INDIAN CHEMICAL INDUSTRY: EXPLORING ITS GROWTH POTENTIAL

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Indian Chemical Industry: Exploring its Growth Potential

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Project Team: Research and Analysis Group

Mr. Rahul Mazumdar, Assistant General Manager

Mr. Mayank Khurana, Deputy Manager

Ms. Sakshi Garg, Deputy Manager

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Introduction

Chemical industry has been a critical component of the modern globalized world economy, converting raw materials like crude oil, natural gas, air, water, metals, and minerals into diverse ready to-use products which are essential to our daily lives. Apart from producing a wide range of finished products like fertilizers, pesticides, LED lighting and other agrochemical products, the industry also produces key inputs for other manufacturing activities like synthetic fibres and plastics and water chemistry that benefit living standards of consumers around the world.

Although the chemical industry is quite heterogeneous in character – ranging from commodity chemicals to research-driven products, it can broadly be classified into three major segments based on industry supply chain, viz., basic chemicals, specialty chemicals, and knowledge-based chemicals.

The global chemical industry is not only important in terms of size but also in terms of its features, involving significant capital investment, high knowledge content and qualified human resources. During 2006 and 2021, the revenue of the global chemicals industry has more than doubled from US$ 2.3 trillion to US$ 4.7 trillion. China leads in chemical manufacturing. It constituted a share of 44.6% in global sales of chemicals in 2020. The European Union, the USA, Japan, South Korea, and India are the other major players.

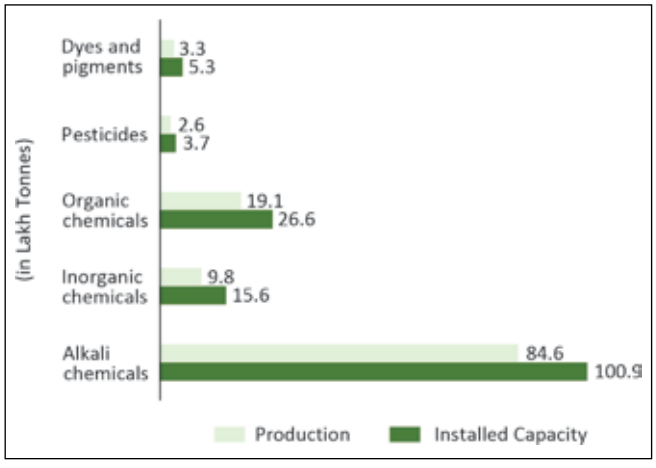
It may be noted that traditionally, the EU and the US were the key chemicals producers. It was after the 2008 financial crisis that manufacturing in developing countries started picking up. The years since have witnessed a global shift towards Asia as the world's chemicals manufacturing hub. Five out of the top ten chemical producers in 2020 were in Asia, namely China, Japan, South Korea, India, and Taiwan. They together constituted a share of 56.2% in global chemicals sales in 2020 as against a share of 41.4% in 2010. Asia is also the largest consumer of chemicals. The region represented 62% of global demand in 2021.

Recent Trends in India

The Indian chemical industry has evolved from being a basic chemical producer to becoming an innovative industry. The 'chemical and chemical products' sector accounted for 1.4% of the total Gross Value Added and 9.6% of total manufacturing output in FY 2021. With increasing investments in research and development (R&D), the industry is registering significant growth in the knowledge arena, including specialty and fine chemicals. The industry now produces many fine and specialty chemicals which have very specific uses and are essential for increasing industrial production. Notably, the industry is also a rich source of employment generation with MSMEs accounting for 25%-30% of the sector.

The installed capacity of major chemicals in India stood at 156 lakh tonnes in FY 2021 as against the production of 112.42 lakh tonnes. During FY 2021, almost 70% of the major chemicals produced in India were alkali chemicals. Organic chemicals had the second highest share in production at 17%, followed by inorganic chemicals (9%), dyes and pigments (3%), and pesticides (2%). Other than inorganic chemicals, all other major chemical segments witnessed growth in production during the period under consideration i.e., from FY 2017 to FY 2021.

Figure 1: Production and Annual Capacity of Major Chemicals in FY 2021



Source: Chemical and Petrochemical Statistics at A Glance - 2021; India Exim Bank Research

As regards trade, chemicals form an integral part of India's export basket, constituting a share of 8% in total exports in 2021. From 2017 to 2021, exports of chemicals registered an AAGR of 12.8% to reach US$ 31.9 billion in 2021. However, India has remained a net importer of chemicals. Imports of chemicals have ballooned from US$ 26.8 billion in 2017 to US$ 41.3 billion in 2021, recording an AAGR of 14.1%. The imports accounted for about 5% of India's import basket in 2021. Thus, overall, trade deficit in chemicals increased to US$ 9.4 billion in 2021 as compared to US$ 6.4 billion in 2017.

Among the segments, exports of organic chemicals (HS 29) have been the highest, at US$ 21.2 billion in 2021, accounting for three fourth of the total exports. Imports of organic chemicals were also the highest at US$ 27.2 billion in 2021, leading to a trade deficit of (-) 6.1 billion. Agrochemicals such as insecticides, rodenticides, fungicides etc. (HS 3808) were the second highest exported category with exports amounting to US$ 4.5 billion in 2021. With imports of US$ 2.7 billion in 2021, agrochemicals falling under HS 3808 registered a trade surplus of US$ 2.7 billion in 2021, a notable increase from a trade surplus of US$ 1.2 billion in 2017.

Tanning or dyeing extracts (HS 32) also registered an increase in trade surplus from 2017 to 2021. Exports and imports were valued at US$ 3.8 billion and US$ 2.5 billion, respectively in 2021. Further, India's export performance in inorganic chemicals (HS 28) has been inadequate. The trade deficit in the segment has increased from (-) US$ 4 billion in 2017 to (-) US$ 7.2 billion in 2021. During 2017 and 2021, amongst all the chemical segment, the imports of inorganic chemicals registered the highest AAGR of 17.6%. At US$ 9.6 billion, imports were much higher than the exports of US$ 2.4 billion in 2021.

