Harnessing the Potential of **Sustainable Manufacturing and Circular Economy in the Indian Chemical Industry**

FICCI GCPMH 2023
Knowledge paper
July 2023

pwc

FICCI

Messages from Ministries

Messages from Ministries

भगवंत खुबा
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BHAGWANTH KHUBA

सत्यमेव जयते

Azadi Ka Amrit Mahotsav

रसायन एवं उर्वरक एवं
नवीन एवं नवीकरणीय ऊर्जा राज्य मंत्री
भारत सरकार
Minister of State for
Chemicals & Fertilizers and
New & Renewable Energy
Government of India

26.07.2023

MESSAGE

Chemical industry touches upon the every segment of human life - be it food, healthcare or energy. The chemical industry has been constantly offering new range of products to meet the growing demand of the population ranging from access to food to medical care to increased connectivity. The chemicals industry is instrumental in providing vital products such as fertilizers, pesticides, pharmaceuticals, plastics, insulation, wiring, battery chemicals, adhesives, etc.

With the support of the Indian government, the chemical industry has witnessed remarkable growth in recent times. The Indian industry has been modernizing over time through the development of novel molecules, technological advancements and improvement in product quality. Also, Indian chemical industry is foraying into new technologies and helping the country to become a world-class chemical industry, which is international competitive. Despite global supply disruptions, this sector is able to record a growth of nearly 100% during the FY 2022-23. Global dynamics that are affecting the chemical industry would present lucrative opportunities for the Indian chemical sector in the near future.

I am delighted to note that Department of Chemicals & Petrochemicals, Ministry of Chemicals & Fertilizers, Government of India jointly with Federation of Indian Chambers of Commerce and Industry (FICCI) is organizing the **"3rd edition of India: Global Chemicals and Petrochemicals Manufacturing Hubs" (GCPMH)** in New Delhi. The industry offers a wide scope for development that contributes positively to economic growth and regional development. The future outlook for the industry is bright with positive developments anticipated in various chemical sub sectors.

Wishing the Summit, a great success. I am sure that the summit will provide the landscape of opportunities available in changed circumstances and explore areas of growth in the industry.

(Bhagwanth Khuba)

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Messages from DCPC

अरूण बरोका, भा.प्र.से.
ARUN BAROKA, IAS

सचिव
भारत सरकार
रसायन और उर्वरक मंत्रालय
रसायन और पेट्रोरसायन विभाग
Secretary
Government of India
Ministry of Chemicals & Fertilizers
Department of Chemicals & Petrochemicals

26th July 2023

Message

The Indian chemical industry is the third-largest producer in Asia and the sixth largest globally. It plays a vital role in India's economic growth, contributing around 3.4% to the country's GDP and employing a substantial workforce. This industry holds a strong position globally and contributes significantly to India's manufacturing sector.

2. India, a vibrant and rapidly expanding economy, proudly stands as one of the world's fastest-growing economies. Our nation's progress is fuelled by a highly growing demand for chemicals and petrochemicals, which shows no signs of slowing down despite global disruptions. The sector is projected to grow by 11 to 12 percent during 2021–26 and by 7 to 10 percent during 2027–2040, these by tripling its global market share by 2040. However, as this growth surges ahead, we face an increasing gap between imports and exports. To bridge this gap and foster further development, the country needs to attract international investments.

3. The Government of India has set up 4 PCPIRs (Petroleum, Chemicals, and Petrochemicals Investment Region), a large infrastructure driven zones enabling growth of both upstream and downstream industries. Production Linked Incentives (PLIs) in 14 allied sectors have further strengthened the manufacturing of chemicals in India. The Government is also exploring the establishment of Speciality Chemical Parks/Chemical Hubs throughout the country, where we aim to bring together the finest talent from around the world to invest in and capitalize on the countless opportunities available.

4. The "3rd edition of India: Global Chemicals and Petrochemicals Manufacturing Hubs" (GCPMH) jointly organised by Department of Chemicals & Petrochemicals, Ministry of Chemicals & Fertilizers, Government of India with Federation of Indian Chambers of Commerce and Industry (FICCI) is an effort to showcase India's potential as a global leader in the chemicals and petrochemicals industry and reinforce country's commitment to contributing to the global value chain. GCPMH offers a valuable platform for fostering international partnerships and attracting foreign investment to further boost the sector's growth.

I wish GCPMH 2023 a resounding success.

(Arun Baroka)

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Messages from the CEOs

Mr. Deepak C. Mehta
Chairman and Managing Director,
Deepak Nitrite Limited

Chemical Parks: for the next sectoral Quantum Jump

Importance of the Chemical sector is well known to all the stakeholders and needless to say growth of the sector will be a cornerstone for the nation's collective USD 5 trillion dream. Amidst currently experienced global headwinds, including from China, Indian Chemical & Petrochemical Industry needs to continue its growth momentum and maintain optimism to meaningfully participate in India's growing chemical consumption. This is a pre-requisite for Indian Chemical Sector to leapfrog to its target of USD 1 Trillion by 2040. In essence, our industry is at an inflection point and is at the juncture where "right" actions taken today will have "disproportionate beneficial" influence on both sector and the Country for decades to come.

One such action will be around getting more traction around Chemical Parks which are essentially integrated & interdependent Chemical & Petrochemical manufacturing hub(s). Globally, it's proven that Chemical Parks are quite essential creating cost competitive downstream units and have sustained competitive advantage over standalone similar sized units. As we gather on the occasion of the 3rd edition of India: Global Chemicals and Petrochemicals Manufacturing Hubs, it becomes important for us to take stock of issues discussed in last two editions and chalk out clear action plan to create these much-needed chemical hubs in India. We have been working on the idea of Chemical Parks since early 2000's and already have PCPIR (Petroleum, Chemicals and Petrochemicals Investment Region) policy. PCPIR policy has met with limited success so far and has failed

to create ‘interdependent and integrated’ manufacturing hub for Chemicals & Petrochemicals. Despite that, the sector continued to grow throughout the last two decades on the back of intrinsic individual strength while also getting support from global tailwinds from time to time. However, we still lag in terms of overall size and diversity of the industry and have to continue to rely on imports to a great extent.

As we face the ripples of geopolitical conflicts like the Ukraine -Russia war, destabilising of the supply chain for critical feedstock, flash price spikes hampering smooth operations and humongous capacity additions in China across value chains; we are staring at next few years which will be challenging in terms of sustaining margins. However, this is also a time when we prepare ourselves for future and create integrated, interdependent, and sustainable platform for the “Industry of the Future” in the form of Chemical Park(s).

A clarion call for the future is for us to be resilient, reinvent and reinvest in ourselves. To remain competitive, we need to be invested in the process of change by increasing our intellectual quotient, upgrading our infrastructure, innovating via R&D, adopting forward & backward integration strategies for world-scale production facilities and sustainability-oriented approaches. We will be able to navigate the undercurrents of challenges if we conduct ourselves with optimism, albeit vigilant one, and agile responsiveness. In addition to much awaited sector specific Production Linked Incentive (PLI) scheme, developing dedicated integrated manufacturing hubs under PCPIR/Chemical parks will surely attract large investments from both domestic and international players. We will need to create an ecosystem that creates facilities (such as on-purpose building block manufacturing, utilities, common-infrastructure) with economies of scale and bring in much needed Competitive Advantage. The need to do a thorough assessment around structuring of Chemical Parks and evaluation of factors such as product specific or value chain driven or common chemistry infrastructure driven (phosgenation, cyanation etc.) is critical. We also need to deliberate on the role of private sector in development of such Chemical parks and whether there is need for private sector to play larger role in the Design & Operations of Chemical Park rather than being limited as an investment partner. We need to fast learn from how such successful chemical parks were created in other geographies and quickly customise solutions relevant for our needs, carefully considering our unique strengths.

As we work on the mission of “Atmanirbharata”, we must acknowledge “Development of world-scale Chemical Parks” is a necessary, a must condition and no longer an option.

We, therefore, need to take a Quantum Jump, and not just a Leap of Faith.

Messages from FICCI

Mr. Prabh Das

Chairman, FICCI National Petrochemicals Committee and Managing Director & CEO, HPCL-Mittal Energy Limited

The Chemicals and Petrochemicals Industry is a key contributor to the Indian economy. India is projected to be the fastest growing major economy in the next five years, and we see this same trend in the polyolefin demand. Globally the polyolefin capacity addition led by China and US has outpaced demand growth in the last three years. However, the demand growth is burgeoning in India, bringing opportunities for new investment in the country.

In the next five years, the chemicals and petrochemicals industry is expected to grow at a rate of 7.5% to 9.5% CAGR. The industry has performed reasonably well despite facing challenges such as excess Global capacity, Geopolitical conflicts, and weak demand from developed economies. The Government of India has supported the growth of Chemicals and Petrochemicals Industry in India by implementing policies such as Production Linked Incentive schemes, easing environmental clearance, simplifying labor laws and programs such as Make in India. The growth will be fueled by strong domestic and regional demand. India can become a Global manufacturing hub for Petrochemicals and export to the international market with continued policy support from the Government.

The Chemicals and Petrochemicals industry plays a crucial role in society, providing essential products and services for various sectors and applications, such as agriculture, health, transport, construction, and energy. However, our industry also faces significant challenges in terms of its environmental impact, especially its carbon footprint. There are multiple opportunities to manage carbon footprint along the complex supply chain such as using alternate feedstocks such as biomass, plastic wastes, liquid wastes etc., powering operations through renewable gas and power, on-site electrification, producing low-carbon synthetic fuels, more sustainable petrochemicals, and deeper chemical integration. Each of these can unlock value for companies.

Circular economy is crucial for the Petrochemical Industry to help us address the challenges of plastic waste by reusing and recycling plastics as much as possible. We need to develop advanced chemical recycling technologies to add value to plastic wastes. We also need to evaluate and promote end-of-life uses for plastics that cannot be recycled or reused.

At HMEL, we maintain high conviction of India's growth potential and have made investments in India setting up capacities of 11.3 million MT per annum refinery, 1.2 million MT per annum multi-feed cracker along with 1.2 million MT per annum Polyethylene and 1 million MT per annum Polypropylene plants. Entire Petrochemical complex has been commissioned and contributing towards India's polymer industry growth through suitable import substitution. We are also actively pursuing opportunities in decarbonisation and promoting end-of-life use cases for plastics, such as plastic waste in road construction.

I am very glad to observe that FICCI jointly with the Department of Chemicals and Petrochemicals, Government of India is organizing the 3rd summit on Global Chemicals and Petrochemicals Manufacturing Hubs in India. I hope that the summit attendees find the insights shared in this knowledge paper helpful and explore the potential that India offers.

I wish everyone all the very best for the event.

Federation of Indian Chambers of Commerce and Industry

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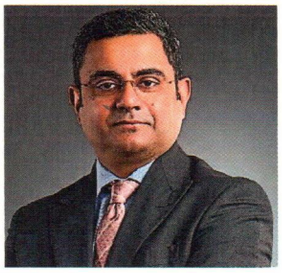
Subhrakant Panda
President



Knowledge Paper
3rd Edition of Summit on
"Global Chemicals and Petrochemicals Manufacturing Hubs in India" (GCPMH 2023)
27th – 28th July 2023 at Hotel Le Meridien, New Delhi
Theme: Sustainability and Circularity

Chemical and petrochemical industry is an important and growing constituent of the Indian economy. Covering more than 80,000 commercial products, the Indian chemicals sector is highly diversified and provides several building blocks & raw materials for a number of key industries. It employs more than 2 million people and has a significant role to play to make India a $5 trillion economy.

