 14: Dyes and pigments exports and imports trends – India<sup>11</sup>

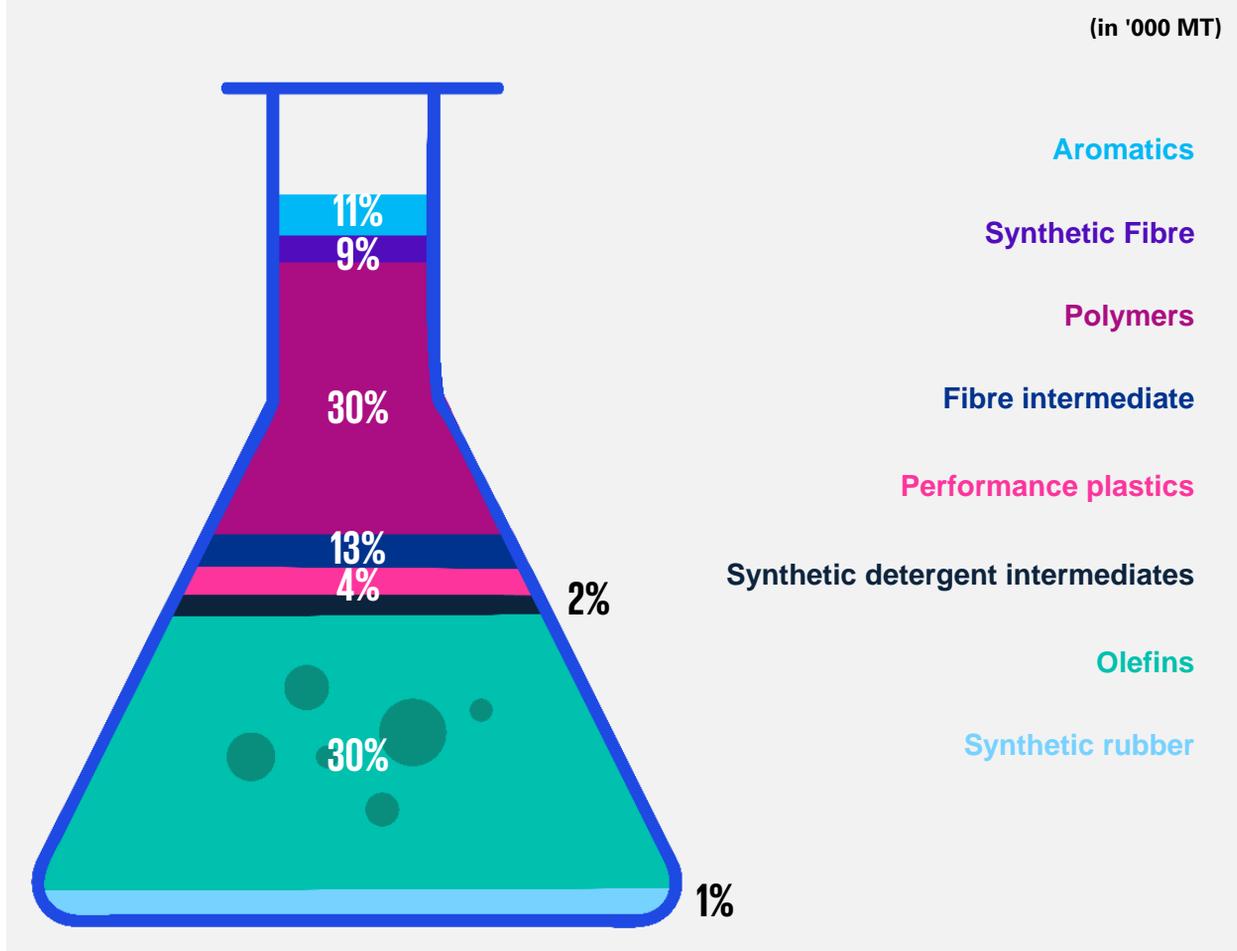


## Overview of the Indian Petrochemicals industry

**Petrochemicals:** Organic chemicals that use crude oil as feedstock are known as petrochemicals. These are often intermediates, that are used in production processes of several commercial derivatives. Petrochemicals are of various types, namely, fibres and fibre intermediates, polymers, synthetic rubber and detergents, olefins, aromatics and performance plastics.

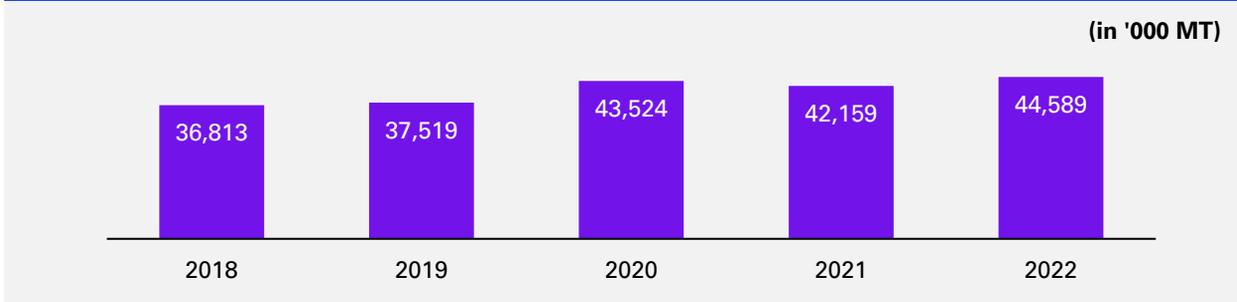
11. Chemical and Petrochemical Statistics at a Glance - 2022, DCPC

Figure 15: Major petrochemicals in production - India<sup>12</sup>

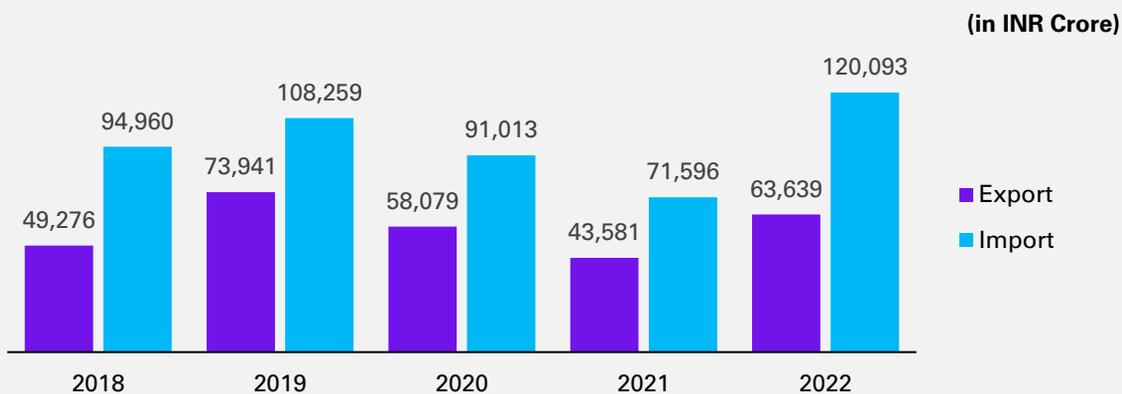


The petrochemicals industry has grown at a CAGR of 4.9 per cent during the period 2017-18 to 2021-22. Government initiatives, like schemes for setting up of plastic parks and centres of excellence, are instrumental to the growth of the sector.

Figure 16: Petrochemicals production trends - India<sup>12</sup>



12. Chemical and Petrochemical Statistics at a Glance - 2022, DCPC

Figure 17: Petrochemicals export and import trends - India<sup>13</sup>

13. Chemical and Petrochemical Statistics at a Glance - 2022, DCPC



## 1.4 Growth trends across chemical segments



**Increased momentum towards chemical consumption in Asian countries**

- Historically, Europe and North America were the major consumers of chemical products. While the demand has been growing, in the last two decades, the consumption markets are transitioning, with Asia's chemicals consumption trend contributing significantly towards the growth of the global industry.
- China, Japan, South Korea, and India has been amongst the top chemical

producers in 2021, with China's contribution in chemical sale significantly from 2011 to 2021, driven by intense competition, technological innovation, and rapid investments in industry.



**Shift towards sustainable consumption leading to increased investments in green chemicals**

- Consumers are now increasingly prioritizing products based on their carbon footprint and circularity. This shift is driving chemical companies to accelerate decarbonisation and re-examine their existing asset portfolios. Among the top global companies active in the Chemicals space, majority of them have made public commitments to achieve net-zero emissions, near-zero emissions, or carbon neutrality in decades to

come. This is leading to the introduction of green technologies on a commercial scale.

- Chemical companies are moving towards adding mechanically recycled and renewable feedstock-based polymers to their product offerings. This is leading to increased investments in advanced recycling and introduction of green technologies on a commercial scale.



**Rise of Automation, Augmented reality, and digital twins to improve operations and boost productivity**

- The chemical industry is gradually leveraging digital practices and transitioning to connected enterprises. This digital transformation has been fast tracked by projects creating testbeds, with integrated modular automation, and digital twins for improved control, maintenance, and other resources to boost productivity in production processes.