The trends indicate that growth in exports is not commensurate with the rising imports of chemicals. This points at the high dependence of the sector on overseas markets. To promote self-reliance, the industry needs to focus on boosting domestic manufacturing and exports by adopting a market- and product-specific approach. The trade deficit for the chemical industry was mostly driven by China, Japan, Singapore, and South Korea. Notably, countries with which India had the highest trade surplus in 2021 were the USA, Brazil, Turkey, UAE, and Bangladesh.

In order to identify the focus areas for strengthening exports of the chemical sector, the Study undertakes a four-quadrant analysis (Product Champions, Underachievers, Growers in Declining Markets, and Losers in Declining Markets) of the chemical products at HS 6-digit level. The analysis considers two major determinants of chemicals industry's performance in overseas markets at a granular level, namely the normalized revealed comparative advantage (NRCA) for products in 2021 and Annual Average Growth Rate (AAGR) of global imports from 2012 to 2021.

Exploring Chemical Industry's Growth Potential

The chemical industry plays an integral role in India's industrial development and trade. The industry has contributed consistently towards value creation and has strong presence globally. However, there are myriad opportunities that are yet to be capitalized on by the chemical industry in India. The low per capita consumption and low penetration levels in the user industries represent huge untapped opportunity for

chemical companies in the long term. Further, with India's trade deficit in chemicals widening to US$ (-) 9.4 billion in 2021, opportunities to substitute imports by developing technology and knowhow and operating at economies of scale arise.

From 2012 to 2021, India's chemical exports grew at a CAGR of 6.6%. Assuming that the chemical exports continue to grow at the same rate, the exports would touch US$ 56.8 billion by 2030 (business as usual scenario). The Study also considers an optimistic scenario wherein it is assumed that India would achieve its export target of US$ 1.2 trillion in merchandise exports by 2030. Under the optimistic scenario, provided the chemical sector grows at the same CAGR during 2022-30 as the anticipated CAGR for overall merchandise exports, i.e., 13.2% - India's chemical exports would then be expected to touch about US$ 97.4 billion by 2030.

Table 1: India's Chemical Industry Export Target

Year	Scenario	Export (US$ Billion)	Required CAGR
2021	Observed	31.9	-
2030	Business-as-usual	56.8	6.6%
2030	Optimistic	97.4	13.2%

Source: Data accessed from ITC Trade Map; India Exim Bank Research

For tapping the potential of the chemicals sector and accelerating export growth, the Study recommends a set of strategies.

Explore new markets and products

The demand for chemicals is highly dynamic. Mature products in one region may be innovative products in another. The Study has identified countries having the highest import growth during the last decade in different segments of chemicals. For inorganic chemicals (HS 28), the top growing markets are found to be Poland, Vietnam, South Korea, Mexico, and Thailand. India's current exports to these markets form a paltry share in the global imports of the latter. For organic chemicals (HS 29), there is potential for India to increase exports to Ireland, Turkey, Russia, Spain, and Belgium. In tanning or dyeing extracts (HS 32), the lucrative markets are Vietnam, Belgium, Poland, the Netherlands, and China. Coming to agrochemicals such as insecticides, rodenticides, fungicides etc. (HS 3808), it has been seen that India enjoys high export competitiveness in the segment. Furthermore, India's exports to the USA and Brazil already account for a considerable share in their imports. Possibilities may be explored for boosting export to other top growing markets as well.

With respect to venturing into new products, it is to be noted the Study has classified 146 products as 'underachievers'. India needs to improve its competitiveness in these products to give significant push to the overall chemical exports. It may be worthwhile to focus on building export capabilities in the identified products under the category.

Facilitate import substitution through capacity addition

India's increasing imports as well as prevalence of high intra-industry trade shed light on the growing demand for chemicals in the country. There is thus need for import substitution through capacity additions particularly with reference to the rising chemical imports from China in the last decade.

Total imports of the chemical segments covered in the Study from China have increased by 2.5 times during the last decade, from US$ 5.9 billion in 2012 to US$ 14.6 billion in 2021.

Furthermore, optimum utilization of existing capacity is also required. The capacity utilization rate of inorganic chemicals stands at 63%. Given that the segment has witnessed rising imports coupled with moderate export growth, present capacity needs to be optimally utilized. Capacity utilization in pesticides and dyes and pigments is also low.

Need for greater integration into the Global Value Chains (GVCs)

Analysing the forward and backward linkages in the chemical sector in the Indian and Chinese context, it is observed that while China has had high forward linkages (above 60%) for the last two decades for chemicals and pharmaceutical products, the same for India has stayed under 50%. Furthermore, India has been having increased dependence (backward linkage) on China for some critical inputs used by the chemical and pharmaceutical industry.

During 2012-2021, while India's import of chemicals from the rest of the world increased at an AAGR of 8.3%, the imports from China grew at an AAGR of 11.8%, making up for about 35% of India's total chemical imports in 2021. It is recommended that in order to reduce the import dependence from China and boost the chemical exports from India, greater focus should be laid on enhancing India's integration into the GVCs, enabling domestic manufacturers to specialize across various stages of production.

Bolstering the R&D

Investments in the Indian chemical industry assume greater importance on two fronts – technology and innovation. Technological development may be achieved by the chemical industry at two levels. In the bulk products segment, the chemical industry should undertake process innovation with the objective of reduction in cost of production.

In addition, the industry needs to invest in technological resources that would lead to specialized product development. Liberalization process has already increased the possibility of intra-firm transfer of technology and management practices in the form of consolidation within the economy as also from developed countries through foreign direct investment.

In order to increase innovation, more dedicated regional clusters for chemical industry should be created and similarly, more universities focused on chemical engineering (e.g., ICT, IIT Mumbai) should be shortlisted to develop innovation hubs for the chemical industry.

Fund for SMEs in Chemical Industry

India's chemical industry consists of several small industries that cover hundreds of segments. However, given the paucity of funds available with them they are unable to upgrade themselves. With considerable market potential abroad, SMEs need to move up the value chain so as to reap the gains in overseas markets.