The Department of Chemicals and Petrochemicals (DCPC), Government of India, has taken significant initiatives to facilitate and boost the development of this sector. A slew of incentives and policy support has been extended to the industry. As a result, India's chemicals sector is on a high growth trajectory. Currently valued at around $220 billion, India's chemical industry is expected to touch $300 billion by 2025 and attain the $1 trillion mark by 2040. Compared to other locations, India has emerged as an attractive business destination for the global chemicals industry on multiple critical parameters.

I am delighted that the Department of Chemicals and Petrochemicals (DCPC), Government of India is organizing, in association with FICCI, the 3rd edition of the Summit on Global Chemicals and Petrochemicals Manufacturing Hubs in India (GCPMH 2023) on 27-28 July 2023 in New Delhi with the theme "Sustainability and Circularity".

I am confident, GCPMH 2023 will accelerate the momentum of development of the chemicals & petrochemicals sector in the country and help in attracting further investment in this area.

I wish this important event a great success and hope all the participants will immensely benefit from it.

Subhrakant Panda

July 25, 2023
Delhi

Foreword

Mr. Manoj Mehta
Head- chemicals and petrochemicals
FICCI India

The chemical industry has played a pivotal role in shaping up the Indian economy and providing livelihood opportunities to more than two million individuals. Chemicals and Petrochemicals are playing an increasingly important role in improving the quality of life of the people as well as support the manufacturing sector having its application spread across the segments.

The chemical industry has been driven by an increasing domestic demand and strong growth in exports. With the flagship initiatives of the government to improve the ease of doing business and zeal towards making India, a global manufacturing hub for chemicals and petrochemicals, Indian Chemical Industry is set to witness positive changes and lead as an epitome of investment destination in near term.

The Government and the private sectors can collectively address the challenges faced by the industry and pave the way towards the sector's long-term growth.

Foreword

Mr. Deepak Mahurkar
Partner – Energy & Chemicals
PwC India

PwC in India recently completed its 150 years of presence in India. On this momentous occasion, it is a matter of pride to also associate with FICCI Global Chemicals and Petrochemicals Manufacturing Hub (GCPMH) 2023 as Knowledge Partner.

In the past year, as the global chemical industry looked towards optimistic growth horizons to its pre-Covid size, the world dynamics kept evolving with the economic slowdown and impact of Russia-Ukraine war. The global Chemicals and Petrochemicals industry is affected by the geo-politics and is constantly addressing the challenges of global economic developments. With the world focusing on sustainable solutions to achieve the net zero targets and address the concerns for climate change, new growth areas continue to present opportunities for the industry. For the Indian industry, these opportunities from the transformation to a sustainable and circular economy are crucial to become the world's manufacturing hub and global economic leader.

GCPMH 2023 would offer an interesting platform for stakeholders to collaborate and share their knowledge on the industry best practices, innovations and solutions to address the pressing need for sustainable manufacturing and circular economy.

PwC is delighted to have supported the Department of Chemicals and Petrochemicals under the Ministry of Chemicals and Fertilizers and FICCI to undertake program management of the FICCI Chemicals and Petrochemicals Awards 2023 and developing the Knowledge Paper.

The Knowledge Paper elucidates the work the industry has put in to deal with environmental sustainability requirements and adopt circular economy. The paper covers the details of the aspects of current industry size & growth drivers, policies and government initiatives for sustainability and circular economy, and the business models that can be adopted by the industry stakeholders to build the businesses resilient and circular. This paper provides background to the GCPMH 2023 to discuss the role of India's Chemicals and Petrochemicals industry in emerging as the global manufacturing hub.

Wishing GCPMH 2023 a grand success.

Yours faithfully,
Deepak Mahurkar
Partner, PwC

Contents

India – the next manufacturing hub

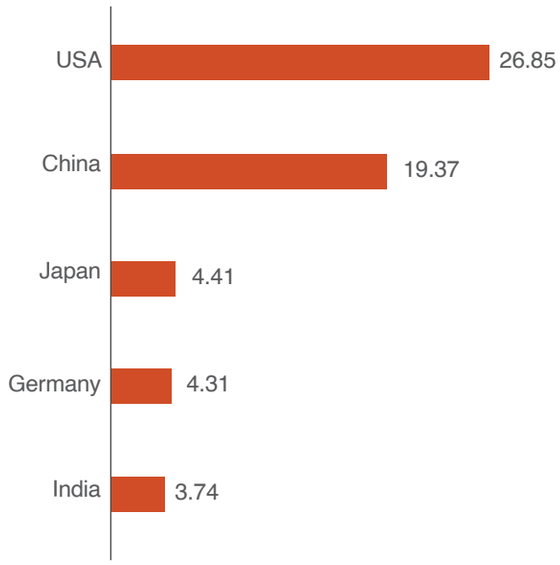
Current Indian scenario

In 2022, India defied the global trends and witnessed a tremendous economic growth remaining the fastest growing economies in the world. The Indian economy remained resilient even during global consumption slowdown and economic headwinds caused by geopolitical factors. The resilience was a consequence of large domestic market demand coupled with government's support to strengthen the supply through reforms like PLI schemes, national logistics reform, digitalisation, fostering ease of doing business, etc.

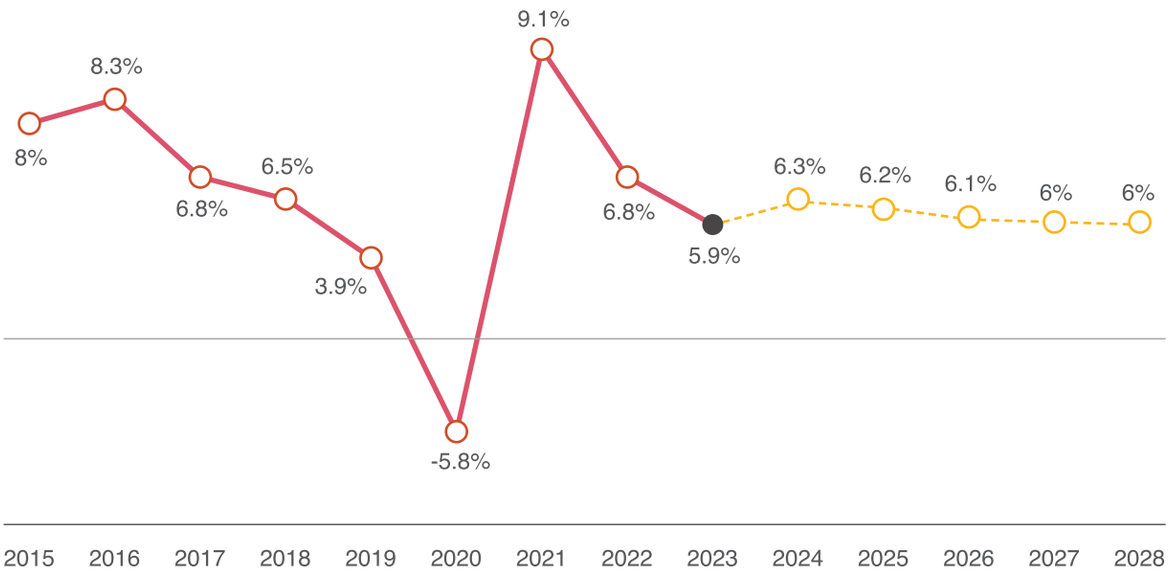
According to IMF, India's GDP for the financial year 2022-23 is estimated to be USD 3,740 trillion with an annual growth of 5.9%. In 2023, through its presidency of the G20, India is inclined to achieve higher economic growth inclusive development, accelerate exports from the core industries, gain position on the global value chain, and expand its contribution to the green sector to meet the climate action targets.

In 2022, Prime Minister Shri Narendra Modi's virtual address in the World Economic Forum in Davos affirmed that India is focused on its goal 'Make in India' and 'Make for the world'. He also stated that the government is focused on making India self-reliant across sectors. Ease of doing business, policy incentivisation for promoting investments, and rapid buildup of supporting infrastructure has seen India emerge as a global manufacturing powerhouse in the recent years. India now ranks fifth biggest economy, only behind China, USA, Japan, and Germany.[1]

GDP(current), by countries, USD triillion (Source: IMF)

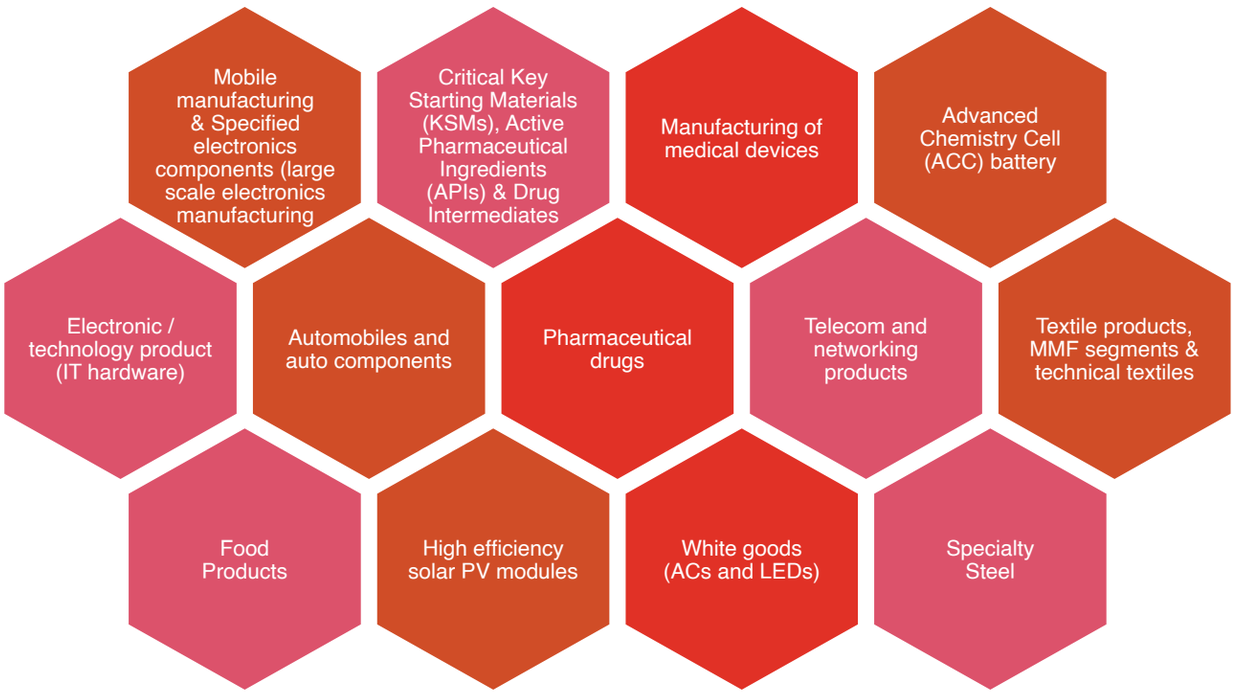


India's Real GDP growth, annual percentage change (Source: IMF)



[1] https://www.imf.org/external/datamapper/NGDPD@WEO/IND/GBR

Sectors included under PLI scheme (Source: Ministry of Commerce and Industry)



As of 2023, India's manufacturing sector is contributing around 17% to the country's gross domestic product.[2] From 2014 to 2021, its contribution to GDP grew from 15% to 17%.

The growth has been a positive impact of various initiatives that aid investment through the "Make in India" and "Atmanirbhar Bharat" programmes. Introduced in the aftermath of Covid-19, sector-specific Production Linked Incentives (PLI) are aimed to incentivise domestic and foreign investments and promote private sector as a co-partner in the India growth story.