- A major share of the chemical firms are expected to achieve advanced digitalisation in near future, with these initiatives directly tied to their growth stories.

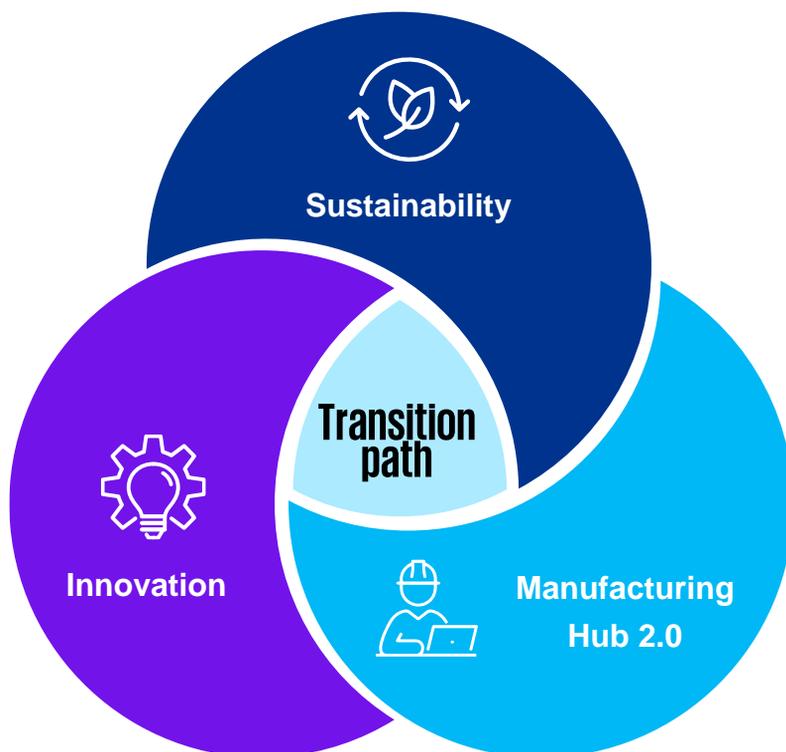


**Increase M&A activities in pursuit of portfolio and geographical diversifications**

- The Chemical sector is witnessing one of the most active M&A markets, with sponsor-owned assets in the process of sale, resulting in large-scale corporate carve-outs.
- There are a multitude of factors driving M&A activity. While there is high debt and a growing private

equity interest in the industry, liquidity pressures on distressed companies due to the pandemic impact, and move to divest underperforming or noncore businesses, are major factors driving increased activities in this space.

India's chemicals sector is in the midst of an extensive transformation that is turning local players global, with the country fast appearing as a global manufacturing hub. Bludgeoning domestic consumption, increasing disposable incomes and switching consumer preferences are quickening already strong demand, putting India on the forefront of global chemical manufacturing map and making it a hub for the world.



### Sustainability

The increasing focus on sustainability and stricter environmental regulations have become global trends, with Indian Chemical companies also embarking on their own sustainability journeys.

### India as Chemicals Hub 2.0

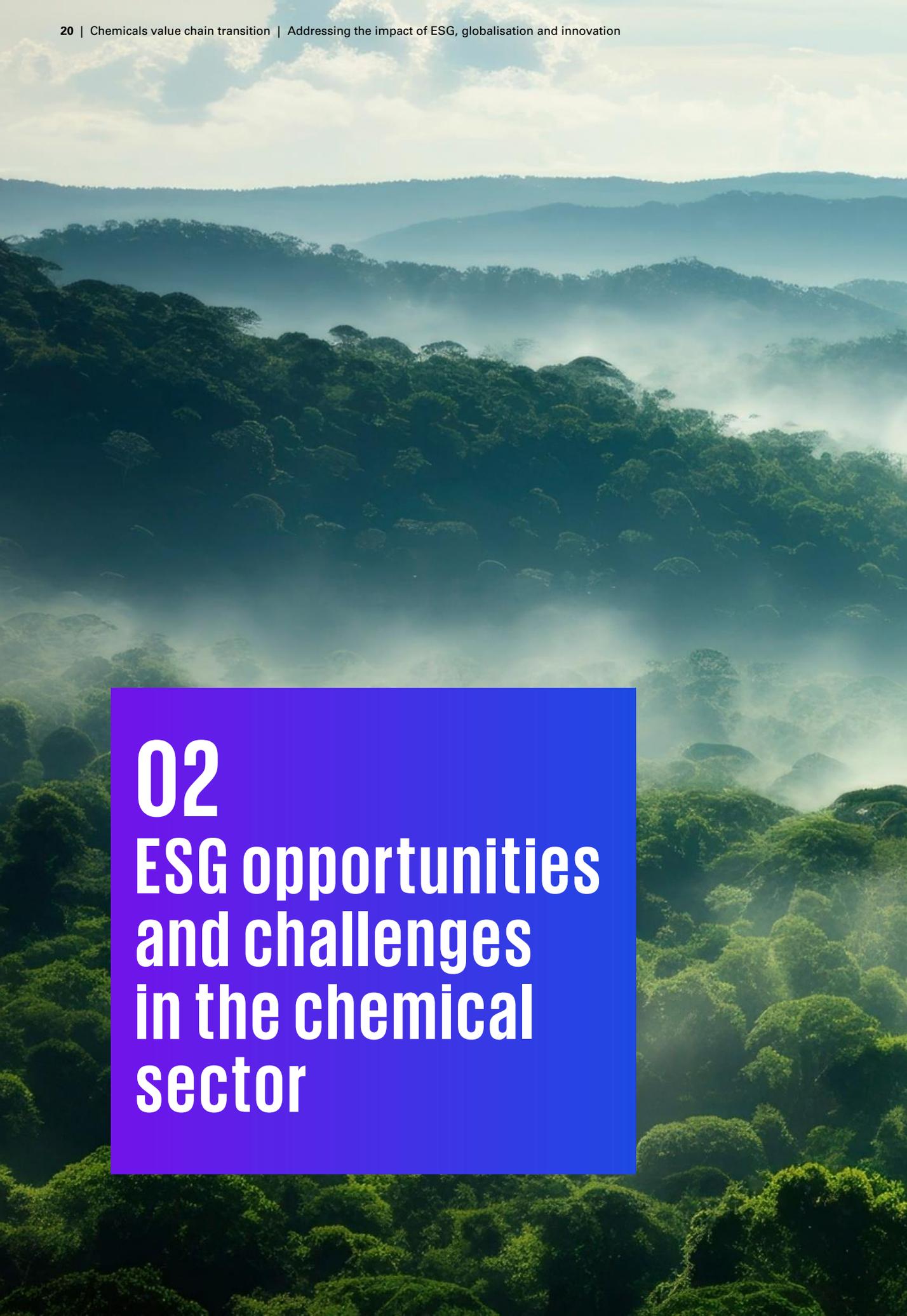
The Indian chemical industry has been buoyed by demographic dividends, low per capita consumption, an increasing export demand and enabling Government initiatives. India's skilled and competent manpower, strategic location advantage, along with good governance, high-quality infrastructure, robust investment policies, strong

regulatory framework, promising labour reforms and trade agreements, and lucrative tax incentives have further propelled it into the league of preferred manufacturing destinations for the Chemical Industry.

### Innovating for brighter future for chemicals

Digitisation and innovations in the Green chemicals space have emerged as enablers for sustaining the growth and securing the future of the Indian chemical industry.

Each of these trends have been discussed in detail below:



# 02 ESG opportunities and challenges in the chemical sector

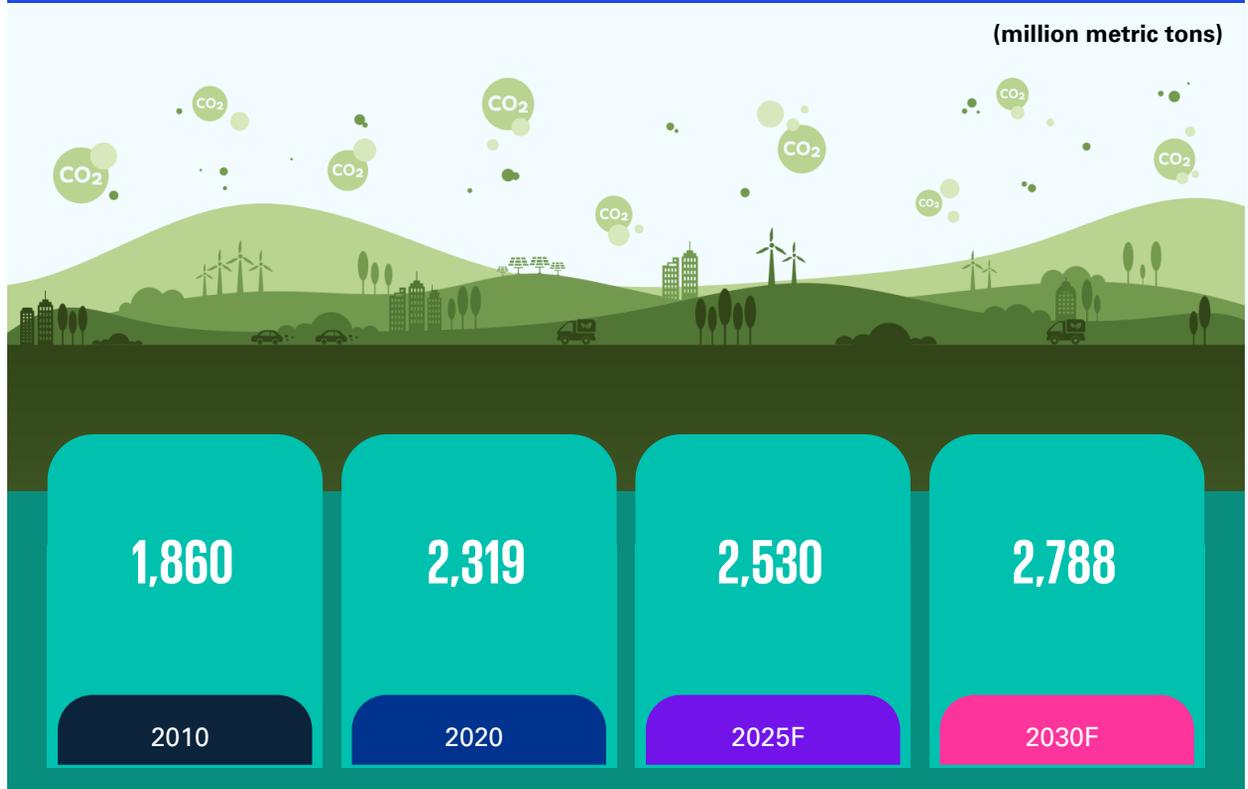
## 2.1 Overview of sustainability in the chemical sector

Sustainability in the chemical sector is crucial for ensuring a healthy and thriving environment, as well as a sustainable future for generations to come. The chemical industry is one of the largest and most complex sectors of the global economy, producing a wide range of products that are essential to modern life, from basic chemicals and agrochemicals to specialty chemicals and electronics. However, the production and use of these chemicals can have significant environmental impacts, including air and water pollution, soil contamination and climate change.

### Efforts undertaken by chemical companies to reduce carbon emissions, include

- Investing in renewable energy
- Implementing energy efficient technologies
- Developing low-carbon products
- Carbon capture and storage
- Exploring alternative feedstocks such as biomass, waste, or algae
- Adopting green chemistry principles
- Carbon offsetting
- Reducing the use of high global-warming-potential (GWP) gases.

Figure 18: Greenhouse gas emissions from global chemicals and petrochemicals industry<sup>1</sup>



1. Statista

Few challenges that have heightened the need for sustainability in the sector include<sup>2</sup>:

### Climate change

The chemical sector is a significant contributor to greenhouse gas (GHG) emissions, primarily due to energy-intensive processes, raw material extraction through drilling, mining, minimal circular economy practices, limited availability of low carbon technologies, lack of data, among others. The sector is responsible for around 6 per cent of global GHG emissions

### Carbon footprint

The chemical sector includes various processes and end-use products such as paints, detergents, adhesives synthetic fibres, plastic, etc. which may release CO<sub>2</sub> when decomposed.

### Resource depletion

The sector relies heavily on non-renewable resources, such as fossil fuels, which are finite and contribute to resource depletion. It also leads to soil depletion and erosion.

### Water scarcity and pollution

The sector requires a large amount of water for production processes, releases toxic chemicals into water bodies and leads to depletion and contamination of ground water.

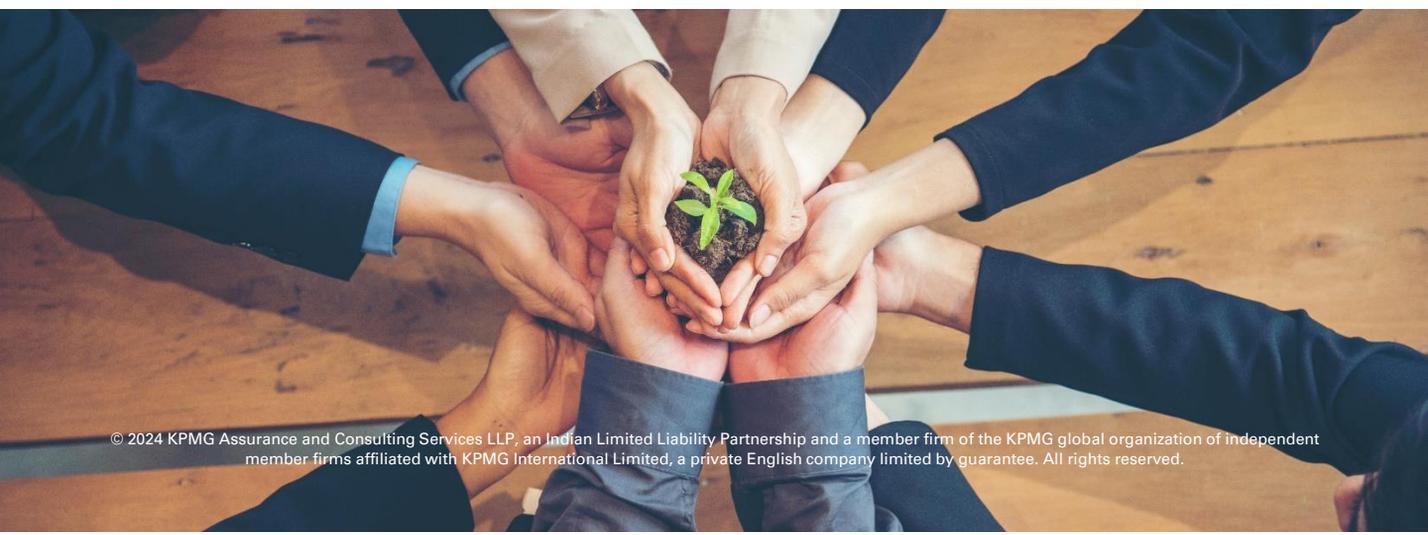
### Toxic waste

The chemical sector generates significant amounts of hazardous and non-hazardous waste such as cyanide compounds, asbestos containing material, among others.

### Other challenges

Health and safety risks to workers, compliance with regulations, increased demand from customers, monitoring complex supply chains, increased pressure to transition to circular economy and adoption of new sustainable technologies.

2. Decarbonizing Chemicals Part One: Sector wide Challenges Will Intensify Beyond 2030, S&P global, September 2023



## 2.2 Sustainability as a driver for long-term vision and value creation

ESG factors have become increasingly important for companies in the chemical sector globally. Sustainability and responsible practices are becoming more important for investors and stakeholders, and they are increasingly considering ESG performance as a key factor in their investment decisions. It is important for stakeholders in the chemical sector to have a sustainability vision.

Some of the keyways in which sustainability vision may be of importance for stakeholders include:

Environmental Protection	Regulatory Compliance	Brand image	Cost savings
<ul style="list-style-type: none"> <li>Reduces GHG emissions and other pollutants through cleaner processes and renewable energy.</li> <li>Minimise waste and emissions throughout the value chain.</li> </ul>	<ul style="list-style-type: none"> <li>Implementation of sustainability metrics and reporting to track progress and compliance.</li> </ul>	<ul style="list-style-type: none"> <li>Ability to differentiate the company's products or services from those of competitors using sustainable materials, processes and packaging, leading to increased market share and revenue.</li> </ul>	<ul style="list-style-type: none"> <li>Reduction of raw materials and energy costs through efficient processes and resources.</li> <li>Lower operating costs through reduced waste and improved resource efficiency.</li> </ul>
Market access	Investor interest	Customer loyalty	Talent attraction and retention
<ul style="list-style-type: none"> <li>Access to new markets and customers who prioritise sustainability</li> </ul>	<ul style="list-style-type: none"> <li>Increased investor confidence and returns</li> <li>Improved financial performance through reduced costs and increased efficiency</li> </ul>	<ul style="list-style-type: none"> <li>Increased customer loyalty and retention through sustainable products and services</li> </ul>	<ul style="list-style-type: none"> <li>Attraction of top talent who prioritise sustainability</li> <li>Improved employee morale and engagement by making a positive impact on the environment and society</li> </ul>

Chemical companies are focusing on green economy by utilizing sustainable production processes. Additionally, they are investing in products that support sustainability-linked areas and improving their existing carbon footprint with renewable inputs which are bio-based or recycled. Moreover, ESG practices are emerging as a value driver across organisations. ESG data management solutions provide real-time progress. By adopting sustainable practices, companies can reduce their exposure to environmental and health risks and ensure long-term viability. To support the sustainable pursuits, government authorities are playing an instrumental role by addressing perceived investment risks through robust policies and fiscal mechanisms.

## 2.3 Decarbonising the sector and managing carbon emissions

Chemical companies are increasingly faced with a challenge to achieve net-zero targets. This has accelerated the need to adopt an integrated approach across demand-production management by deploying clean energy technologies and participate in sustainability-driven transformations. Addressing the heavy carbon footprint, chemical firms are reporting

their scope 1 (carbon emitted from their manufacturing processes), scope 2 emissions (emissions from generating the energy to run their overall operations) and also somewhat scope 3 emissions. Many leading organisations are taking steps towards achieving decarbonisation and are reporting emissions throughout their value chain.