The SMEs also need to conform by the various rules, regulations, and good practices prevalent abroad. In this regard, a suitable fund may be constituted by the Government on the lines of the Technology Upgradation Fund as available to the textile industry, or provision of accelerated depreciation as available to the solar energy sector. The fund could also be utilized to access designs, patents, processes, and technology.

Moving towards Sustainability and Green Chemistry in India

Relevant across the life cycle of chemical products, green chemistry is an approach that could be considered towards manufacturing chemical products to reduce or eliminate chemical perils. The goal of green chemistry is to create better and safer chemicals while identifying the safest and most efficient ways to manufacture them and to mitigate wastes. A transformation to green chemistry techniques would result in safer workplaces for industry workers, greatly reduced risks to fence line communities and safer products for consumers. Since green chemistry processes are more efficient, companies would consume less raw materials and energy as well as save money on waste disposal.

To accelerate the uptake of green chemistry, it is important to continue to build a comprehensive, ongoing understanding of green chemistry enablers, market drivers and obstacles. It is equally important to support conducive federal policies that increase the supply of and demand for green chemistry solutions besides addressing the problems related

to funding, training, and streamlining the permit for green chemistry products.

Road Ahead

The Indian chemical industry is contributing almost 8% of the country's exports, and the share has been expanding. However, given its potential it can grow faster, especially within the new aged areas like specialty chemicals. This Study in fact projects chemical exports in an optimistic scenario to touch US$ 97.4 billion by 2030.

It is also important to acknowledge that there are some major trends that are observed, given the increasing deglobalization and the recognition of climate change. This in the process is expected to bring in greater focus on the environment friendly ways of production as well as the digitalization in the operations and management of the Indian chemical firms.

Further with the government's industry friendly policies in place and upcoming PLI scheme for chemicals and petrochemicals, the chemicals industry would be at an important junction wherein with the appropriate expansion plans, it could become a global leader in the years ahead.

1 Introduction

The chemical industry plays a crucial role in most sectors of the economy. Chemicals are an important constituent of global value chains having widespread applications ranging from energy generation, transportation, and construction to supporting agriculture and providing clean drinking water.

Besides producing finished products like fertilizers, pesticides, LED lighting and other agrochemical products, the industry also produces key inputs for other manufacturing activities like synthetic fibres, plastics and water chemistry that benefit living standards and consumers around the world.

The International Council of Chemical Association (ICCA) estimates that over 95% of all manufactured products rely on some form of industrial chemical process. The industry is also an important source of skilled employment.

As outlined in Division 20 of Eurostat's NACE Rev. 2, the chemical industry broadly contains the following sub-sectors:

- Manufacture of basic chemicals, fertilizers and nitrogen compounds, plastics, and synthetic rubber in primary forms;
- Manufacture of pesticides and other agrochemical products;
- Manufacture of paints, varnishes and similar coatings, printing ink and mastics;
- Manufacture of soap, detergents, cleaning, polishing, perfumes, and toilet preparations;
- Manufacture of other chemical products, including explosives and pyrotechnic products, glues, essential oils, and chemical products not elsewhere classified (e.g., photographic chemical material, composite diagnostic preparations, etc.); and
- Manufacture of man-made fibres.

Although the chemical industry is quite heterogeneous in character – ranging from commodity chemicals to research-driven products, it can broadly be classified into three major segments, viz., basic chemicals, specialty chemicals, and pesticides.

Table 1.1: Classification of the Chemical Industry

Segments	Characteristics	Constituent Industries
Basic	• High Volume, Low Value-Added • Limited product differentiation across manufacturers • High entry barriers on account of high capital spending and stringent regulations	Organic and inorganic chemicals, bulk petrochemicals, other chemicals intermediates, plastic resins, synthetic rubber and dyes and pigments,
Pesticides	• Meant for protecting agriculture crops against insects and pests	Pesticide
Specialty	• High product differentiation and value-addition • Typically, smaller production units • Derived from basic chemicals	Paints, adhesives, electronic chemicals, water management chemicals, oilfield chemicals, flavours and fragrances, rubber, paper and plastic additives, industry cleaners and fine chemicals, sealants, catalysts etc.

Source: Ministry of Chemicals and Petro-chemicals

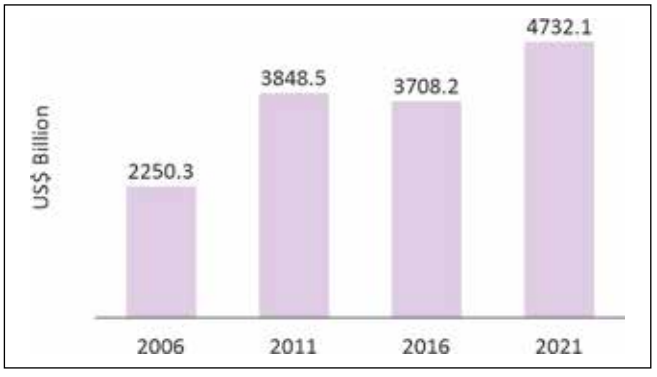
Global Chemical Industry

The global chemical industry, as categorized above, is not only important in terms of size but also in terms of its features, involving significant capital investment, high knowledge content and qualified human resources.

According to an analysis done by Oxford Economics, on average in 2017, every US$ 1 of gross value added (GVA) created directly by the chemical industry supports an additional US$ 4.2 contribution elsewhere in the global economy. Interestingly, the industry supported 7.1% of GDP through its direct and indirect impact according to the analysis. Indirect impact refers to the activity across the globe that is supported as a result of the procurement of goods and services by the chemical industry. Furthermore, the industry supported 120 million jobs both directly and indirectly and contributed to the GDP of every sector with the highest contributions seen in mining and quarrying, wholesale and retail trade, R&D and other business activities, real estate activities, financial services, and agriculture[1].