Till now the government has announced an outlay of INR 1.97 lakh crores over the next five years for PLI schemes across 14 sectors[3] (i.e., auto components, automobile, aviation, chemicals, electronic systems, food processing, medical devices, metals and mining, pharmaceuticals, renewable energy, telecom, textiles and apparels, and white goods) which will create 60 lakh new jobs and national manufacturing champions. The scheme is anticipated towards aiding import substitution by developing manufacturing capacity to cater to domestic and global needs in the medium term. Focus has also been towards creating high tech-intensive and cutting-edge markets to gain competitiveness and address anticipated future demand at the global level.

As per FICCI's latest quarterly survey on manufacturing sector for Q4 Jan-March (2022-23)[4], the growth momentum continued in subsequent quarters of FY 2022-23 post revival of Indian economy in FY 2021-22 with temporary effect of global slowdown. About 58% respondents reported higher production levels in Q3 Oct-Dec FY 2022-23, and approximately 50% respondents expect higher production in Q4 Jan-Mar FY 2022-23 with order books taken into consideration.

India has set an ambitious goal to reach a USD 32 trillion GDP by 2047[5], coinciding with the 100th anniversary of its independence. To achieve this target, India's vision encompasses multiple facets that support the ambition of becoming the world's leading manufacturing hub.

[2] https://www.ibef.org/industry/manufacturing-sector-india
[3] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1932051#:~:text=Incentive%20amount%20of%20around%20Rs,Processing%20and%20Drones%20%26%20Drone%20Components.
[4] https://ficci.in/public/storage/SEDocument/20634/Economic_Outlook_Survey_Jan2023.pdf
[5] https://pib.gov.in/PressReleasePage.aspx?PRID=1911174#:~:text=Union%20Minister%20of%20State%20for,and%20the%20global%20community%20alike.

Major global trends that are driving opportunities in "Atmanirbhar Bharat" (Source: PwC analysis)

Geopolitical tensions and the aftermath of the pandemic had forced the world to critically evaluate its supply chain resilience and thus look beyond China. This presents India with the opportunity to become an integral player in the Global Value Chains. To make India a global manufacturing hub, an easy access to markets, development of infrastructure to support smart manufacturing techniques based on Industry 4.0 and aiding skill development and job creation is important.

For access to markets, FTAs will be pivotal as that will ideally result in lower trade barrier between countries, movement of personnel, standardisation of product or service specifications. Upskilling and reskilling programmes will be required to equip the workforce (incumbent and incoming) to be future ready and enable transformation from a cost based to a value-based manufacturing powerhouse.

Three key pillars to transition to global manufacturing hub

Enhancing Ease of Doing Business	Infrastructure Development	Skill Development
The governement continues to simplify regulations, reduce bureaucracy, and steamline processes to attract more investments and foster a conducive business environment.	India is investing significantly in infrastructure projects such as smart cities, industrial corridors, logistics hubs, and improved connectivity. These initiatives aim to create a robust ecosystem for manufacturing and economic growth	Recognizing the importance of a skilled workforce, India is implementing various skill development programs and initiatives to enhance the capabillities of its workforce. These efforts include vocational training, apprenticeship programs, and promoting technical education.

Source: *PwC Analysis*

In conclusion, as global companies adapt supply chains and manufacturing to remain resilient in a fast-changing industry, India has a unique opportunity to become the next manufacturing destination by capitalising on growing domestic demand and demographic advantage, as well as government support to promote manufacturing and innovation.

Overview to India's Chemicals and Petrochemicals Industry

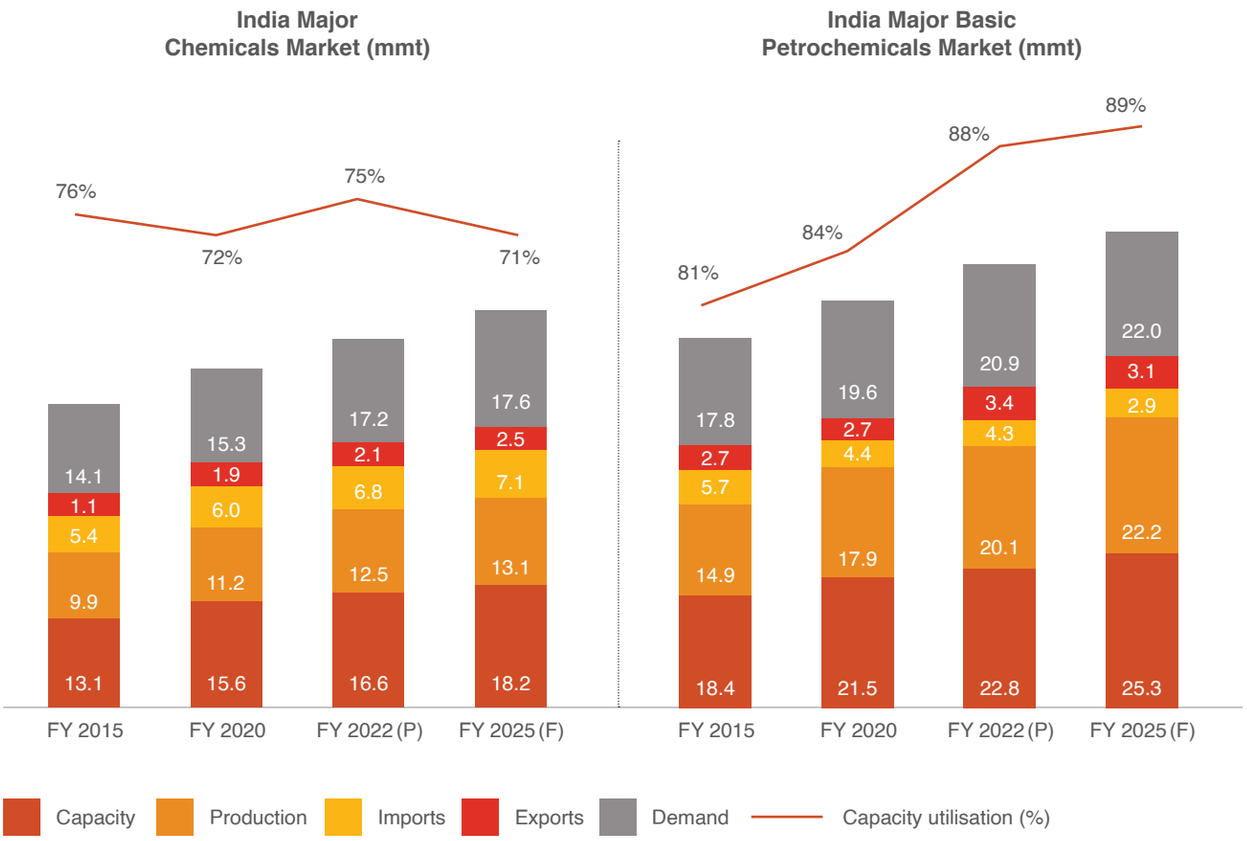
Indian Chemical Industry

The Indian chemical industry serves as a critical provider of building blocks and raw materials for numerous sectors, including textiles, paper, paints and coatings, pharmaceuticals, and agriculture among others. According to the Department of Chemicals and Petrochemicals under the Ministry of Chemicals and Fertilizers, the Indian chemical industry is the third-largest producer in Asia and the sixth largest globally.

It plays a vital role in India's economic growth, contributing around 1.5% to the country's GDP and employing a substantial workforce. It is also among the top three basic chemical-producing countries globally.

According to the Department of Chemicals and Petrochemicals (DCPC), Indian chemical industry is currently valued at USD 220 billion and is expected to reach USD 300 billion by 2030 and USD 1 trillion by 2040.

India's major basic petrochemicals and major chemical markets (million mt) – Capacity, Production, Imports, Exports, Demand and Capacity Utilisation (%)



With reference to the graph above, the growth in the demand is expected to be driven by increase in refining capacity, exploration of new cracker to chemicals (C2C) projects, and significant investments across demand clusters due to growing end-use consumption. Some of the major suppliers are exploring diverse opportunities for growth. For instance, Indian Oil Corporation Limited has undertaken the Paradip Cracker and Polymer Complex project, which aims to enhance the production of ethylene, propylene, and other petrochemicals. Market capacity expansions of chemicals and petrochemicals such as the above are aimed to cater to the increasing demand from the end-use sectors as per the industry projections.

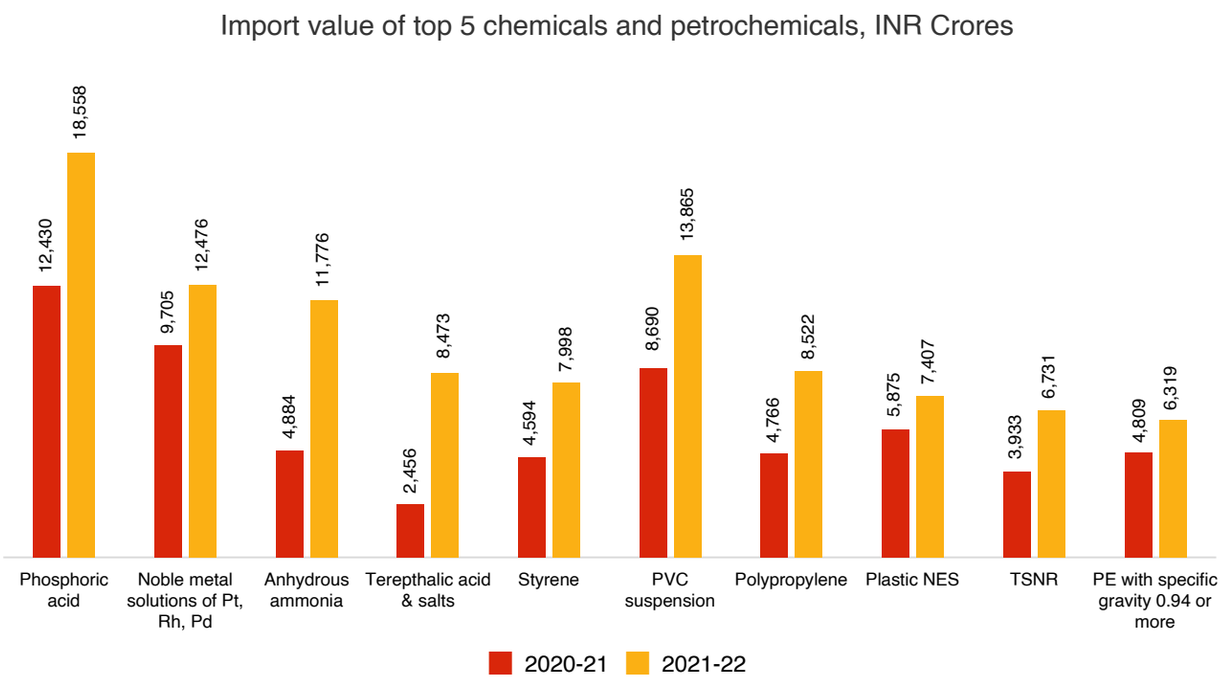
The industry encompasses three main segments: basic, intermediate, and specialty chemicals. Basic chemicals account for a significant portion of production, followed by intermediate and specialty chemicals. The specialty chemical's segment is experiencing rapid growth due to the rising demand for specialised products in sectors such as automotive, electronics, aviation, construction, healthcare, personal care, flavors & fragrances, and agriculture.

The demand for specialty chemicals is steadily increasing worldwide, and India has witnessed substantial growth in its share of the global specialty chemical's market and several sectors contribute to this demand. The government has also shifted its focus on the current and future demand growth of niche products and hence has included sectors such as pharmaceuticals (APIs, KSMs and intermediates), semiconductors, batteries, electronics, medical devices, and automotives in the PLI schemes that are heavily dependent on consumption of the specialty chemicals.

Key constraint of the industry - Import dependence

Even as the demand of chemicals is steadily increasing, the major challenge lies in the insufficient supply capacity to meet this demand, which in turn leads to heavy import dependence. China has emerged out as the key source of imports of chemicals..