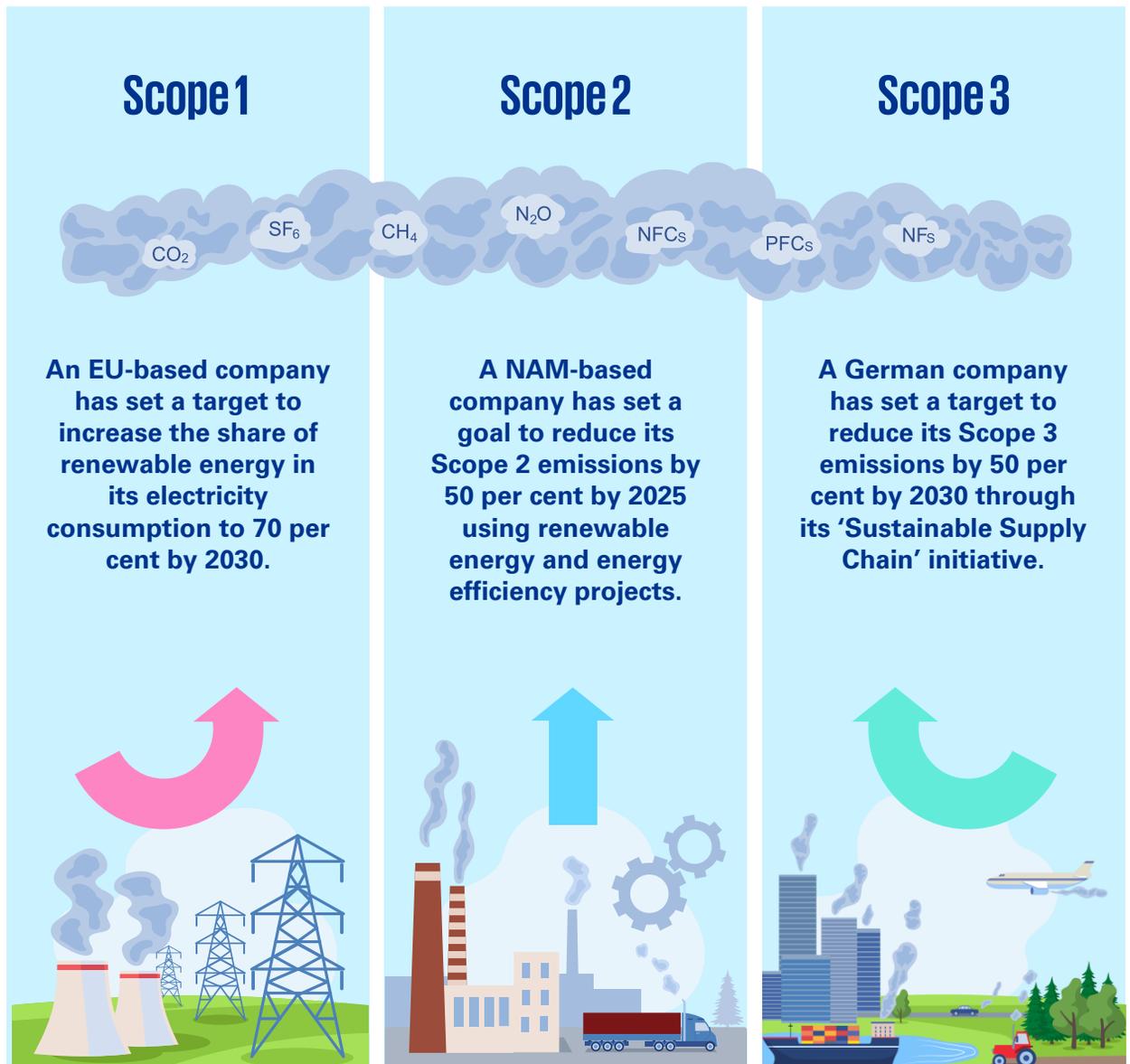
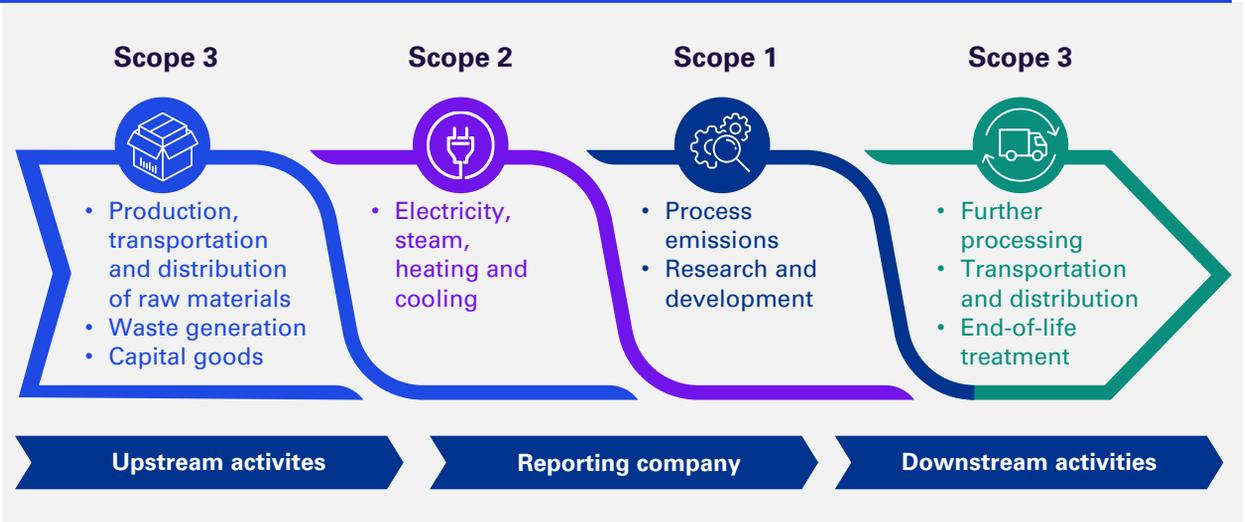
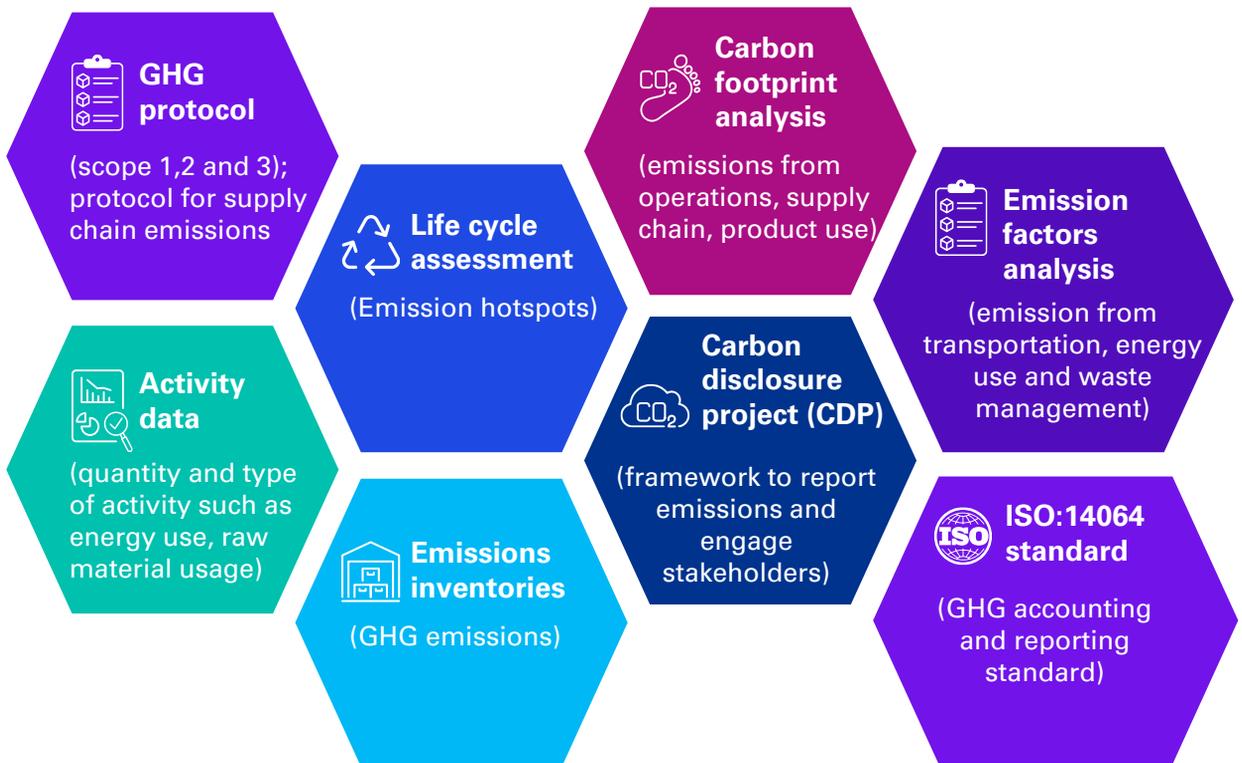


Figure 20: Chain of decarbonisation<sup>3</sup>



Methods of calculating carbon emissions are particularly beneficial for chemical companies as they are among the largest emitters of greenhouse gases. By accurately quantifying their carbon footprint, chemical companies can identify areas where they can reduce emissions and improve their environmental performance. Additionally, by implementing carbon accounting software and tools, chemical companies can streamline their data collection and analysis process, saving time and resources. Some of the ways in which companies analyse and report their emissions include:



3. C&EN World Chemical Outlook 2022

## 2.4 Adoption of green practices by chemical companies

In recent years, there has been a growing awareness of the need to adopt green practices in the chemical sector to reduce the impacts and promote sustainability. One of the keyways through which chemical companies can adopt green practices is by using renewable energy sources such as solar, wind and hydro power to reduce their carbon footprint. Overall, the adoption of green practices in the chemical sector is essential for promoting sustainability and reducing environmental impacts.