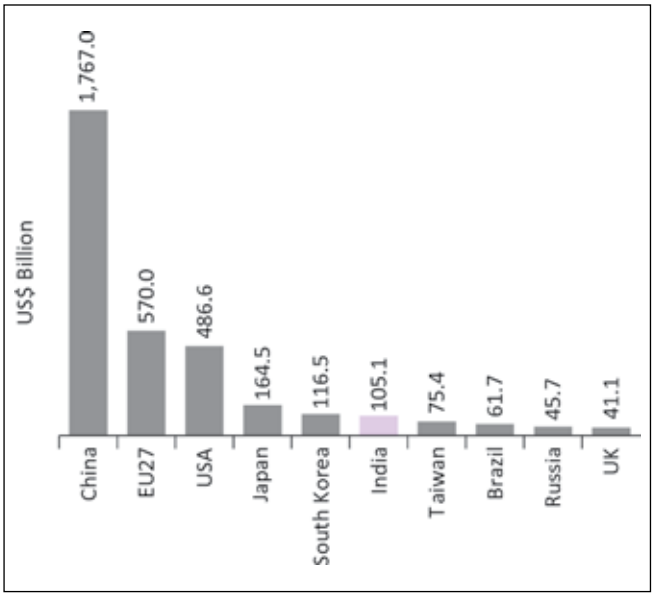
During 2006 and 2021, the revenue of the global chemical industry has more than doubled from US$ 2.3 trillion to US$ 4.7 trillion. Notably, after falling to US$ 3.8 trillion in 2020 from US$ 4 trillion in the previous year, the chemical industry reached its highest value of the last 15 years in 2021. China is the undisputed leader as a chemicals manufacturer, constituting a share of 44.6% in global sales of chemicals in 2020. The European Union is the second largest manufacturer with a share of 14.4% in global chemicals sales, followed by USA (12.3%), Japan (4.1%), South Korea (2.9%) and India (2.7%)[2].

Figure 1.1: Global Revenue of the Chemical Industry



Source: Statista

Figure 1.2: Global Chemical Sales by Country in 2020: Top 10



Source: CEFIC; India Exim Bank Research

Traditionally, the EU and the US were the key producers of chemicals. However, after the 2008 financial crisis, manufacturing in developing countries started picking up. The years since have witnessed a global shift towards Asia as the world's chemicals manufacturing hub. Five out of the top ten chemical producers in 2020 were in Asia, namely China, Japan, South Korea, India, and Taiwan. They together constituted a share of 56.2% in global chemicals sales in 2020 as against a share of 41.4% in 2010[3].

[1] ICCA and Oxford Economics. The Global Chemical Industry: Catalysing Growth and Addressing Our World's Sustainability Challenges

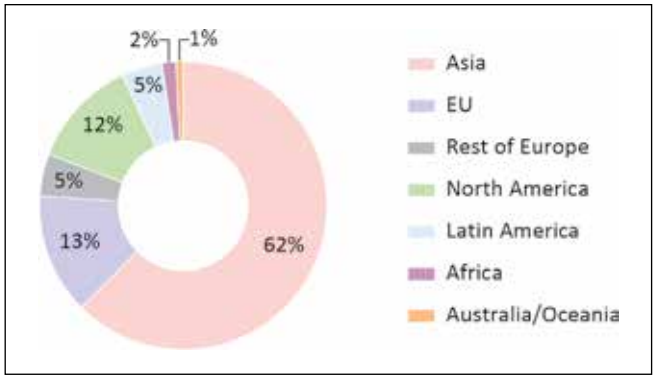
[2] Cefic Facts & Figures 2022. Average exchange rate of 1US$= £0.8768 used for conversion of sales figures.

[3] Ibid.

Low labour costs, relatively relaxed environmental norms and government subsidies are among the driving forces behind this shift[4]. Within the region, however, only China and India have seen an expansion in their share in global sales of chemicals by 18.8% and 0.2%, respectively. The EU and the USA have seen their share decline by 4.9% and 4.2%, respectively, between 2010 and 2020.

Asia's importance in global chemicals market is further evident by its colossal contribution to global consumption. Asia represented 62% of global chemical demand in 2021, led largely by China. The EU was the second largest consumer of chemicals with a share of 13%, followed by the rest of Europe (5%), North America (12%), and Latin America (5%).

Figure 1.3: Consumption of Chemicals by Region, 2021



Source: Statista; CHE Manager; India Exim Bank Research

China also leads globally in terms of investment in the industry owing to favorable factors like large consumer base and conducive government policies. In 2020, China invested US$ 105.3 billion in the chemical industry, an increase of 80% from its US$ 58.4 billion capital spending in 2010. The investments made by North America are the second highest at US$ 30.2 billion followed by the EU (US$ 23.2 billion), Japan (US$ 8.1 billion) and South Korea (US$ 6.9 billion). India's investments during 2010 and 2020 increased by 63% to US$ 4.5 billion[5].

[4] CRISIL (2019)
[5] Cefic Facts & Figures 2022

Chemicals Sector on the Cusp of a Paradigm Shift

The chemicals sector globally is undergoing considerable changes, driven by evolving technology, environmental concerns, changing geo-political dynamics and COVID induced supply shocks. The disruption resulting from the pandemic demonstrated the need for localization of supply chains with focus on resilience and efficiency. Consequently, there is a growing focus on the following areas:

- **Innovation -** Fostering innovation in chemicals has far-reaching impact on the global economy given its extensive integration with most of the industries and end-use products. Furthermore, the ongoing structural transformation in key industries such as automotive and materials necessitate investing in R&D to cater to the changing demand. Developments are taking place in the areas of bio and photodegradable plastics, advanced materials for construction applications, materials for microelectronics, solvent cleaning technologies etc. with growing focus on end-market challenges.

- **Digitalization** - According to EY's DigiChem Survey 2022, digitalization has become the second most prominent capital issue for chemical firms. The supply chain constraints and spiraling inflation are driving chemical businesses to expedite digitalization. Leveraging digital tools such as Internet of Things and Blockchain for forecasting demand, tracing of materials, real tracking of orders and automation of processes, among others is instrumental for optimizing supply networks.