Key import-dependent chemicals in India



***Source**: Source: Data Analysis of Import & Export of C&PC, DCPC (Aug 2022)*

There are multiple contributors to this supply constraints scenario, however the key constraints have a direct impact on the industry dynamics:

1. **Feedstock constraints –** due to heavy import dependence of the crude oil and natural gas, the landed price of the feedstock is higher than many countries which impacts price competitiveness of petrochemical-derived chemicals. The potential resolution can be Indian companies setting up manufacturing units in geographies with easy availability of feedstock at cheaper price. For example, Reliance setup an EDC plant in the middle east and bring it to India to produce PVC.

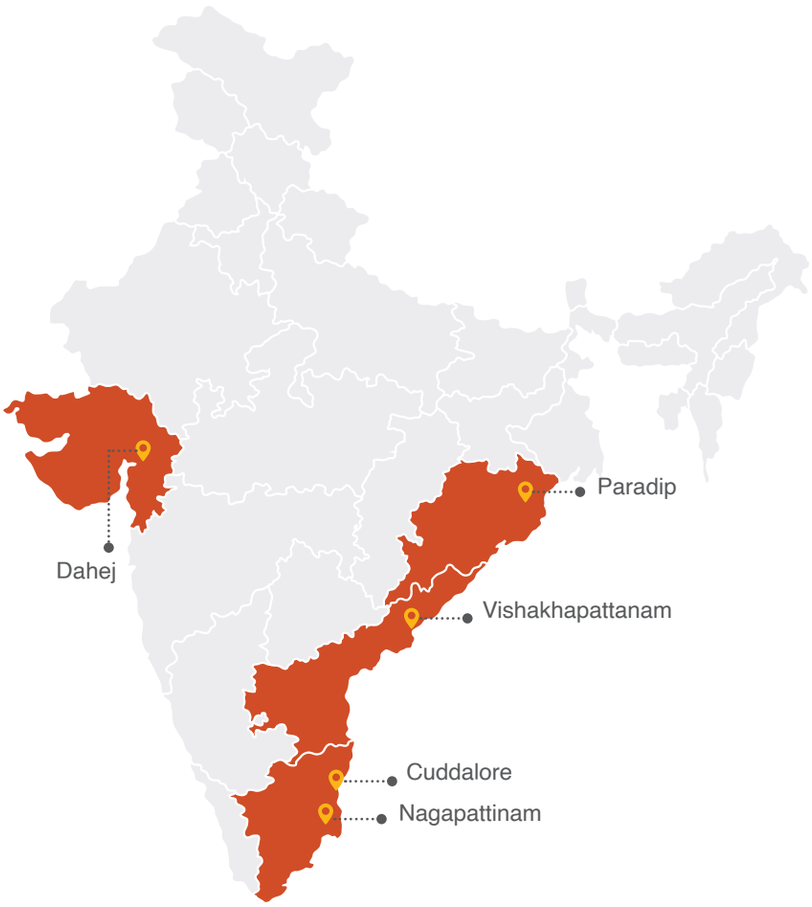
2. **Investment constraints –** India needs large projects to support the demand growth and only major players are financially capable for high associated investments. In such scenarios, joint ventures and collaborations should be explored to setup capabilities in India with overseas investment partnership.

3. **Technology constraints** – unavailability of globally competitive technology in India is the major setback as it is dependent on import of technology implying high cost of acquisition of technology. Industry-academia collaborations and government incentives on manufacturing innovation will play a crucial role in shifting the trade balance in chemical production technologies in the longer run.

Demand clusters of Indian chemical industry - Chemical hubs and PCPIRs

The government understands the criticality of the chemical industry's role in India's economic growth and the current supply chain constraints. To foster the industry's development and boost its competitiveness on a global scale, the establishment of chemical clusters has emerged as a key strategy. One of the prominent initiatives to promote chemical industry by the government is the Petroleum, Chemicals, and Petrochemicals Investment Regions (PCPIRs) to promote investments and industrial development through benefits from co-sitting, networking and efficiencies through common use of infrastructure. These PCPIRs also play a vital role in development of downstream industries, including chemical manufacturers which will help reduce the import dependence of the country.

Existing - PCPIRs:



- Strategic locations at port for domestic and global markets
- Availability of adequate land with government agencies/ developers
- Excellent connectivity
- Institutional mechanism for management and implementation
- Deregulated industry and promotion of 100% FDI
- Ready availability of technical and skilled manpower
- Opportunities for investment through PPP mode and consortium with Indian partners
- Investment in utilities and services

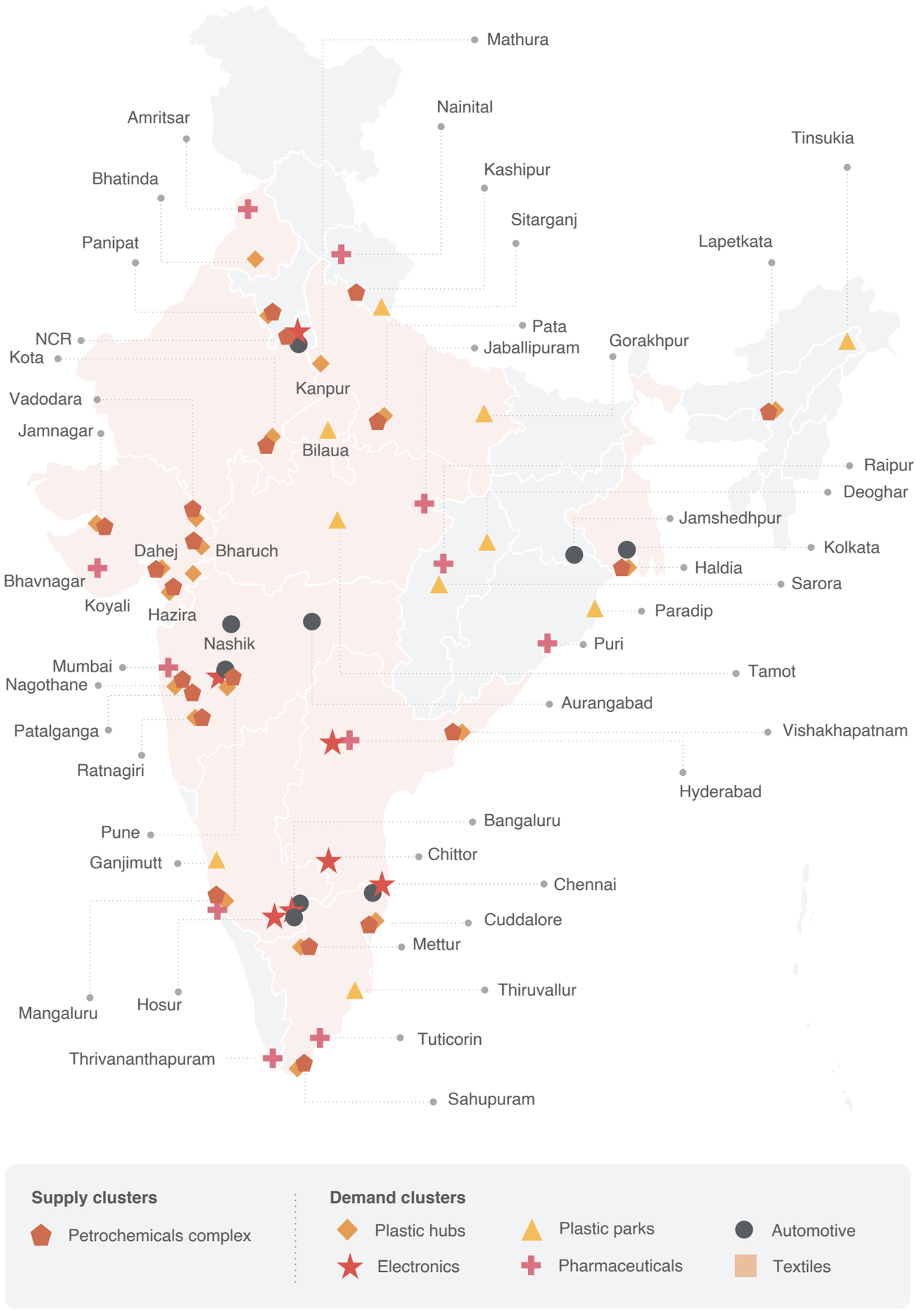
Source: *Department of Chemicals and Petrochemicals (DCPC)*

India has made considerable progress in establishing chemical clusters, particularly through the PCPIR programme. Currently, the government of India has approved four Petroleum, Chemical and Petrochemical Investment Regions which are- Dahej in Gujarat; Vishakhapatnam in Andhra Pradesh; Paradip in Odisha; and Cuddalore and Nagapattinam in Tamil Nadu. These PCPIRs have emerged as a thriving hub attracting major national and international chemical companies and witnessing rapid growth thereby offering favorable investment opportunities. Once fully established, these PCPIRs are expected to attract investment of INR 34 lakh crores (USD 420 billion) approximately.[6]

Supply and demand clusters of chemicals and petrochemicals in India

To ensure the success of chemical clusters in India, it is crucial to learn from best practices adopted by global chemical clusters. Countries like Singapore, Germany, and China have successfully established world-class chemical clusters offering valuable insights into infrastructure planning, technology adoption, environmental sustainability, and cluster management. By incorporating these best practices, India can create a conducive environment for chemical companies to thrive, fostering innovation, collaboration, and competitiveness. Additionally, the establishment of plastic parks within chemical clusters has proven to be beneficial. These parks provide specialised infrastructure and common facilities for plastic manufacturers, enabling them to enhance productivity, reduce costs, and optimise resource utilisation. Government incentives such as tax benefits, grants, and subsidies further bolster the attractiveness of chemical clusters, encouraging both domestic and foreign investments.

[6] https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1925546



Source: *Various industry sources, PwC analysis*

Global shift towards sustainability - why is it important in Chemical Industry?

Climate Change as a Global Challenge

Climate change has emerged as an inevitable and urgent global challenge necessitating the adoption of sustainable practices across various industries. In response to increasing policy and regulatory pressure from governments worldwide, industries are striving to reduce their environmental impact.

Climate change poses significant challenges and the governments worldwide are taking steps to address this issue. Countries are adopting various measures to mitigate their carbon emissions and transition to renewable energy sources. The Intergovernmental Panel on Climate Change (IPCC) warns that without acute measures the world will face irreparable consequences.

India being highly vulnerable to the impacts of climate change is already experiencing adverse climatic conditions such as frequent floods and droughts, heat waves and extreme weather conditions.

Sustainability and circularity economy in India

According to the Global Carbon Atlas, India is the third largest emitter of carbon dioxide (CO2) globally, contributing 7.2% of the world's emissions.[8] In its tryst to become the world's manufacturing hub and eventually become a leading economic power, the consumption of raw materials and the potential emissions are expected to increase exponentially. This places India in a crucial position to adopt sustainable practices and significantly contribute to climate change mitigation.

Largely, India's current economic model is linear where it operates through resource extraction, processing, transformation to products, and consumption by end-users. Post consumption, the majority of the spent products are disposed-off leading to large waste generation. According to CPCB, out of 62 million tons of waste generated each year, 43 million tons (~70%) is collected, 12 million tons is treated, and 31 million tons is disposed-off to landfills.[9]

With growing economy in the current linear model, India is expected to lose the opportunities to attain regenerative development path for long-term prosperity. Circular economy model can be the solution for India that can provide a strong framework for development and in setting up principles and SOPs to guide businesses across policies, innovations, and resources.