Considering the multitude of environmental challenges our planet currently grapples with, an immediate need for innovative solutions has arisen. Chemical companies are designing and producing cost-effective, cost-competitive chemical products and processes that achieve the highest level of pollution prevention hierarchy. The following table highlights a few of the recent green chemistry trends and levers making waves in the chemical industry and transforming how chemical products are produced.

**Table 1: Trends and levers in green chemistry**

Advanced Materials	Bio-based building blocks	Nanotechnology	Waterless processes	Green chemistry	Biotechnology
Graphene and advanced composites	Using bioplastics, biodegradable materials	Using nanoparticles, nano-coating	Using solvents such as ionic liquids, gas-phase reactions	Using local, renewable resources	Using microorganisms to produce bio-based chemicals
Closed-loop manufacturing	Digitalisation	Circular economy-based models	Sustainable transportation	Carbon Capture and Utilisation	Electrochemical Processes
Designing products and processes that are restorative and regenerative	Digital sensors and monitoring systems can be used to detect leaks and other issues in chemical processes	Business models, such as product-as-a-service and sharing models	Sustainable transportation options, such as electric or hybrid vehicles	Capture CO <sub>2</sub> emissions from chemical processes and convert them into valuable fuels, chemicals	Processes such as electrolysis to produce hydrogen gas

Green chemistry principles can also be used to design safer and more sustainable chemical products and processes. This involves using non-toxic and biodegradable materials, reducing the use of hazardous chemicals and designing processes that minimise energy consumption and waste generation.

## Few key advantages of green chemistry

- Encourages the use of renewable resources, such as biomass, algae, etc.
- Enhances brand image and reputation
- Leads to cost savings by reducing waste, energy consumption and the need for expensive pollution control measures
- Encourages the development of new, innovative technologies
- Reduces exposure to liability associated with environmental damage or health problem
- Provides better access to funding from investors who prioritise sustainability
- Reduces the risk of supply chain disruptions by promoting the use of local and renewable resources

## ESG-driven green initiatives by chemical companies globally

Green initiatives	Description
<b>Biodegradable plastic</b>	A German chemical company has developed a range of sustainable products and processes, including a biodegradable plastic alternative to polyethylene, which is made from renewable resources such as sugarcane.
<b>Biodegradable Aluminium</b>	A Canadian chemical company has developed biodegradable Aluminium alternative to traditional Aluminium, which is made from renewable resources such as bauxite.
<b>Sustainable enzymes</b>	A Danish biotech company that specialises in developing enzymes for use in a range of industries, including the chemical sector. The company has developed a range of sustainable enzymes that can be used to replace hazardous chemicals in chemical production, reducing the environmental impact of these processes.
<b>Bio-based materials</b>	A global chemical company has developed various sustainable products and processes, including bio-based materials and energy-efficient production methods.
<b>Green research and innovation</b>	An American chemical has established partnerships with universities and research institutions to promote innovation in green chemistry.
<b>Bio-based polyethylene</b>	A Japanese company has developed multiple sustainable products, including a bio-based polyethylene.
<b>Bio-based paint</b>	A Netherlands company has implemented a green chemistry program that focuses on sustainable raw materials, energy efficiency and reduced waste. They have developed bio-based paint.
<b>Waste reduction</b>	A leading Indian chemical company has introduced various sustainable products and processes, including bio-based materials and closed-loop systems that minimise waste generation.

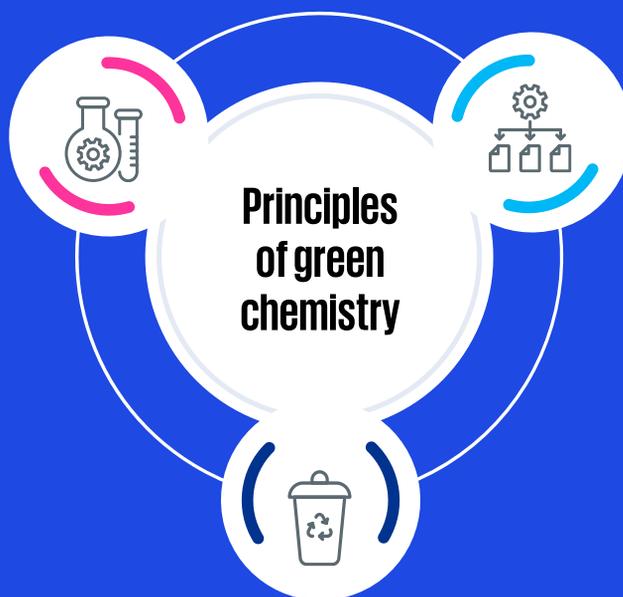
# Principles of green chemistry

## Safer alternatives during production

- Avoiding usage of auxiliary substances
- Use of renewable feedstocks
- Implementing safer chemistry for accident prevention
- Reduced usage of derivatives
- Using less hazardous chemical synthesis

## Efficient process design

- Design for energy efficiency
- Design for degradation
- Adoption of synthetic methods in production
- Designing safer chemicals with minimised toxicity
- Usage of catalytic reagents
- Real time analysis of pollution prevention



## Waste minimization

- Prevention of waste

From an Indian perspective, to better confront climate change, Indian chemical companies shall necessarily need to take a holistic and comprehensive approach towards sustainability and aim to improve ESG performance on environmental metrics, rather than looking at ESG aspects as purely compliance driven. Indian Chemical companies shall be required to develop multi-pronged strategies to adapt to the changing requirements and keep ESG at the very heart of their operations, which would poise them to derive sustainable business advantages. At the very least, the following areas should be considered as a starting point to embark on the ESG journey:

**Framing an ESG vision and strategy:**

Chemical companies endeavouring to move up the sustainability maturity curve need to formulate a clear ESG vision and convey it to all the stakeholders. Current practices need to be reviewed, post which sustainability levers which have the most material impact need to be prioritised on the basis of which the ESG strategy needs to be prepared.

**Developing decarbonisation strategies:**

Chemical companies must develop strategies to achieve decarbonisation without damaging business productivity and achieve increased business productivity without increasing overall emissions. This would enable the industry to not only decarbonise across different levels of emissions but also protect assets and business against an evolving regulatory landscape, changing demand patterns and also physical climate risk.

**Exploring green growth prospects:**

Product development needs to be undertaken with a focus on sustainability, as customers are increasingly choosing brands with strong ESG credentials and are ready to pay a premium in prices for such green products. Green chemistry trends and levers need to be adopted to cover the supply chain, right from resource acquisition, through consumption and to the disposal of products.





# 03 India as Chemicals Hub 2.0

## 3.1 Impact of supply chain disruptions and COVID in recent past

The chemical sector in India is a major industry in the Indian economy and contributes significantly to the country's GDP and employment. It drives growth by providing raw materials and performance to other sectors. It fuels the needs of several downstream industries such as textiles, papers, paints, varnishes, soaps, detergents, pharmaceuticals, etc. Except for a few hazardous chemicals, majorly the sector is delicensed and deregulated.

As of 2023, India is the world's sixth-largest producer of chemicals and the third largest in Asia. The market size of the Indian chemical industry is around ~USD 233 billion as of FY22 and is expected to expand at a CAGR of ~9 per cent reaching a value of ~USD 304 billion by 2025<sup>1</sup>.