- **ESG adoption** - Chemicals are omnipresent. Thus, it is crucial for the chemical industry to mainstream environmental and social governance (ESG) across the value chains. Sustainable Development Goal (SDG) 12 calls for "environmentally sound management of chemicals and all wastes throughout their lifecycle" and "for significantly reducing their release to air, water and soil". Several other SDGs also focus on ensuring sustainability in the chemicals sector.

Figure 1.4: Chemicals and Related SDGs

Source: Strategic Approach to International Chemicals Management (SAICM)

Many chemical companies have committed to significant emissions reduction targets. Going forward, the industry is expected to transit to circular business models that would in turn promote sustainability in other sectors as well.

This Study

Indian chemical industry is one of the fastest growing in the world and has emerged as one of the focus destinations for chemicals worldwide. The chemical industry's growth in India is largely driven by its consumption growth story. Per capita consumption of chemicals in India is about one-tenth of the world average, and even when compared with other developing countries, Indian chemicals consumption is low. This makes India a very attractive destination to invest, grow and export.

This Study acknowledges that the chemical industry by itself is very large and hence the analysis focuses on the performance of four specific segments within the industry, which inter-alia, include – organic chemicals, inorganic chemicals, tanning or dyeing extracts, and insecticides, rodenticides, fungicides, herbicides, etc. The international trade of these products has been examined based on harmonized codes (HS-Codes).

In this Study, a section has been dedicated to studying the performance of India's domestic chemical industry (analyzing the aforesaid categories), followed by analysis of the global trade market. The Study concludes by identifying a set of strategies that could be adopted at the backdrop of some of the challenges that the Indian chemical industry faces.

2 Indian Chemical Industry

Background

Chemical industry is among the oldest industries in India and forms the backbone of industrial and agricultural development of the country. It provides building blocks for downstream industries making it a significant contributor to India's national economic growth. The industry is knowledge and capital intensive and is one of the most diversified industrial sectors, covering more than 80,000 commercial products. These products range from basic chemicals and its products, petrochemicals, fertilizers to paints and varnishes soaps, perfumes, and toiletries[6].

Chemical and chemical product sector accounted for 1.4% of the total Gross Value Added and 9.6% of manufacturing output in 2020-21. The share of the sector in gross valued added for all economic activities was 1.4% and the share in manufacturing was 8.8% during the period[7].

The chemical industry comprises both small and large-scale units. The fiscal concessions granted to the small sector in mid-eighties led to the establishment of many units in the small-scale industries (SSI) sector. Many MNCs also participate in the industry. Major chemical producing states in India are Gujarat and Maharashtra, with some base at other states including Andhra Pradesh, Tamil Nadu, Karnataka, and West Bengal.

Over the last decade, the Indian chemical industry has evolved from being a basic chemical producer to becoming an innovative industry. With increasing investments in research and development (R&D), the industry has been registering significant growth in the knowledge arena, including specialty and fine chemicals. The industry now produces many fine and specialty chemicals which have very specific uses and are essential for increasing industrial production. These chemicals find wide usage as, inter alia, food additives and pigments, polymer additives, and antioxidants in the rubber industry.

Given this varied range of products, the scope of analysis in this Study has been confined to basic, specialty and agricultural chemicals. Thus, segments for analysis in the Study include organic and inorganic chemicals, tanning, dye extracts and insecticides and pesticides.

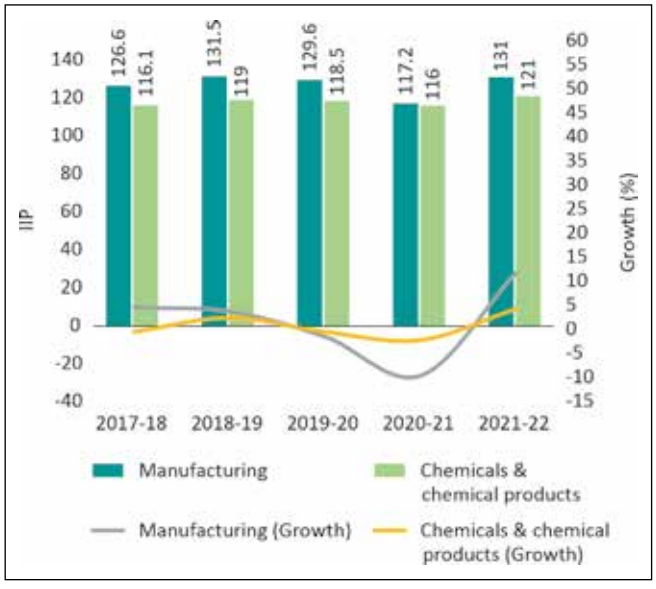
Index for Industrial Production

The 'Chemicals and Chemical Products' is an important industry group within the index for industrial production (IIP) with the weight of this category being 7.87 in the IIP. The IIP for the chemicals and chemical products in 2021-22 witnessed 4.2% increase from 2017-18. The impact of COVID-19 on the manufacturing sector has been considerable as is evident by the contraction in IIP by (-) 9.6% in 2020-21 as compared to the previous year. The contraction in IIP of the chemical and chemical products sector during this period was relatively low at (-) 2.1%. In the current financial year (April-September 2022), IIP for the sector has expanded by 10.3% over the corresponding period of the previous year.