Economics of circular economy in India

According to the Economic Advisory Council to the Prime Minister of India (EAC-PM), India's circular economy development is expected to generate an annual value of USD 218 billion (INR 14 lakh crores) by 2030 and USD 624 billion (INR 40 lakh crores) by 2050.[10] The cost savings is expected to account for 11% of the current Indian GDP and 30% by 2050. 1 However, the implementation of circular economy in India needs an efficient ecosystem to encourage identification and adoption of sustainable and circular business models.

Major challenges for circular economy in India
(Source: Economic Advisory Council to the PM)

Currently, multiple challenges are limiting the transition of India to a circular economy. The key areas of improvements include-

1. Creating awareness and educational campaigns, development of supporting infrastructure for waste management and recycling.
2. Develop policy frameworks and incentives, promote research and development and innovations.
3. To achieve maximum efficiency in implementation of circular economy, India needs to adopt a multi-stakeholder approach that will enable collaboration between businesses, government agencies, and consumers which can help to eradicate the barriers and accelerate transition towards circular economy.

[8] https://globalcarbonatlas.org/emissions/carbon-emissions/
[9] https://www.trade.gov/market-intelligence/india-solid-waste-management
[10] https://eacpm.gov.in/wp-content/uploads/2023/07/17-Indias-Tryst-with-a-Circular-Economy.pdf

- Lack of awareness and understanding among policymakers, businesses and consumers
- Lack of differentiation between circularity and recycling
- Inefficiencies in waste management sector
- Absence of understanding on multi-stakeholder level circular economy
- Limited availability of recycled materials
- Downcycling
- Lack of incentives for businesses
- Limited research and development focus

The role of the Indian government towards sustainability and circular economy

Recognising the gravity and urgency of addressing the environmental issues and climate change crisis, the Indian government is committed to environmental stewardship and has set ambitious targets and initiated several programmes and policies. Supporting the Sixth Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC) which endorses that the behaviour and lifestyle changes play a significant role in mitigating climate change, the Indian government has announced 'Lifestyle for Environment' (LiFE) and set five ambitious goals for 2030 at the 26th session of the Conference of the Parties (COP26) to the United Nations Framework Convention on Climate Change (UNFCCC).

The goals are as follows:

- Increase non-fossil energy capacity to 500 GW
- Reduce carbon intensity of the economy by 45%
- Reduce total projected carbon emissions by 1 billion tons
- Substitute 50% of energy requirement by renewable sources
- Achieve net-zero emission target by 2070

[11] https://pib.gov.in/PressReleasePage.aspx?PRID=1795071

Key initiatives by Government of India for realising "Panchamrit" Strategy (Source: Niti Ayog)

Renewable Energy

Target: Develop renewable capacity 500 GW by 2030, renewable energy share as 50%

Investments: Rs 1500 crores in the Indian Renewable Energy Development Agency

Initiatives:

Solar Energy

- PLI scheme – Solar Park Scheme
- Roof Top Solar Programme Phase-II\
- Pradhan Mantri Kisan Urja Suraksha evam Utthan Mahabhiyan (PM-KUSUM)
- International Solar Alliance (ISA) with France

Wind Energy

- Offshore Wind Energy Policy

Bio-Energy

- Programme on Energy from Urban, Industrial, and Agricultural Wastes/ Residues
- Scheme to support Promotion of Biomass-based cogeneration in sugar mills and other industries
- Biogas Power (Off-Grid) Generation and Thermal application Programme (BPGTP)
- New National Biogas and Organic Manure Programme (NNBOMP)
- Bio-ethanol blending
- National Hydrogen Mission
- Green Energy Corridor

Reducing Emissions

Target: Reduce total projected carbon emissions by one billion tons by 2030

Initiatives:

- Implementation of BS-VI norms for fuel and vehicles with effect from April 2020
- National Clean Air Programme (NCAP)
- Faster Adoption and Manufacturing of Hybrid and Electric Vehicles in India (FAME Scheme)
- Electrification of Indian Railways network by 2023

Sustainable Agriculture

Initiatives:

- Rainfed Area Development (RAD) focusing on Integrated Farming System (IFS)
- National Innovations in Climate Resilient Agriculture (NICRA)
- Sub-mission on Agroforestry
- Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)
- Paramparagat Krishi Vikas Yojana (PKVY)
- National Bamboo Mission (NBM)

Infrastructure & Waste Management

Initiatives:

- Coalition for Disaster Resilient Infrastructure (CDRI)
- Infrastructure for Resilient Island States for Small Island Developing States (SIDS)
- Swachh Bharat Mission
- Atal Mission for Rejuvenation & Urban Transformation (AMRUT) for Smart Cities

Source: *Press Information Bureau, Government of India*

The government has launched initiatives for fulfilling these ambitious goals:

- **The National Action Plan on Climate Change (NAPCC)** – launched in 2008, works across the areas of solar energy, enhanced energy efficiency, green India, sustainable agriculture, sustainable habitat, water, sustaining the Himalayan ecosystem, and strategic knowledge on climate change.
- **The State Action Plan on Climate Change (SAPCC)** – corresponds to the objectives of the NAPCC and focuses on agriculture, water, health, biodiversity, infrastructure, and coastal areas.
- **The National Adaptation Fund on Climate Change (NAFCC) and Climate Change Action Programme (CCAP)** – established to aid implementation of the NAPCC and SAPCC objectives in all sectors that are impacted by climate change.

The role of the Indian government across circularity

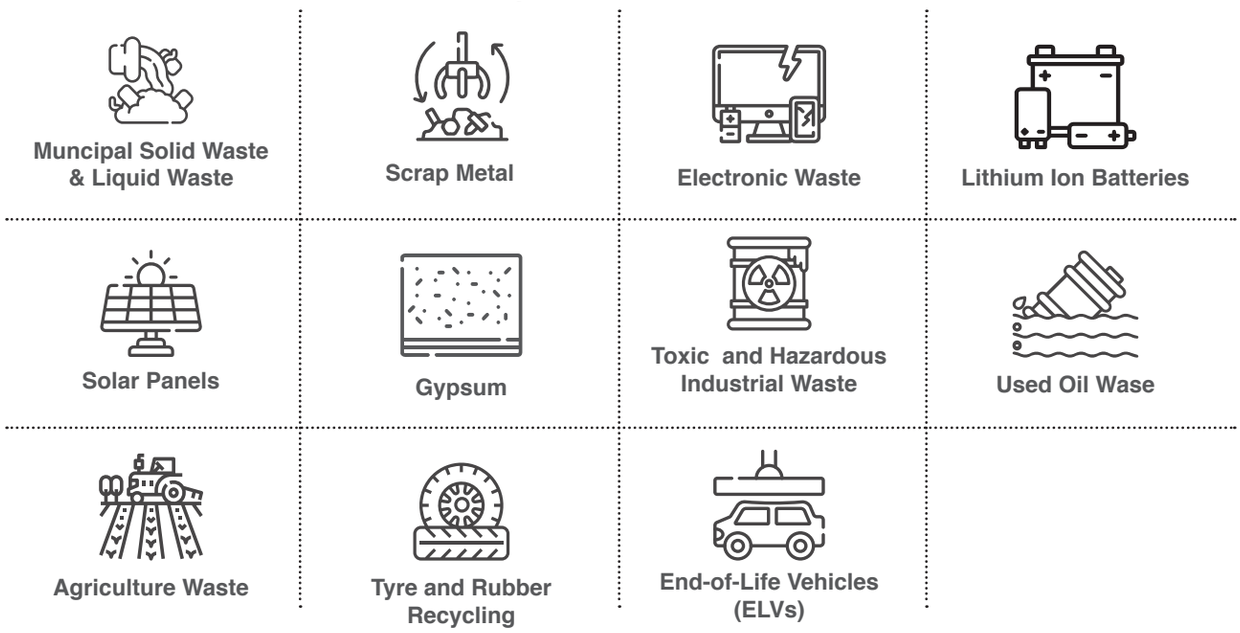
India's transition to circular economy is expected to help create larger opportunities for businesses and jobs as well as enhance productivity. Furthermore, it is evident that the states transitioning towards circular economy will need support from the government to establish state-level committees to develop strategies, infrastructure, reverse logistics, material recovery facilities, etc.

The current policy framework in India to promote circular economy is developed on the multi-pronged approach of awareness programmes, regulatory measures, financial incentives, and capacity building. Major initiatives undertaken by the government are:

- **National Resource Efficiency Policy (NREP)** – launched in 2019, NREP focuses on promoting enhancing resource efficiency, sustainable production and consumption patterns, and reducing environmental impact. The circular models that are promoted under this policy are Extended Producer Responsibility (EPR), product-as-a-service, sharing and leasing, and use of recycled materials.
- **Swachh Bharat Mission (SBM)** – launched in 2014, this policy promotes cleanliness, hygiene, and waste management through waste collection, segregation, and recycling.
- **Atal Innovation Mission** – launched in 2016, the objective of this policy is to encourage innovation and entrepreneurship. It includes initiatives to promote and support the development of circular business models (for resource efficiency, and reduced waste generation) and adoption of sustainable technologies.
- **Financial incentives** – the government has introduced multiple interventions around financial aids/ incentives such as subsidies, tax benefits, and low-interest loans for efficient utilisation of resources and adoption of circular business model.

The government has also developed action plans for 11 sectors that are undertaken by 11 different committees to facilitate the change from a linear to a circular economy. The focus areas are as below:

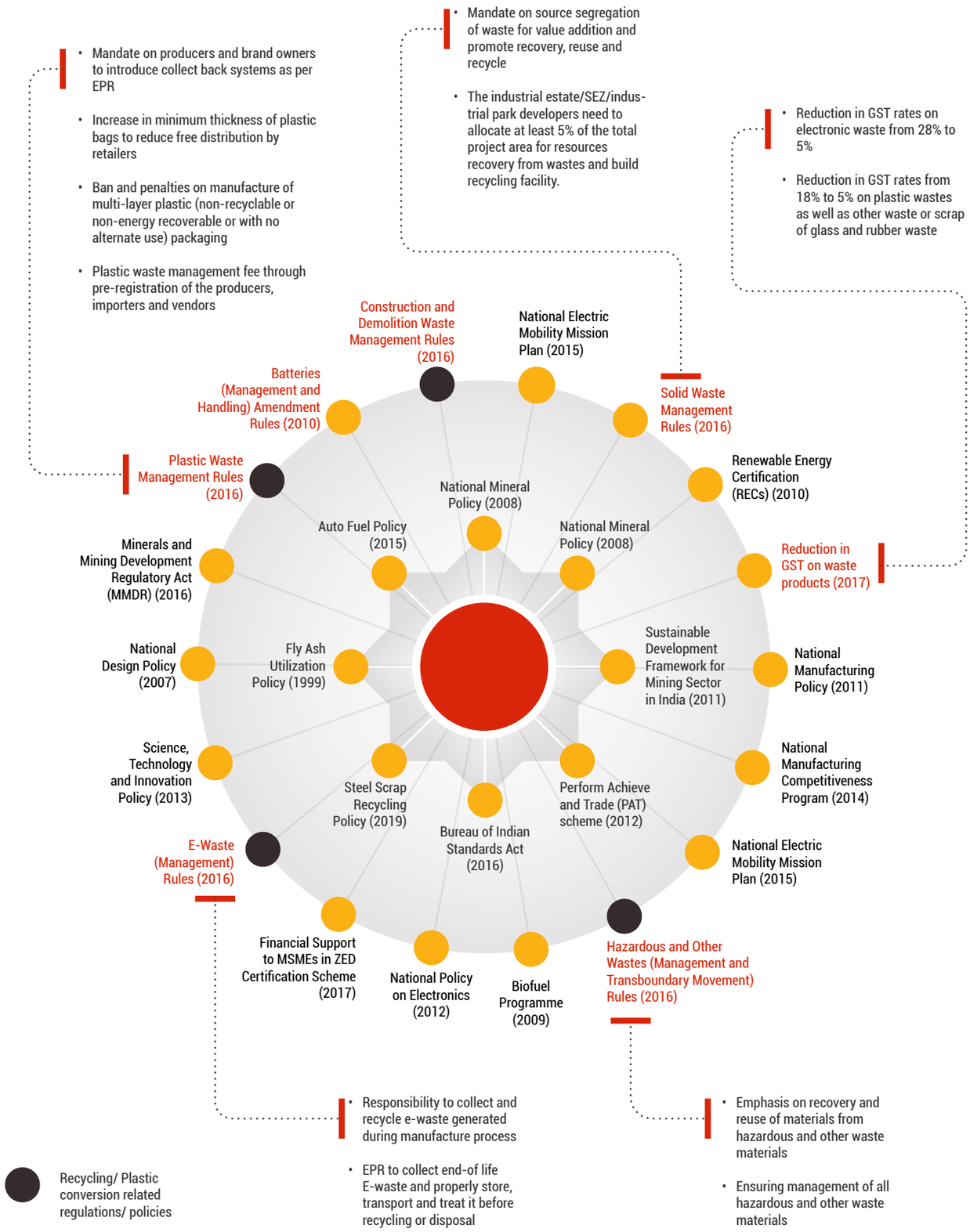
Government focus sectors for circular economy



Source: *India Budget FY 2022-23*

Along with the key sectors, the focus by the government is to address relevant cross-cutting issues of reverse logistics, infrastructure, technology advancement, and integration with the informal sector. This will be supported by active public policies covering Extended Producer Responsibilities (EPR), innovation and regulations.