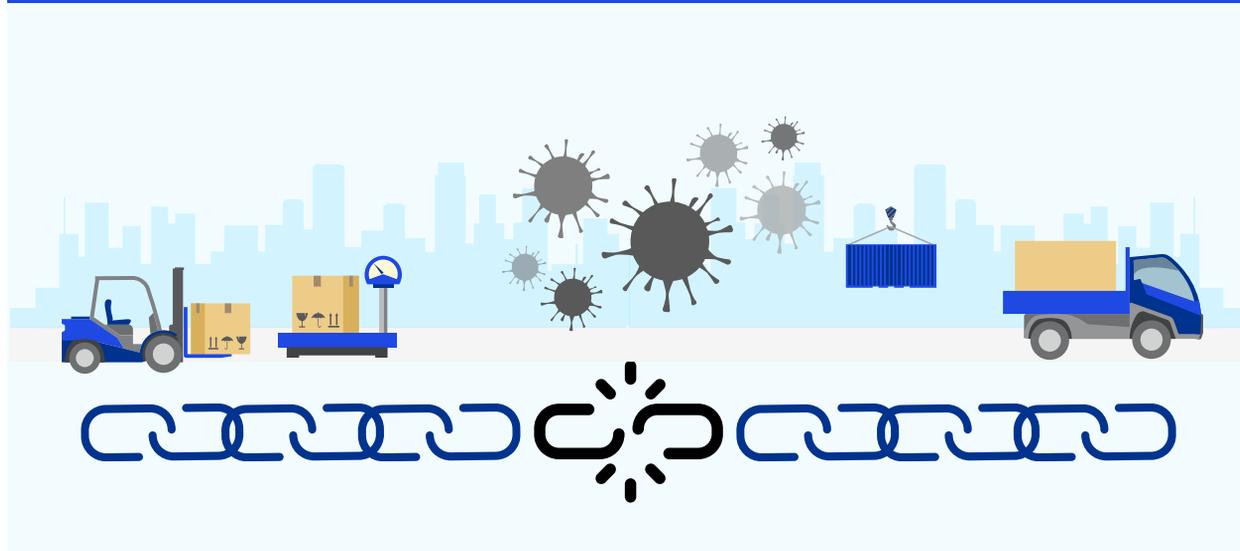
India is one of the largest consumers of chemicals in the world, but it is also heavily dependent on imports to meet its demand. The chemical sector in India imports around 80 per cent of its basic chemicals and 50 per cent of its specialty chemicals. Net import of

chemicals & petrochemicals increased from INR 1,20,902 Cr in FY18 to INR 1,61,740 Cr by FY22 and is likely to be over INR 3,00,000 Cr in FY25<sup>2</sup>. This high dependence on imports makes the sector vulnerable to global price fluctuations and supply disruptions. The reasons for India's high dependence on imports of chemicals include:

- Lack of domestic production capacity
- Predominant usage of outdated technology
- High cost of production.

Given the high import dependency, it is very critical for countries like India to ensure an uninterrupted global supply chain. The COVID-19 pandemic had a significant impact on businesses not just in India but all over the world. The pandemic has caused widespread disruptions to supply chains, demand, and operations. Many businesses have been forced to close temporarily or reduce their operations, and some have even gone bankrupt.

Figure 21: Supply chain disruption during COVID-19



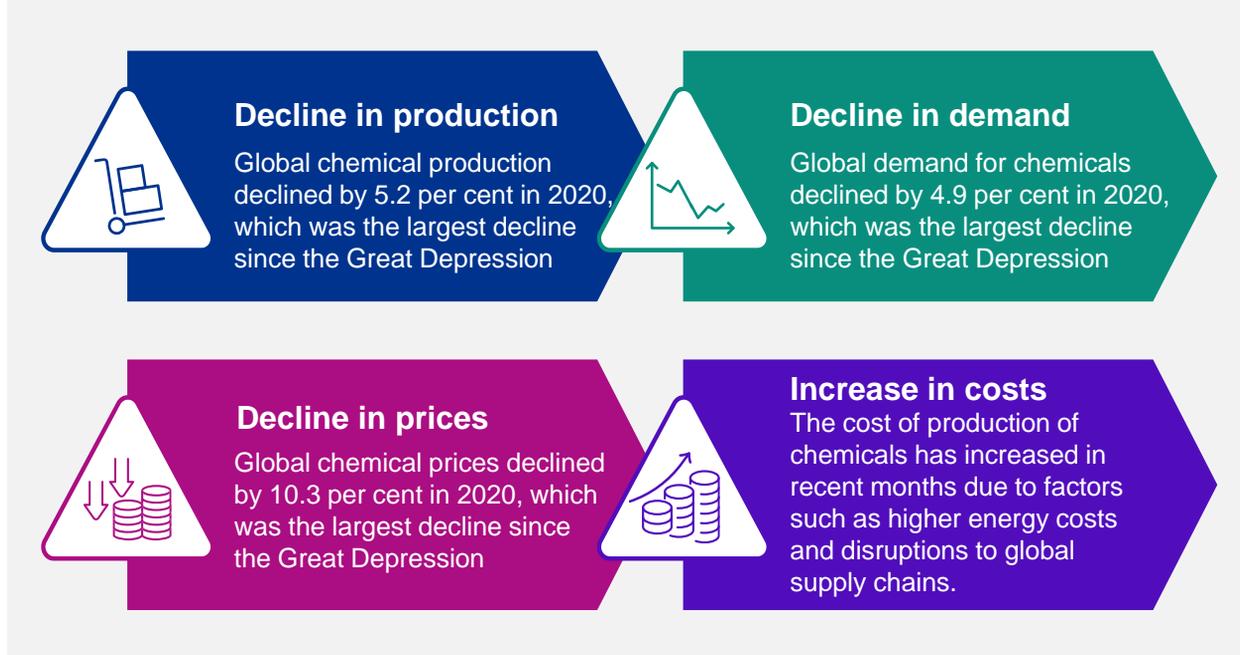
1. IBEF Report August 2023  
2. pib.gov.in, 2022

The COVID-19 pandemic has also had a major impact on the global economy. It has led to a sharp increase in unemployment and poverty around the world. Even major electronics behemoths were not resilient enough to avoid supply chain disruptions in China. Chinese factories experienced issues producing and assembling various electronic casings and memory chips which lead to unprecedented restrictions on the purchase behaviour of the end consumer.

The chemical sector has been one of the most affected sectors by the COVID-19 pandemic. The pandemic has caused widespread disruptions to global supply chains, which has made it difficult for chemical companies to obtain the raw materials and intermediate products they need to produce their products. The pandemic has also led to a decline in demand for chemicals from many of their downstream industries.



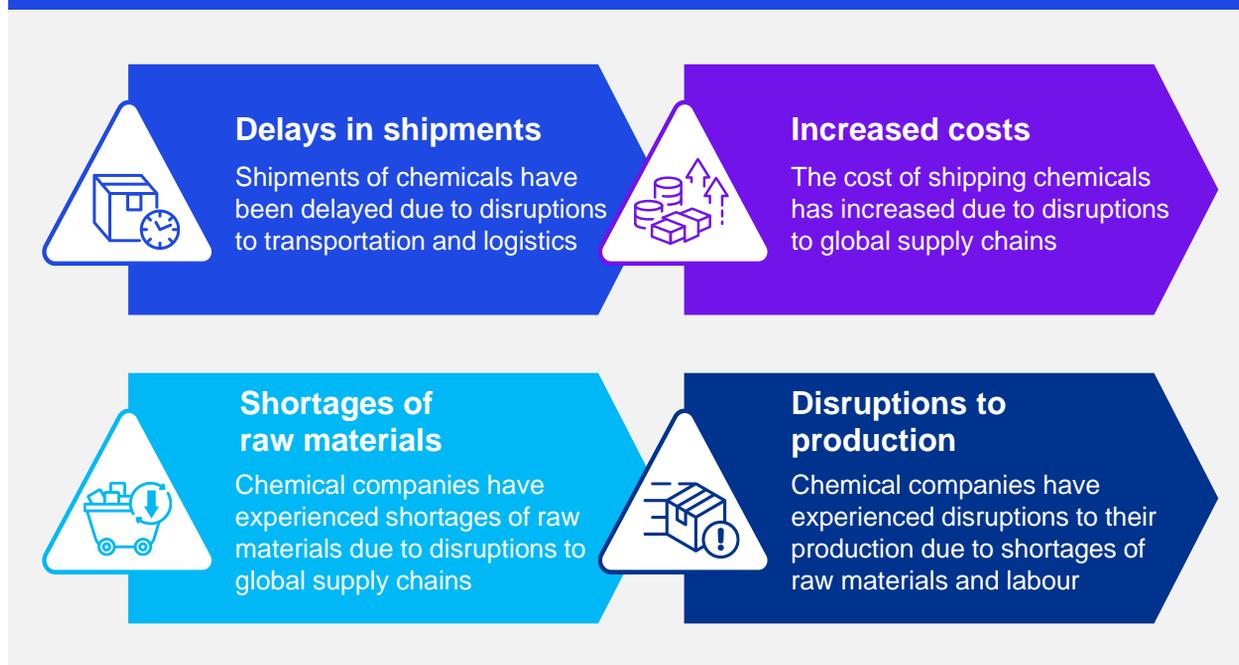
**Figure 22: Some negative impacts of COVID-19 pandemic on the chemical industry<sup>3</sup>**



3. IBEF Report August 2023

The COVID-19 pandemic has had a significant impact on global supply chains. The pandemic has caused widespread delays and disruptions to transportation, logistics, and manufacturing. These disruptions have made it difficult for businesses to obtain the raw materials and intermediate products required for production of products. The pandemic has also led to a decline in demand for goods and services, which has further disrupted supply chains.

**Figure 23: Negative impacts on the chemical supply chain**



Many chief executives now identify supply chain turmoil as the greatest threat to the sectoral growth which has a direct impact on national economies. Organisations need to re-imagine and manage their supply chain differently to ensure business continuity and growth for the future.