[6] Department of Chemicals and Petrochemicals, Ministry of Chemicals and Fertilizers, Government of India

[7] Calculations based on National Accounts Statistics 2022

Figure 2.1: Trends in Industrial Production: Index and Growth



Source: Data accessed from CMIE Industry Outlook; India Exim Bank Research

Table 2.1: Major Chemical Groups and Sub-Segments Produced in India

Group	Sub – Products
Alkali	Soda ash, Caustic soda, and Liquid chlorine
Inorganic chemicals	Aluminum fluoride, Calcium carbide, Carbon black, Potassium chlorate, Sodium chlorate, Titanium dioxide and Red phosphorous.
Organic chemicals	Acetic acid, Acetic anhydride, Acetone, Phenol, Methanol, Formaldehyde, Nitrobenzene, Citric acid, Maleic Anhydride, Penta Erithritol, Aniline, Chloro methanes, ONCB, PNCB, MEK, Acetaldehyde, Ethanolamines, Ethyl acetate and Ortho nitro toluene.
Pesticides	Pesticides and insecticides registered under the Insecticide Act of 1968.
Dyes and dyestuff	Azo dyes, Acid direct dyes, Basic dyes, Fast colour bases, Ingrain dyes, Oil soluble (solvent dyes), Optical whitening agents, Organic pigment colours, Pigment emulsion, Reactive dyes, Sulphur dyes, Vat dyes, Food colours and Napthols

Source: Ministry of Chemicals & Fertilizers

Installed Capacity and Production of Major Chemicals

According to the latest available information from the Chemical and Petrochemical Statistics, Government of India, the installed capacity of major chemicals in India has increased from 134 lakh tonnes in FY 2017 to 156 lakh tonnes in FY 2021 at an AAGR of 3.8%.

Table 2.2: Installed Capacity of Major Chemicals ('000 MT)

Group	FY 17	FY 18	FY 19	FY 20	FY 21	AAGR (FY 17 - FY 21)
Alkali chemicals	8422	8422	9274	9422	10089	4.6%
Organic chemicals	2529	2535	2575	2671	2664	1.3%
Inorganic chemicals	1313	1315	1300	1538	1560	4.7%
Pesticides	322	325	324	334	371	3.7%
Dyes and Pigments	471	478	492	528	532	3.1%
Total Major Chemicals	**13456**	**13927**	**14112**	**15160**	**15601**	**3.8%**

Source: Chemical and Petrochemical Statistics At A Glance - 2021; India Exim Bank Research

It may be observed that while the installed capacity has seen an increase, the production of major chemicals during the period has lagged - the production of major chemicals in FY 2021 stood at 112.42 lakh tonnes recording an AAGR of 2.5% from FY 2017 to FY 2021

Other than inorganic chemicals, all other major chemical segments witnessed growth in production during the period as demonstrated by a positive AAGR. The production of major chemicals further increased to 115.8 lakh tonnes during FY 2022 (April 2021 to Feb 2022), registering an on-year growth of 14.1%.

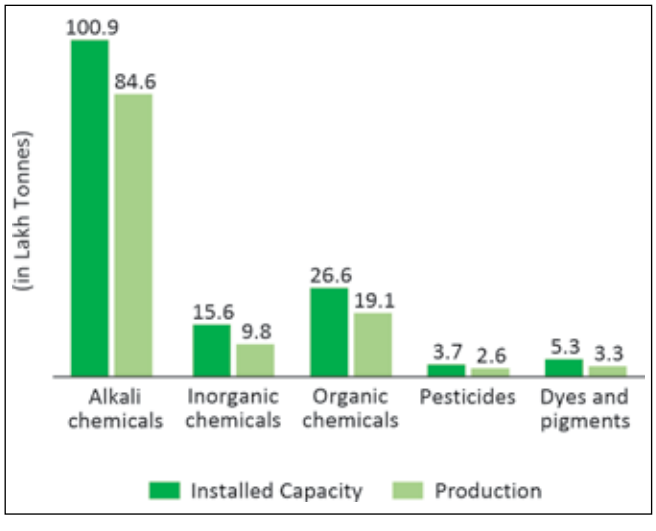
Table 2.3: Production of Major Chemicals: Recent Trends ('000 MT)

Group	FY 17	FY 18	FY 19	FY 20	FY 21	AAGR (FY 17 - FY 21)	Share in basic major chemicals (FY 21)	2021-22 (up to Feb-22)
Basic Major Chemicals								
Alkali Chemicals	7009	7631	8043	8457	7776	2.8%	69.2%	8205.8
Organic Chemicals	1638	1799	1884	1847	1906	3.9%	17.0%	1788.1
Inorganic Chemicals	1053	1058	1064	1063	978	-1.8%	8.7%	949.3
Dyes and Pigments	320	367	382	384	327	1.1%	2.9%	362.8
Pesticides	214	213	217	192	255	5.7%	2.3%	276.2
Total	**10234**	**11068**	**11590**	**11943**	**11242**	**2.5%**	**100%**	**11582.2**

Source: Ministry of Chemicals & Fertilisers, Government of India; India Exim Bank Research

During FY 2021, almost 70% of the major chemicals produced in India were alkali chemicals. The production has however showed lackluster growth, declining from 80.4 lakh tonnes in FY 2019 to 77.8 lakh tonnes in FY 2021. The production has been lower than the installed capacity. Organic chemicals had the second highest share in production at 17% with the production growing at an AAGR of 3.9% during FY 2017 to FY 2021. Production of pesticides has shown a robust growth during the same period, registering an AAGR of 5.7% while production growth of dyes and pigments has been low (1.1%).

Figure 2.2: Production and Annual Capacity of Major Chemicals in FY 2021



Source: Chemical and Petrochemical Statistics at a Glance - 2021; India Exim Bank Research

Given that specialty chemicals such as dyes and pigments are knowledge oriented, per unit price realization is higher than most other segments of the chemical industry. Hence, growth in this segment in value terms may likely be greater than what is evidenced in volume terms. It may be noted that production of inorganic chemicals has contracted during the period by 1.8% on average.

During the current financial year, (up to June 2022), the production of major chemicals stood at 32.56 lakh tonnes, an increase of 7.2% as compared to the production during the corresponding period of the previous year.

India's Trade in Chemical Products: An Analysis

Chemicals[8] form an integral part of India's export basket, constituting a share of 8% in total exports in 2021. During the period 2017 to 2021, exports of chemicals registered a strong AAGR of 12.8%. However, India has remained a net importer of chemicals for a long time. Imports of chemicals have ballooned, recording an AAGR of 14.1% during 2017-21 and accounting for about 5% of India's import basket in 2021. Consequently, India's trade deficit in chemicals has burgeoned over the years.