India's policy-wheel for circular economy



Source: *PwC Analysis*

Current implementation scenario

Is Indian policy framework ready for circular economy?

The Government of India has tried to facilitate the implementation of a circular economy through creation of recycling infrastructure with over 10,000 recycling points for plastic packaging. It has also imposed stringent regulations in the form of 'plastic waste management rules and a ban on single-use plastics.

The Central Pollution Control Board has specified a system whereby makers and users of plastic packaging can collect certificates called Extended Producer Responsibility (EPR) certificates and trade them to ensure minimum level of recycling of plastic packaging waste..

There are still key challenges in India with respect to the plastic waste management like segregation at source, lack of infrastructure for subsequent management, limited spread of recycle facilities in rural regions, et al. The inexistence of a concrete market and lack of incentives have not been encouraging for companies who want to invest in a circular business model. Government needs to put in place stringent regulations with strict monitoring frameworks to ensure that companies adhere to the rules. Companies that are compliant should be incentivised while those incompliant, should be fined with hefty penalties.

The collaboration of India and Australia to jointly work on reduction of plastics can be replicated with other nations as well. Germany leads in waste management and recycling through their policies which are stringent for both manufacturers and consumers. Companies are held responsible for whether their packaging is recyclable, and consumers who purchase the goods are responsible for its disposal. The government has also imposed a penalty fee when more packaging is used which has led to reduction and lesser packaging material being used. Some global best practices for plastic recycling also include pyrolysis, chemical recycling, and gasification for which there are developed technologies available.

Business scenarios in Indian chemical industry

The chemical industry is one of the most important industrial sectors and contributor to nation's GDP growth both in India and globally. The chemical industry produces the building blocks for products in almost all downstream industries within the manufacturing sector and unlike other industries, chemicals have a unique position for value creation and potential to deliver a positive impact to the society.

Key trends re-shaping business operations in the chemical industry

	Key trends	What does this mean for business?
Customer Behavior	Increasing Customer demand for more environmentally friendly and socially responsible products and services	Consumers are wising up to companies that aren't organized in an environmentally and socially responsible manner (and that includes their supply chain)
Technological Breakthrough	Tracking mechanisms, communications systems and operating models that weren't previously available or affordable are now becoming mainstream	• Technology is opening opportunities for business to innovate and investigate options that weren't previously viable • Businesses that explore technology solutions to increase resource productivity will have the upper hand
Climate Change & Resource Scarcity	• Resource scarcity has led to increased resource price volatility and tighter environmental standards • Increasingly stringent environmental regulation such as ban on single use plastics, etc.	With little or no control over supply and price of resources, business will have to either accept the risk of these fluctuations or look for ways to reduce or remove it

Source: *PwC Analysis*

While these trends present real risks to businesses that fail to respond adequately, they also bring big opportunities for forward-looking organisations to innovate through newer business models.

Source: *PwC Analysis*

Sustainability in chemicals industry

Sustainability is not a new topic to the industry and has been a business strategy imperative owing to regulatory compliance, cost optimisation, and revenue maximisation. However, it is in this decade that the motivation has been shifted towards 'value to society'. Hence, it is safe to consider that the future of sustainability in the chemical industry lies in the integration into daily business.
The conventional industry value chain primarily operates on the linear model that generates waste across the value chain, which has now stunted the industry growth and led to scarcity of materials. Sustainability in the linear value chain can only focus on two key areas:

- Reduce waste and emissions – strong focus on operational cost reduction and waste management.
- Resource management – focus on resource optimisation and productivity.

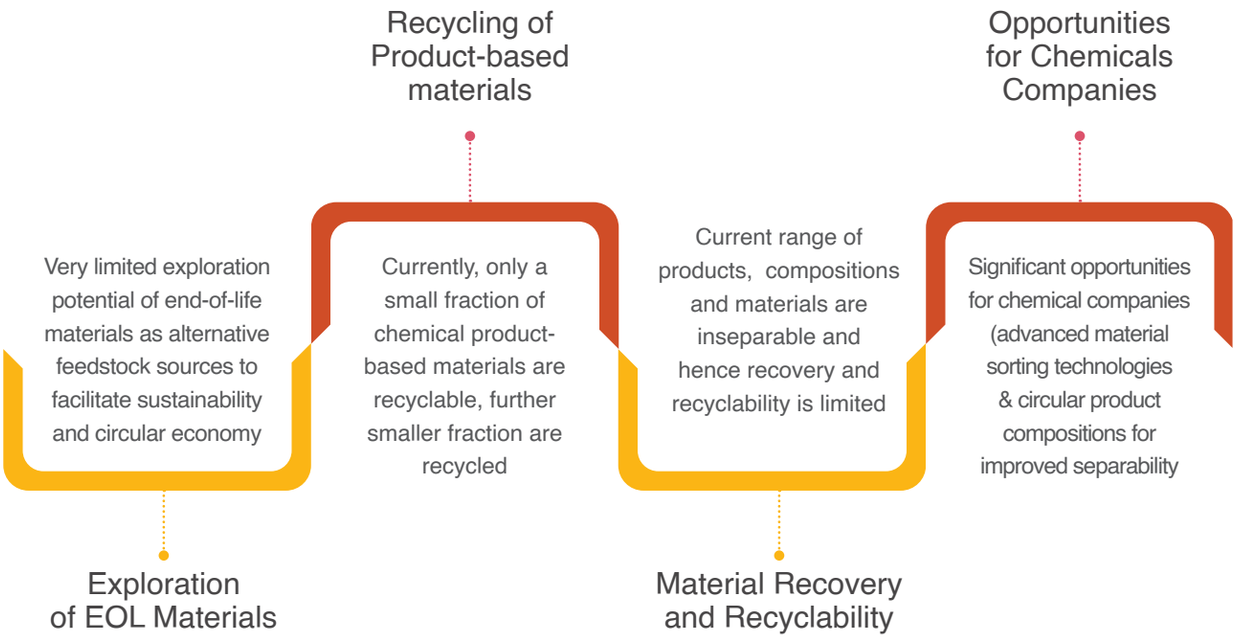
Conventional Linear Value Chain of Chemicals Industry

Source: *PwC Analysis*

To attain highest efficiencies in the value chain, the industry needs to address three major waste streams:

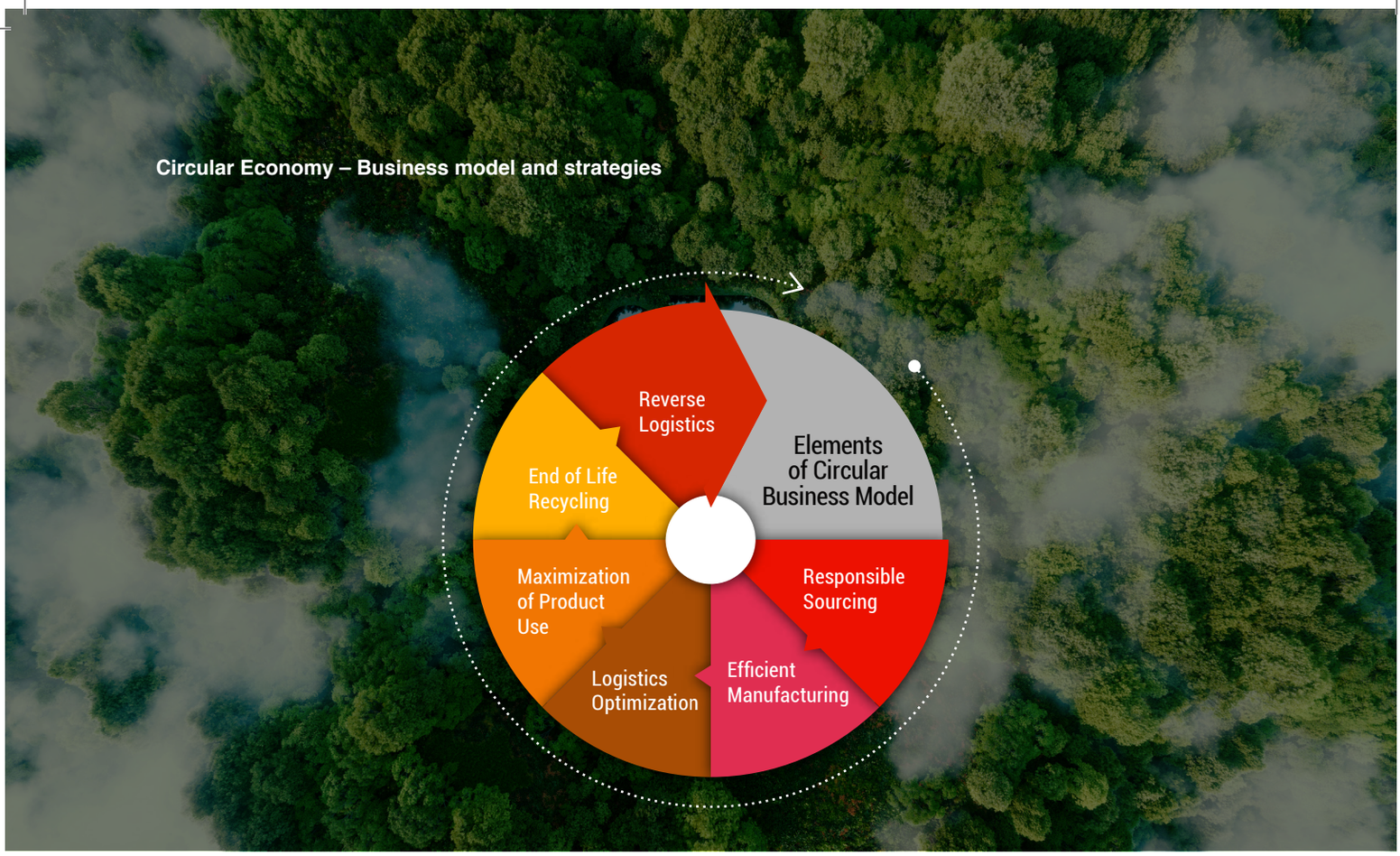
- Use of non-renewable resources as feedstock and sources of energy – highest inefficiencies, wastage, and emissions;
- High energy intensity and hazardous by-products in manufacturing – limited recovery and recycling of by-product and energy
- Waste generated from end-consumer products – limited material recovery from consumer product disposal

Key inefficiencies and opportunities in linear value chain model



Source: *PwC Analysis*

These efficiencies can be addressed by adopting sustainable and circular business model, which can turn them into opportunities. Circular business models cater to constantly evolving consumer needs, resource scarcity, industry preferences, and technology implementation by ensuring sustainability across each business function. It helps to minimise ecological and social costs by creating an economic value that can be recovered from maximum utilisation and reuse of a product.