## 3.2 India emerging as viable manufacturing alternative

China has been the global manufacturing hub for several decades, attracting investments from all over the world. The country's favourable business environment, low labour costs, and efficient infrastructure have made it an attractive destination for manufacturers.

China received USD 179 billion in foreign direct investment (FDI) in 2021, accounting for 20 per cent of global FDI inflows and made China the world's largest recipient of FDI for the 19th consecutive year<sup>4</sup>. The chemical sector is one of the key sectors in China, attracting significant investments. In 2021, the Chinese chemical sector received USD 12.3 billion in FDI, accounting for 7 per cent of total FDI inflows into the country<sup>5</sup>.

The concentration of manufacturing and assembling in China has made the global supply chain vulnerable to disruptions. The COVID-19 pandemic has highlighted the risks of this over-concentration, as it has caused widespread supply chain disruptions and shortages of goods. These supply chain disruptions have had a significant impact on businesses around the world including India. The Indian chemical sector had been particularly affected, as it was heavily dependent on imports from China.

India and China are the two largest economies in Asia and two of the most important manufacturing hubs in the world. However, there are some key differences between the two countries that investors should consider before planning an investment.

- **Labour Costs** – These are one of the key factors that investors consider when taking decisions. Labour costs in India are significantly lower than those in China. For example, the average monthly wage for a manufacturing worker in India is around USD 200, while the average monthly wage for a manufacturing worker in China is around USD 600<sup>5</sup>.
- **Infrastructure** – China has a more developed infrastructure than India. This includes roads,

railways, ports, and airports. The better infrastructure in China makes it easier to transport goods around the country and to export them to other countries.

- **Regulatory Environment** – The regulatory environment in China is comparatively complex than that in India. The Indian government, on the other hand, in the recent years, has taken steps to streamline the regulatory environment for foreign investors.

Both India and China offer several advantages for investors in the chemical sector. India has almost similar advantages like China, which includes lower labour costs, a more favourable regulatory environment, and a growing domestic market. Hence, India is a viable alternative to China for investment in the chemical sector



4. World investment report 2023, UNCTAD

5. Chemical and Petrochemical Statistics at a Glance - 2022, DCPC

## 3.3 Enablers for capturing export and manufacturing opportunity

India's chemical exports have been growing steadily in recent years. In 2021-22, India exported USD 16 billion worth of chemicals, up from USD 11 billion in 2020-21<sup>6</sup>. The key export destinations for Indian chemicals include the United States, the United Arab Emirates, China, Bangladesh, and Germany.

The key enablers that can make India an attractive manufacturing hub for chemicals and exports.

- Enhancing Domestic Production:** Identifying opportunities for R&D incentives and collaborations with foreign companies can boost technology transfer and develop indigenous capabilities in specialty chemicals.
- Policy and regulatory reforms:** Government policies are crucial enablers of making India a chemical hub as they provide incentives for domestic production, innovation and export competitiveness. The Indian government has already implemented several policies to support the chemical sector, such as the National Chemical Policy, Chemical Promotion Development Scheme (CPDS), and the Plastic Park Scheme.
- Ease of doing business:** Implementing free trade agreements with key countries to reduce tariffs can create new market opportunities for Indian chemicals. Investments in promoting Indian chemicals globally, highlighting their quality, cost-competitiveness and sustainability features, providing financial assistance, market research, and export facilitation services to Indian chemical companies can help boost chemical exports
- Focus on green and sustainable chemicals:** Investing in the production of bio-based and eco-friendly chemicals to align with global demand and meeting international environmental standards can help the Indian chemical sector to gain a competitive edge, access to new markets and attract investments and partnerships

India heavily relies on its chemical imports despite being one of the top exporters. The total value of India's chemical imports in the year 2023 is estimated to be around INR 1000 crores (USD 120 billion)<sup>7</sup>. This is primarily contributed by growing domestic demands and limited production due to technological and infrastructure limitations, economic and regulatory factors, skill gaps and indigenous resources.

While India makes a steady progress towards achieving complete 'Atmanirbharta' in the chemical sector, it requires sustained efforts and continuous adoption to evolving market dynamics and technological advancements. The Department of Chemicals and Petrochemicals Vision 2024 aims to use this opportunity to establish India as a leading chemicals and petrochemicals manufacturing hub, with importance on reduction in import dependency by attracting investments for manufacturing quality products using cutting-edge technologies in specified clusters with focus on sustainability and contribute USD 200 billion to the manufacturing sector<sup>8</sup>. Demographic dividends, low per capita consumption, steadily increasing export demand and positive government steps and initiatives are expected to transform India into a global manufacturing hub for chemicals and petrochemicals and help realise the vision of the country becoming a USD 5 trillion economy<sup>9</sup>.

6. IBEF Report dated August 2023

7. Statista

8. Chemical and Petrochemical Statistics at a Glance - 2022, DCPC

9. data.worldbank.org, KPMG analysis



# 04 Innovating for brighter future for chemicals

## 4.1 Emergence of green chemicals

There is an ever-growing concern over the adverse effects of industrial chemicals and synthetic materials on human health and environment. The term 'safe' is sometimes difficult to define and the definition has to involve personnel, institutional, or social values and regulatory requirements. The concepts of green and sustainable chemistry have gained significant attention around the world given their potential to innovate and advance

chemistry to help achieve global sustainable development goals. The global green chemicals and materials market is estimated to be ~USD 100+ billions and is expected to grow at CAGR of 10 per cent till 2030<sup>1</sup>. A framework manual was designed by the United Nations Environment Programme which indicates ten objectives which could be achieved through green and sustainable chemistry.

Figure 24: Objectives of Green and Sustainable Chemistry by UNEP<sup>2</sup>

### Minimizing chemical hazards



Design of chemicals with minimised (or no) hazardous properties for use in materials, products, and production processes

### Avoiding regrettable substitutes and alternatives



Develop safe and sustainable alternatives for chemicals of concern through material and product innovations that do not create negative trade-offs

### Sustainable sourcing of resources and feedstocks



Use of sustainably sourced resources, materials and feedstocks without creating negative trade-offs

### Advancing sustainability of production processes



Use of green and sustainable innovation to improve resource efficiency, pollution prevention, and waste minimisation in industrial process

### Minimising chemical releases and pollutions



Reducing chemical releases throughout the life cycle of chemicals and products

1. Straits research 2023

2. United Nations Environment Programme 2020

## Enabling nontoxic circularity



Use of chemistry innovations to enable non-toxic circular material flows and sustainable supply and value chains throughout the life cycle

## Maximising social benefits



Consider social factors, high standards of ethics, education, and justice in chemistry innovation

## Protecting workers, consumers and vulnerable populations



Safeguard the health of workers, consumers, and vulnerable groups in formal and informal sectors

## Developing solutions for sustainability challenges



Focus chemistry innovation to help address societal and sustainability challenges

Green Chemistry is defined as the invention, design and application of chemical products and processes to reduce or to eliminate the use and generation of hazardous substances in any form. They are made from renewable resources, are biodegradable, and have low toxicity. Green chemicals are essential for building a more sustainable future, and they are becoming increasingly important in a wide range of industries, including agriculture, energy, and manufacturing.

Some examples of green chemicals include:

- **Bio-based plastics** – these plastics are made from renewable resources such as corn starch, or sugarcane, instead of petroleum.
- **Biodegradable solvents** – these solvents are made from renewable resources and can be broken down by microorganisms.
- **Green catalysts** – these catalysts are used to speed up chemical reactions without harming the environment.
- **Biofuels** – Biosuccinium is a 100 per cent biobased succinic acid produced by converting renewable, plant-based resources via a novel low pH yeast process
- **Green cleaning products.**

1. Straits research 2023

2. United Nations Environment Programme 2020

## 4.2 Digitalisation and Innovation initiatives to build manufacturing edge

Digitalisation and innovation are transforming the chemicals industry. Companies are using digital technologies to improve efficiency, reduce waste, and develop new products and processes. There are three main ways in which digital will affect the chemical industry.