[8] Excluding fertilizers and pharmaceuticals

Table 2.4: India's Major Chemical Export and Import Markets in 2021

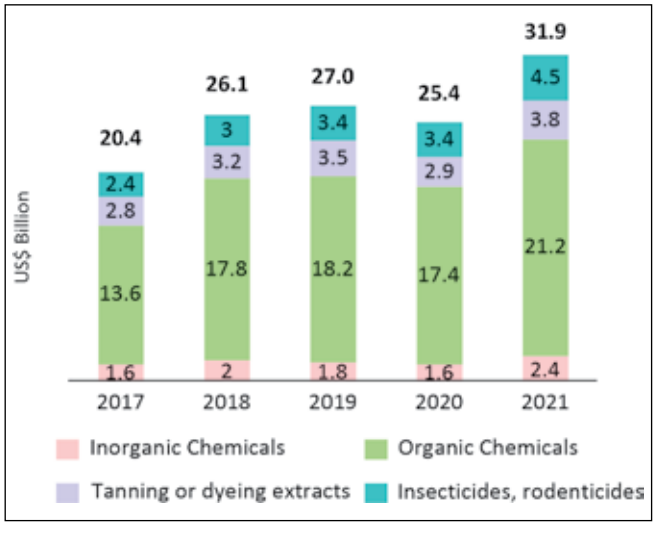
HS 28: Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes			
Total Export: US$ 2.4 Billion, Total Import: US$ 9.6 Billion			
Export Destination	**% share**	**Imports sourced from**	**% share**
UAE	18%	Japan	17%
USA	8%	China	9%
China	6%	Morocco	9%
Bangladesh	4%	Jordon	7%
Oman	4%	Vietnam	6%
HS 29: Organic chemicals			
Total Export: US$ 21.2 Billion, Total Import: US$ 27.2 Billion			
Export Destination	**% share**	**Imports sourced from**	**% share**
USA	14%	China	44%
China	12%	USA	7%
Saudi Arabia	4%	Saudi Arabia	6%
Netherlands	4%	Singapore	5%
Germany	4%	South Korea	5%
HS 32: Tanning or dyeing extracts; tannings and their derivatives; dyes, pigments and other coloring matter; paints and varnishes; putty and other mastics; inks			
Total Export: US$ 3.8 Billion, Total Import: US$ 2.5 Billion			
Export Destination	**% share**	**Imports sourced from**	**% share**
China	9%	China	35%
USA	8%	USA	6%
Bangladesh	7%	Germany	6%
Turkey	7%	Spain	5%
Germany	5%	Singapore	5%
HS 3808: Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant growth regulators, disinfectants and similar products, put up for retail sale or as preparations or articles			
Total Export: US$ 4.5 Billion, Total Import: US$ 1.9 Billion			
Export Destination	**% share**	**Imports sourced from**	**% share**
Brazil	26%	China	50%
USA	21%	USA	10%
Japan	4%	Singapore	6%
Vietnam	3%	Netherlands	6%
Argentina	3%	Germany	5%

Source: Data accessed from ITC Trade Map; India Exim Bank Research

Exports

India's exports of chemicals have increased from US$ 20.4 billion in 2017 to US$ 31.9 billion in 2021. Organic chemicals were the highest exported category among the group, with exports amounting to US$ 21.2 billion in 2021. The exports registered a healthy AAGR of 12.7%. The other categories also witnessed strong export growth during the period. Exports of inorganic chemicals grew by 13.3%, at US$ 2.4 billion in 2021; tanning or dyeing extracts grew by 9.9% at US$ 3.8 billion; and with an AAGR of 17.2% exports of insecticides, rodenticides etc. were valued at US$ 4.5 billion in 2021.

Figure 2.3: India's Export of Major Chemicals: 2017-2021

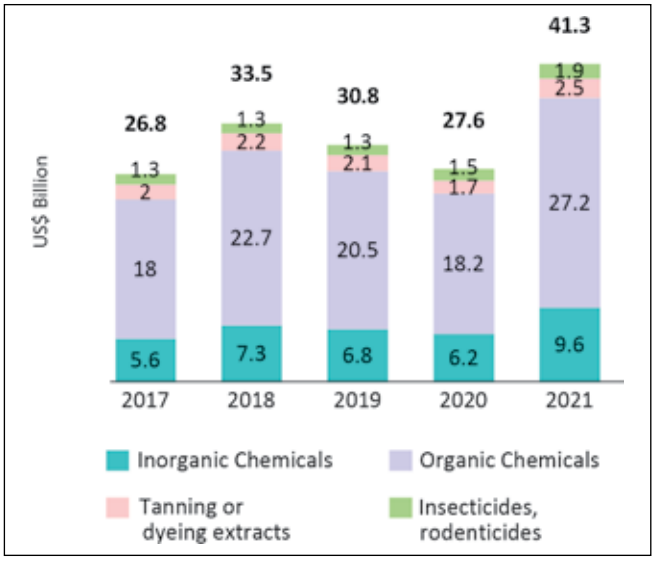


Source: Data accessed from ITC Trade Map; India EXIM Bank Research

Imports

During the same period (2017-2021), India's imports of chemicals grew from US$ 26.8 billion to US$ 41.3 billion. Organic chemicals constituted the majority of imports (66%) at US$ 27.2 billion, a rise of US$ 9.3 billion from imports of US$ 18 billion in 2017. Inorganic chemicals grew at the highest AAGR of 17.6%, with imports recorded at US$ 9.6 billion in 2021. The imports of tanning or dyeing extracts and insecticides, rodenticides etc. grew at an AAGR of 9.1% and 10.6%, with imports at US$ 2.5 billion and US$ 1.9 billion in 2021, respectively.

Figure 2.4: India's Import of Major Chemicals: 2017-2021



Source: Data accessed from ITC Trade Map; India Exim Bank Research

Trade Balance

Overall, for the industry, trade deficit amounted to US$ 9.4 billion in 2021, higher than the deficit of US$ 6.4 billion in 2017. The increase in trade deficit is largely attributed to the growing imports of inorganic chemicals, which led to the trade deficit in the segment increasing from US$ 4 billion in 2017 to US$ 7.2 billion in 2021. Trade deficit in organic chemicals has also grown to US$ 6.1 billion in 2021.