Circular Economy Strategies		Definitions
Prioritize recycling inputs	**Circular sourcing**	Replace finite materials with bio based or recycled materials
	Sustainable design	Design products to be effectively disassembled, reused, repaired and up cycled
	Resource efficiency	Optimize usage of raw materials minimize waste
Maximize product use	Product as a service	Provide a service in areas that were traditionally sold as products
	Sharing/ virtualizing	Share durable assets such as cars, rooms, appliances & digitize products to increase lifetime
	Usage optimisation / maintenance	Increase performance / efficiency of product and prolong life through maintenance
	Reuse/ redistribution	Purchase and sell second hand and previously owned products to increase product lifecycle
Recover by products and waste	**Refurbishing/ remanufacture**	Replace finite materials with bio based or recycled materials
	Recycling from manufacturing	The waste or by products from manufacturing become the inputs for another product
	Recycling from consumption	Recycle discarded materials after the end of consumption and extract biochemical feedstock

Source: *WRI, FICCI, PwC Research*

Role of chemical industry in circular economy

Chemical companies can act as enablers of circularity within themselves as well as in the downstream businesses. They need to embrace the disruptive changes that are reshaping the industry and explore and tap the opportunities emerging throughout the value chain. Chemical companies can enable circularity through multiple approaches synergistic to their business model and vision.

The approaches to circularity can be:

- **Collaboration with downstream value chain partners** to co-develop sustainable/ circular solution
- **Leveraging in-house application and technology expertise** through application development services to support companies offering secondary raw materials
- **Closing the loop** by integrating capabilities for waste collection, sorting, recycling, and extraction of secondary raw materials and high-value material streams
- **Material certification provider** for sustainable/ circular or secondary raw materials
- **End-of-Life aggregator** to secure and bundle waste stream feeds to optimise demand-supply and logistics
- **Technical assessor** offering lab services for technical assessments and carbon management services (reporting, analysis, consultation, tools etc.)

Adoption of sustainability and circular economy by the industry

Measures by companies (net zero targets, reduction in carbon emissions, etc.)

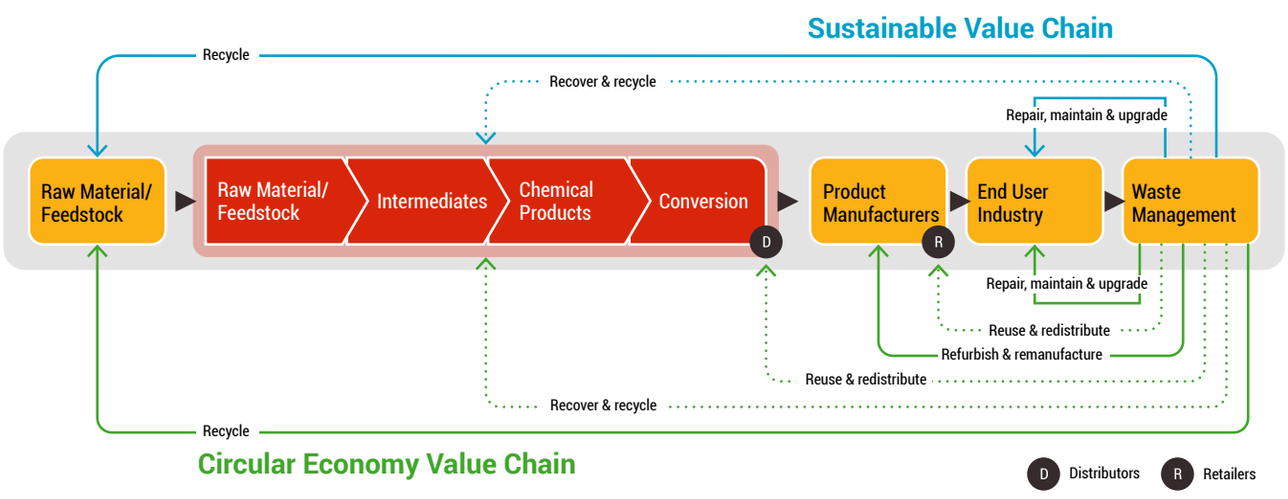
Sustainability has emerged as one of the most crucial aspects of any business ethos in recent years globally. Across various end-use sectors, there is a growing demand for more sustainable practices driven by concerns over climate change, resource depletion, and social responsibility. In India, the chemical industry, a significant contributor to carbon emissions, has recognised the urgency to address sustainability challenges. Leading companies within the sector are taking proactive measures to reduce their environmental footprint and embrace sustainable practices. This article explores the measures undertaken by major Indian chemical companies for achieving net-zero targets and reducing carbon emissions across all scopes.

To combat climate change and reduce their carbon emissions, several major Indian chemical companies have set ambitious net-zero targets and implemented initiatives to mitigate their environmental impact, which demonstrates their commitment towards sustainability and their efforts to reduce carbon emissions across all scopes.

By setting net-zero targets, investing in renewable energy, and implementing carbon reduction initiatives, the major Indian chemical companies are actively contributing to the global sustainability agenda. Embracing sustainability not only improves environmental performance but also strengthens market competitiveness, attracts investments, and fosters a positive brand image. By recognising the urgency to adopt sustainable practices and reduce-environmental impact, Indian chemical industry can drive the transition towards a greener and more sustainable future through continued efforts and collaboration.

- **Reliance Industries Limited (RIL),** one of India's largest conglomerates, has pledged to achieve net-zero carbon emissions by 2035.[12] The company aims to utilise renewable energy sources, increase energy efficiency, and adopt carbon capture technologies. RIL plans to invest USD 10 billion on 'Green Energy Plan' to achieve its sustainability goals.

Sustainable and circular opportunities across the value chain

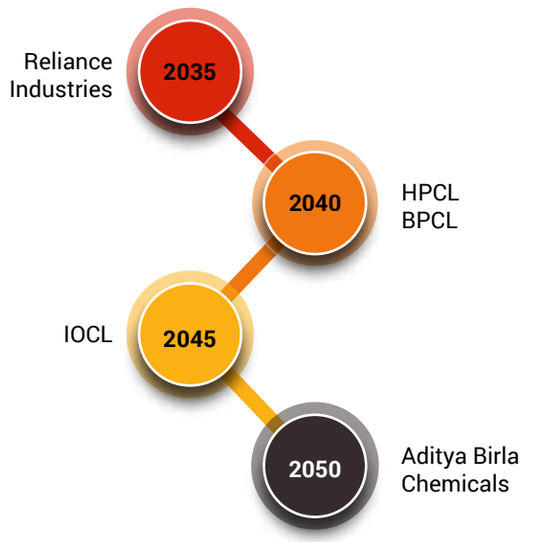


[12] https://www.ril.com/ar2020-21/natural-capital.html

- **Tata Chemicals** has committed to reduce absolute emissions by 30%.[13] The company has formulated a roadmap to reduce Scope 1, Scope 2, and Scope 3 emissions. It is actively investing in renewable energy projects, energy-efficient technologies, and exploring carbon offsetting solutions. These measures align with their goal of transitioning to a low-carbon economy.

- **Aditya Birla Chemicals** has set a target to reduce its carbon emissions intensity by 35% by 2030, compared to the baseline year of 2018 and achieve net zero by 2050.[14] The company is investing in energy-efficient processes, exploring renewable energy options, and adopting circular economy principles to minimise waste generation and resource consumption.

Solutions and practices currently adopted by the industry (technologies available, green / bio-based products, etc.)



The chemical industry plays a critical role in driving sustainability by adoption of green molecules (bio-based chemicals), usage of renewable energy, usage of green hydrogen, development of cleaner and more efficient production process that generates less waste and consumes less energy through sustainable technologies, reuse and recycle of plastic through plastic waste collection and recycling.

While the elimination of carbon cannot be achieved completely, efficient usage of carbon through GHG emission reductions can be achieved through various practices which are being adopted across the chemical and petrochemical industries today. Such as:

- **Agrochemicals:** Indian agrochemical companies are adopting more environment friendly practices through implementation of zero discharge solutions, being able to recover more than 80% of water, reduce TDS levels by 60 times, and COD levels by 40 times.[15]

- **Inks, dyes, and paints:** The pigment industries are focusing on sustainability though stricter regulatory standards, usage of renewable materials, and responsible manufacturing practices. Whereas the paint and coating industries has primarily focused on eco-friendly alternatives to reduce the number of Volatile Organic Compounds (VOCs) and heavy metals.

- **Petrochemicals:** The petrochemical industries have implemented various practices including circular economy, usage of renewable power, and decarbonisation efforts to promote sustainable growth in their sector.

- **Chlor-alkali chemicals:** In India, majority of the chlor-alkali plants are based on green membrane technology. By-products such as hydrogen is being utilised in flakes plant and boilers while fly ash and brine sludge is used in coal-based captive power plants and construction bricks / blocks respectively. The industry is also working towards zero effluent discharge mission and recycling of the liquid effluents generated within the plant.

In the global stage, decisions taken by governments to reduce / achieve net-zero emissions have fueled the chemical and petrochemical industry to look into various paths towards sustainability through advanced recycling, decarbonisation, renewable power, hydrogen as a fuel, low-carbon products / technologies, and bio-based alternatives. These various routes to sustainability also generate value-added opportunities giving rise to pricing and development of high-growth and high-margin markets.

Europe is poised to be a leader in circular economy and clean technologies. Their developed green technologies and advanced recycling methods and practices to close the loop of plastic reuse and recycling can be borrowed and implemented in India to ensure sustainable growth.

[13] https://www.livemint.com/brand-post/gradual-shift-towards-the-implementation-of-green-practices-11642071756888.html
[14] https://www.grasim.com/Upload/PDF/grasim-sustainability-data-book-fy-2021-22.pdf
[15] https://www.tatachemicals.com/upload/content_pdf/integrated-annual-report-fy-2022-23.pdf

Deep dive: Circular Economy in Plastics Industry

At global level, over 353 million ton of plastic is consumed, however, less than 10% of plastic waste is recycled.[16] Majority of the plastic today is made from crude oil or gas and due to its durability, versatility, and low cost plastic consumption has quadrupled over the past 30 years. India which currently consumes 31 million tons of plastic compared to USA's 85 million tons is expected be at par with USA by 2060 with plastic consumption at 160 million tons.