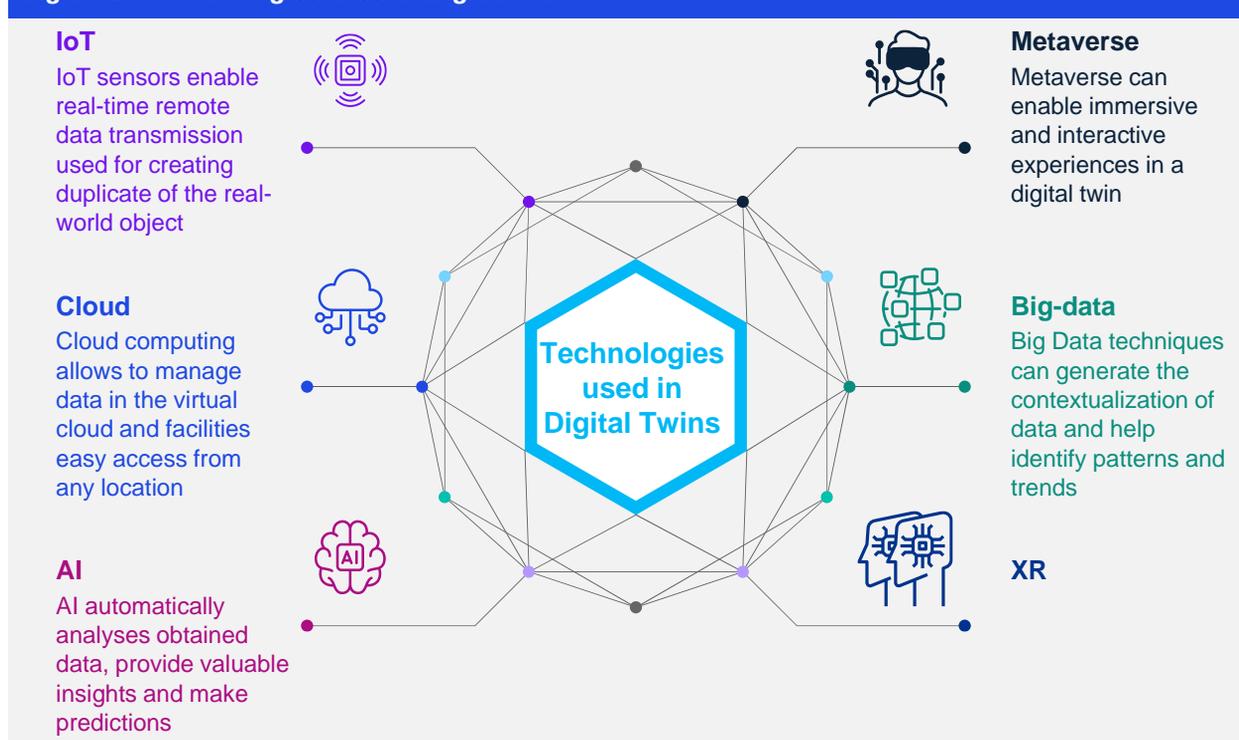
- The first is using digital-enabled approaches to improve companies' business processes, which we call functional excellence.
- Second is the potential for digital to assess and model demand patterns in end markets, with implications for the chemical industry's value chains.

- The third is where digital developments lead to changes in the business models through which chemical companies capture and create value for customers.

Some examples of such initiatives in chemicals industry include:

- **Digital Twin technology** – A digital twin is a virtual model designed to accurately reflect a physical object
- **Artificial Intelligence (AI) and Machine Learning (ML)** – to develop new products, and predict market trends.

Figure 25: Technologies used in Digital Twins



- **Big data analytics** – used to analyse large datasets of chemical data to identify patterns and trends. This information can be used to improve efficiency, reduce costs, and develop new products
- **Internet of Things (IoT)** – used to connect chemical plants and equipment to the internet. This allows data to be collected and

analysed in real time, enabling faster and more informed decision making.

These digital technologies are helping build the age of green chemicals by enabling companies to develop more sustainable products and processes. They are also helping to improve efficiency and reduce costs, which makes the chemical industry more competitive.

## 4.3 Enablers for sustaining growth & innovation

Innovation is essential for the future of the chemical industry. There are a number of enablers that can help to sustain growth and innovation in the chemical industry.

These include –

- **Government support** – Governments can play a role in supporting innovation in the chemical industry by providing funding for research and development (R&D), creating tax breaks for R&D, and investing in infrastructure

US Government has established a number of programs to support innovation in the chemical industry. One such program is the Advanced Manufacturing National Program Office (AMNPO). It provides funding for research and development in advanced manufacturing technologies

- **Collaboration** – Collaboration between companies, universities, and government agencies can help to accelerate innovation

European Union established European Chemical Industry Council (CEFIC) which is a trade association that represents the European chemical industry. CEFIC works

to promote innovation and sustainability in the chemical industry

- **Investment** – Investment in new technologies and R&D is essential for sustaining growth and innovation in the chemical industry
- **Education** – Investing in education and training is essential for developing the skilled workforce that the chemical industry needs to innovate.

The Government of India has set up Centre of Excellence with an aim to help in development of new products, newer applications, innovation and improvement of technology, process innovation, quality, environmentally sustainable development, etc.

- **Technological advancements** – Implementation of digital technologies to optimise processes and developing new materials with improved properties and bio-based materials such as bioplastics, self-healing materials and graphene can create new markets and applications.



# Key takeaways

The Indian chemicals sector is a fast-growing sector with a high CAGR of 9 per cent<sup>1</sup>. The sector exhibits several positive aspects that contribute to its overall strength and potential in terms of expansion and diversification making it a significant contributor to the nation's economic development. However, the Indian chemicals sector can take several strategic actions to further enhance its market, sustainability, and overall positive impact on the economy.

Firstly, investing in research and development is highly crucial. The industry should allocate resources to innovate new processes, materials and technologies that align with global sustainability standards. Through fostering a continuous innovation, the sector can stay ahead of regulatory changes, stringent compliances, environmental concerns, and path a way to develop high-value eco-friendly products.

Secondly, adopting digitalisation can significantly improve efficiency and operational excellence. Advanced technologies such as AI, IoT, Bigdata, etc., can optimise production processes, enhance supply chain management, and reduce resource consumption. Digitalisation along with concerted efforts towards sustainable

practices like production of green chemicals, adoption of green manufacturing processes, minimisation of waste and emissions, and incorporation of circular economy principles can contribute towards better environmental standards, align with the global market trends and address the everchanging customer preferences.

Lastly, ensuring supply chain resilience. Chemical companies need to build a more resilient supply chain to protect themselves from small to large scale disruptions. Considering the fact that chemical sector relies heavily on the international trade, it become extremely important for chemical companies to build resilient supply chain.

While the chemicals industry start their transition journey towards a sustainable approach, assistance from government in an appropriate form could expedite the transition. Provision of production linked financial incentives, subsidies and budget allocation for research and development, incentives for environmentally friendly practices, creation of public forums for collaboration across the industry are some of the ways the government bodies could assist the chemicals sector.

1. IBEF report, August 2023

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## Confederation of Indian Industry

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- Shamayata Chowdhury – Consultant

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- Shveta Pednekar – Manager
- Khushi Kansara – Executive

# About KPMG

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KPMG firms are a leading provider of advisory, audit, and tax services to the chemicals and materials industry. KPMG professionals understand the new realities of today's chemical industry and have extensive experience working with the world's leading chemicals and performance technology companies

# About CII

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering Industry, Government and civil society, through advisory and consultative processes.

CII is a non-government, not-for-profit, industry-led and industry-managed organization, with around 9,000 members from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 300,000 enterprises from 286 national and regional sectoral industry bodies.

For more than 125 years, CII has been engaged in shaping India's development journey and works proactively on transforming Indian Industry's engagement in national development. CII charts change by working closely with Government on policy issues, interfacing with thought leaders, and enhancing efficiency, competitiveness and business opportunities for industry through a range of specialized services and strategic global linkages. It also provides a platform for consensus-building and networking on key issues.

Extending its agenda beyond business, CII assists industry to identify and execute corporate citizenship programmes. Partnerships with civil

society organizations carry forward corporate initiatives for integrated and inclusive development across diverse domains including affirmative action, livelihoods, diversity management, skill development, empowerment of women, and sustainable development, to name a few.

As India strategizes for the next 25 years to India@100, Indian industry must scale the competitiveness ladder to drive growth. It must also internalize the tenets of sustainability and climate action and accelerate its globalisation journey for leadership in a changing world. The role played by Indian industry will be central to the country's progress and success as a nation. CII, with the Theme for 2023-24 as 'Towards a Competitive and Sustainable India@100: Growth, Inclusiveness, Globalisation, Building Trust' has prioritized 6 action themes that will catalyze the journey of the country towards the vision of India@100.

With 65 offices, including 10 Centres of Excellence, in India, and 8 overseas offices in Australia, Egypt, Germany, Indonesia, Singapore, UAE, UK, and USA, as well as institutional partnerships with 350 counterpart organizations in 133 countries, CII serves as a reference point for Indian industry and the international business community.

# KPMG in India contacts:

## **Akhilesh Tuteja**

Head  
Clients and Markets  
P: +91 124 2549191  
E: [atuteja@kpmg.com](mailto:atuteja@kpmg.com)

## **Manas Majumdar**

Partner, Leader  
Oil & Gas and Chemicals  
M: +91 98117 55297  
E: [manasm@kpmg.com](mailto:manasm@kpmg.com)

## **Ram Soni**

Associate Partner  
Transformation S&O  
M: +91 82900 97572  
E: [ramsoni@kpmg.com](mailto:ramsoni@kpmg.com)

# CII contact:

## **Priya Katoch**

Confederation of Indian Industry  
P: + 91 11 45771000  
E: [priya.katoch@cii.in](mailto:priya.katoch@cii.in)

[cii.in](http://cii.in)

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KPMG Assurance and Consulting Services LLP, Lodha Excelus, Apollo Mills Compound, NM Joshi Marg, Mahalaxmi, Mumbai - 400 011 Phone: +91 22 3989 6000, Fax: +91 22 3983 6000.

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