Plastic consumption for China, USA and India, FY 2022-2060 in million mt

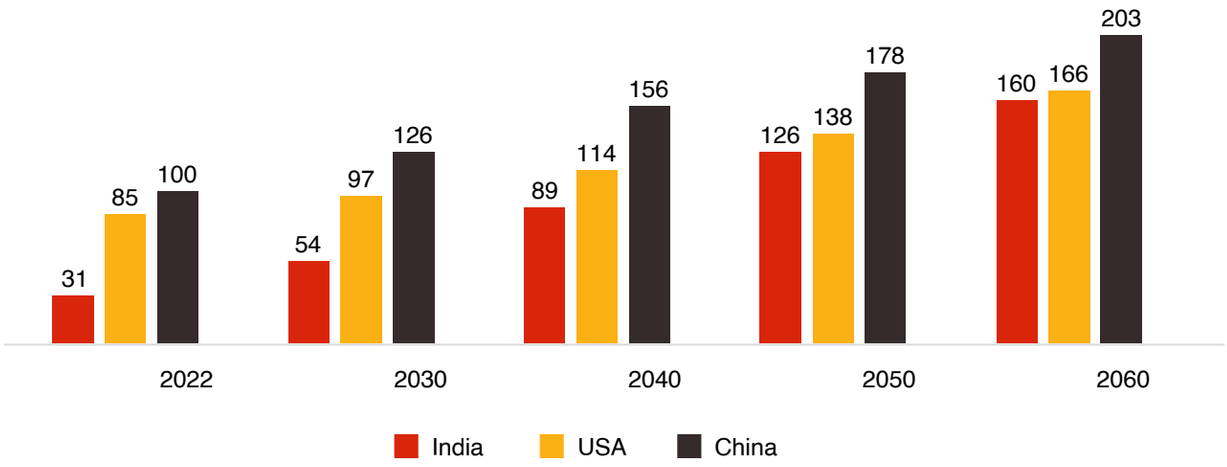
According to the Ministry of Environment, Forest and Climate Change, India generated around 3.47 million tons of plastic waste[17], out of which 1.58 million tons of plastic waste was recycled and 1.67 million tons was co-processed, which made 50% of total plastic waste recycled.

A reduction in plastic waste can be achieved by adopting a circular economy approach that is focused on reduction, reusing, and recycling. Packaging is one of the largest application areas of plastics and the regulations imposed by the government on single-use plastics have a positive impact. Companies are now looking at alternative packaging so lutions to replace single-use plastics.

However, waste segregation is a major challenge being faced today due to the dumping of mixed waste. More efforts should be taken to increase awareness among the general population regarding the importance of waste segregation at source. Advanced mechanical and chemical recycling methods need to be adopted to ensure sustainable growth.

To achieve the true potential, consumers are required to create a demand for recycled / reused material to generate a high value market that will encourage companies to invest in a circular business model. A collective effort from the consumers, suppliers, and government would be required to achieve this.

Plastic consumption for China, USA and India, FY 2022-2060 in million mt



Source: *Organization for Economic Co-Operation and Development (OECD)* [18]

[16] https://www.oecd-ilibrary.org/sites/de747aef-en/index.html?itemId=/content/publication/de747aef-en
[17] https://www.niti.gov.in/sites/default/files/2022-07/Plastics%20Alternative%20Study_Final_Report_compressed.pdf
[18] https://www1.compareyourcountry.org/global-plastics-outlook/en/1/all/default/2019-2024/USA1+IND1+CHN1

Initiatives taken by Indian companies adopting plastic waste recycling and management

Company	Circular Economy Initiative	Description
Tata Chemicals	Dry waste processing plant	• The dry waste management plant processes three types of wastes namely industrial, municipal, and scrap; • Processed products are supplied to the cement manufacturers where it is used as a fuel supporting the circular economy concept.
	Dry waste management	To practice Extended Producer's responsibility, proactive steps are taken for collection, segregation, and safe disposal of plastic waste.
ITC	Solid waste recycling	ITC collects and recycles over 5,000 tons of post-consumer low-value plastic.
	Multi-layered plastic waste management model	A replicable model which provides an end-to-end solution for converting plastic waste into commercial products leveraging upon the technology of ITC Life Sciences and Technology Centre
Hindustan Unilever Ltd	Plastic waste management model	• In partnership with United Nations Development Programme, launched a technology – powered model • Segregation, collection, and recycling of plastic waste along the value chain that will create resource efficiency and help achieve circular economy • Around 2,500 tonnes of plastic waste is collected annually
Indian Oil Corporation	Chemical recycling	Conversion of plastic waste into waxes which are value-added products A technology patent has been obtained that converts plastic waste into Bharat VI fuel
Saahas Zero Waste	Reverse supply chain solutions	Offers decentralised waste management solution for bulk waste generators across cities in South India, utilising the wet waste for composting, food waste to generate biogas, and dry waste is sorted for valuable materials which are sold
India Glycols Ltd.	Sugarcane molasses based derivatives, Waste as energy	• Utilise waste from sugar plants e.g. sugarcane molasses as raw material to produce Bio-Mono Ethylene Glycol (Bio-MEG) and Ethylene Oxide (EO) derivatives • Use waste from Ethanol plants as fuel for steam and power generation
Tata Steel	Upcycling waste into fertilisers	• Innovated GeoGreen, a bio-fertiliser, made from recycled waste such as effluents and molasses from sugar mills and distilleries • Enriched with nutrient additives and lifegiving microbes, it can improve yields per acre by 15-20%
	Alternative fuels at Tata Coffee	Utilising waste produced in instant coffee manufacturing (with very high calorific value) as alternative fuel for boilers
IFFCO	Seaweed-based plant growth promoter	• Producing red seaweed derivatives-based crop enhancement product • Providing livelihoods to more than 1500 fishermen families in Tamil Nadu who are partners in cultivation
Mahindra Group	Mahindra Accelo's car shredding business, Bio-CNG plant	• Utilising world class processes to shred end-of-life automobiles and recycling recovered steel and materials • Setting up of Bio-CNG plant in Mahindra world city which utilises the city's food and kitchen waste to generate biogas, CNG, and fertilisers

Conclusion

India's ambition to become a manufacturing powerhouse and a global economic leader needs to go hand in hand with its commitment towards sustainability and circular economy. To achieve a successful and impactful transition to circular economy, macro-economic level planning is crucially warranted as a comprehensive and systematic implementation roadmap. The net-zero future is a significant necessity, globally as well as nationally, and it will affect every aspect of our daily lives. Hence, it will present plethora of opportunities ranging from carbon emission trackers to plant-based proteins and from electric vehicles to new battery technologies involving waste management aiming to close-the-loop and contribute to a more sustainable planet.

To succeed in circularity, companies will be required to excel across four key dimensions:

1. **Operations –** by addressing the value lost through the operations and by-products of the business processes across energy, water, emissions, and waste;

2. **Products and services –** by rethinking the design, lifecycle, and end use of a product or service to eliminate waste, optimise usage, and close product loops;

3. **Lifecycle and lifestyle approach –** by embedding the circular approaches to the foundation of businesses and consumers by redefining practices, policies, and processes;

4. **Ecosystem –** by collaborating with public and private sector players along with the government, education, and consumer segments to create a holistic and enabling environment for collective transformation.

All these factors are pivotal and define a successful transformation journey from a **circular company** that has achieved circular economy within the company, to a **circular business** that has enabled a circular economy with the customers, and then finally a **circular ecosystem** that has multi-stakeholder collaborations and innovation platforms with vertical and horizontal integration.

In conclusion, the roadmap to circular economy from the current linear economy is going to be very challenging. However, the transition is expected to be rewarded with accelerated economic growth and environmental conservation for future generations. A circular economy will not only create economic value pools but also a world that is livable for our future generations. Businesses forming an integrated network through multiple circular business models can lead to the creation of a circular economy. With a system-level approach and favorable economic conditions, India can become a sustainable manufacturing hub. And as the emerging sustainable and circular value chains will provide significant opportunities in the coming years, but the right time to start is NOW!

Notes

Messages from the CEOs

Mr. Janardhanan Ramanujalu
Chairman and Managing Director,
Deepak Nitrite Limited

Chemicals and Petrochemicals industry is the largest amongst manufacturing accounting of quarter of manufacturing output. Chemical building blocks, intermediates, and finished products feed into multiple other manufacturing sectors. The chemical and petrochemical industry is a good indicator of the health of manufacturing sector as it draws its demand from across all sectors including consumer goods.

India's growth puts Chemicals & Petrochemicals sector in a sweet spot as the industry has higher than GDP growth rate. The scale provided enables not only manufacturing for domestic needs but also competitively cater to global needs. The PLI scheme in 14 sectors has spin off effect for demand growth of Chemical industry as well and the industry is expected to see enhanced demand growth as a result. India's ongoing Free Trade negotiations with EU, UK etc. will also open up additional market opportunity for many of our sectors adding to demand growth of Chemical sector. Geopolitics will re-shape manufacturing and investments as a result of energy and feedstock disruptions. While India will be natural beneficiary as an outcome, our industry needs to be prepared to ride the demand with advance Capex and investments.

Global environmental challenges leading to increased regulations over plastic waste, recycling content, extended producer responsibility as well as carbon neutrality would mean our industry need to reinvent and innovate not only for ourselves but also for other industries too.

Chemical Industry is already leading with examples of low carbon ammonia, hydrogen and facilitating EV transition. Our industry will see growing importance in delivering the global goal of carbon neutrality by 2050
Wishing GCPMH 2023 all the success.

Messages from the CEOs

Mr. Rajendra Gogri
Chairman & Managing Director
Aarti Industries Ltd.

In a world marred by rising energy prices, inflationary pressures, and a bewildering business landscape, the past year has undeniably been one of daunting challenges. From the aftermath of a relentless pandemic to navigating the complex Russia-Ukraine conflict and disruptive supply-side shocks, the odds have been stacked against us. Yet, amidst this tempestuous backdrop, India's specialty chemical sector has demonstrated remarkable resilience and steady recovery. However, due to a weak global economy and ongoing customer destocking, a complete recovery may require an additional two to three quarters.

In the fiscal year 2023, India's GDP grew at an impressive rate of 7.2%, laying the foundation for a return to pre-pandemic levels of growth. The specialty chemical sector has played a significant role in fortifying key national initiatives, firmly cementing its position as a significant player on the global stage. Moreover, the sector has played an instrumental role in fortifying key national initiatives such as Make in India and Atmanirbhar Bharat Abhiyaan, firmly cementing its position as a significant player on the global stage. As multinational corporations seek to diversify their supply chains, India's favorable economic indicators and competitive labor costs make it an alluring destination for investment. India has become a dependable supplier for global companies aiming to mitigate risks through strategic initiatives such as China+1 and Europe+1. Expert's project substantial growth for the chemical sector in India, with estimates ranging from 11 to 12 percent between 2021 - 2027 and 7 to 10 percent between 2027 - 2040. By 2040, our industry is anticipated to triple its global market share. With favorable policy reforms and the industry's vital role in providing essential building blocks and raw materials for major sectors, we are witnessing the dawn of a 'Golden Decade' for the Indian chemicals industry.

However, it is crucial to address the current headwinds impacting global demand and achieve a balanced trade position. India's current trade deficit for our industry, amounting to USD 9 billion to USD 10 billion, is projected to balloon from USD 40 billion to USD 42 billion by 2040. Achieving a balanced trade position becomes paramount.

As India's chemical industry is poised to dominate the global arena in the coming decade, we warmly invite global companies to explore partnership opportunities with domestic enterprises in India's vibrant chemical manufacturing ecosystem. To all participants in GCPMH 2023, I extend my heartfelt wishes for success as you navigate challenges and seize opportunities in the Indian chemical industry. Staying motivated and united in shaping a prosperous future together is essential.

About FICCI

Established in 1927, FICCI is the largest and oldest apex business organisation in India. Its history is closely interwoven with India's struggle for independence, its industrialization, and its emergence as one of the most rapidly growing global economies.

A non-government, not-for-profit organisation, FICCI is the voice of India's business and industry. From influencing policy to encouraging debate and engaging with policymakers and civil society, FICCI articulates the views and concerns of industry. It serves its members from the Indian private and public corporate sectors and multinational companies, drawing its strength from diverse regional chambers of commerce and industry across states, and reaching out to over 2,50,000 companies.

FICCI provides a platform for networking and consensus building within and across sectors and is the first port of call for Indian industry, policymakers and the international business community.

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Data Classification: DC0 (Public)

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