The trends indicate that growth in exports is not commensurate with the rising imports of chemicals. This points at the high dependence of the sector on overseas markets. To promote self-reliance, the industry needs to focus on boosting domestic manufacturing and exports by adopting a market- and product-specific approach – contours of which this study envisages to draw. The trade deficit for the chemical industry was mostly driven by China, Japan, Singapore, and South Korea. Notably, countries with which India had the highest trade surplus in 2021 were USA, Brazil, Turkey, UAE, and Bangladesh.

Table 2.5: India's Trade Balance for the Chemical and Dye Industry: 2017 vs 2021

HS Code	Description	Trade Balance in 2017 (US$ Billion)	Trade Balance in 2021 (US$ Billion)
HS 3808	Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growth regulators, disinfectants and similar products, put up for retail sale or as preparations or articles, e.g., Sulphur-treated bands, wicks and candles, and fly-papers	1.2	2.7
HS 32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other coloring matter; paints and varnishes; putty and other mastics; inks	0.8	1.3
HS 28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes	-4.0	-7.2
HS 29	Organic chemicals	-4.4	-6.1
	Total Trade Balance	**-6.4**	**-9.4**

Source: Data accessed from ITC Trade Map; India Exim Bank Research

Foreign Direct Investment in the Chemical Industry

Chemical industry in India is increasingly becoming a globalized industry. Foreign direct investment (FDI) in the chemical industry and trade between parent firms and their subsidiaries is increasingly becoming significant for the sector. FDI has had a positive impact on growth, development, productivity, and competitiveness for the Indian chemical industry. The country has benefited from the transfer and use of technology and the associated benefits of FDI inflows, which has increased over the last few years due to the several incentives that have been provided by the Government of India. The policy now allows for 100% FDI in chemicals under the automatic route except in the case of certain hazardous chemicals such as phosgene, hydrocyanic acid, and their derivatives.

Chemical sector has been one of the top ten FDI receiving sectors in India. During January 2000-June 2022, the chemical sector in India (excluding fertilisers) received FDI equity inflows worth US$ 20.4 billion[9]. The sector accounted for 3% of the total FDI received by India during the period. It may be noted that the FDI inflows in the chemical sector have witnessed high volatility ranging from US$ 292 million in 2012-13 to a peak of US$ 1981 million in 2018-19. In the subsequent years, FDI inflows have witnessed a dip. In FY 2022, FDI amounting to US$ 966 million was channelized in the Chemicals sector.

Figure 2.5: FDI Equity Inflows in India's Chemical sector (excluding Fertilisers)

Source: Data accessed from DIPP FDI Statistics; India EXIM Bank Research

[9] Department for Promotion of Industry and Internal Trade

3 Export Competitiveness of the Indian Chemical Industry

Exports of chemicals[10] by India constituted a considerable share of 8.1% in India's total exports and 4.1% in global exports of chemicals in 2021. In 2021, India was the tenth largest exporter of chemicals globally. Segment-wise, India is the fourth largest exporter of agrochemicals, seventh largest exporter of tanning or dyeing extracts, ninth largest exporter of organic chemicals and fourteenth largest exporter of inorganic chemicals[11]. India holds the potential to further strengthen its export competitiveness in the sector. In this regard, the chapter seeks to analyse India's cross-border trade performance in chemicals and ascertain the growth potential of the industry.

Granular Analysis of India's Trade in Chemicals

India's total exports from the chemicals industry (inorganic chemicals (HS 28), organic chemicals (HS 29), tanning or dyeing extracts (HS 32), and agrochemicals such as insecticides, rodenticides, fungicides etc. (HS 3808) stood at US$ 31.9 billion in 2021, a growth of 57% from 2017. During 2017-2021, the exports witnessed an AAGR of 9.9%, higher than the world chemical export AAGR of 7.4%.

As noted earlier, exports from the Indian Chemicals industry have been largely dominated by organic chemicals (HS 29), constituting about 66% of total exports, followed by agrochemicals comprising of insecticides, rodenticides, fungicides, herbicides, anti-sprouting products, plant-growth regulators etc. (HS 3808), with a share of 14%.

Across the sub-groups, the highest AAGR in exports during 2017-21 was noted for agrochemicals under HS 3808 at 17.2%. Exports of inorganic chemicals and organic chemicals also grew at a healthy AAGR of 13.3% and 12.7%, respectively. The exports of tanning or dyeing extracts, pigments, paints, varnishes etc. registered the lowest AAGR of 9.9% among all the sub-groups.

HS 29: Organic Chemicals

Organic chemicals and intermediates are one of the most important segments of the Indian chemical industry. Major organic chemicals produced in India include acetic acid, acetic anhydride, acetone, phenol, methanol, formaldehyde, nitro benzene, citric acid, maleic anhydride, pentaerythritol, aniline, ortho nitro chloro benzene, acetaldehyde, ethanolamine, and ethyl acetate. Used in many household products like paints, varnishes and products of cleaning and disinfecting, this segment has been playing a significant role in providing vital chemicals and intermediates to associated sectors of the Indian chemical industry (like drugs and pharmaceuticals, dye stuffs and dye intermediates, leather chemicals, paints, and pesticides).

With respect to trade, the exports of organic chemicals (HS 29) from India in 2021 amounted to US$ 21.2 billion, up from US$ 12.5 billion in 2012. The exports had a considerable share of 5.4% in India's export basket. During 2012-2021, India's exports of organic chemicals registered an AAGR of 6.8% as against the

[10] HS 28: Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes; HS 29: Organic chemicals; HS 32: Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other coloring matter; paints and varnishes; putty and other mastics; inks; HS 3808: Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growth regulators, disinfectants and similar products, put up for retail sale or as preparations or articles, e.g., Sulphur-treated bands, wicks and candles, and fly-papers

[11] Exim Bank analysis based on ITC Trade Map Database

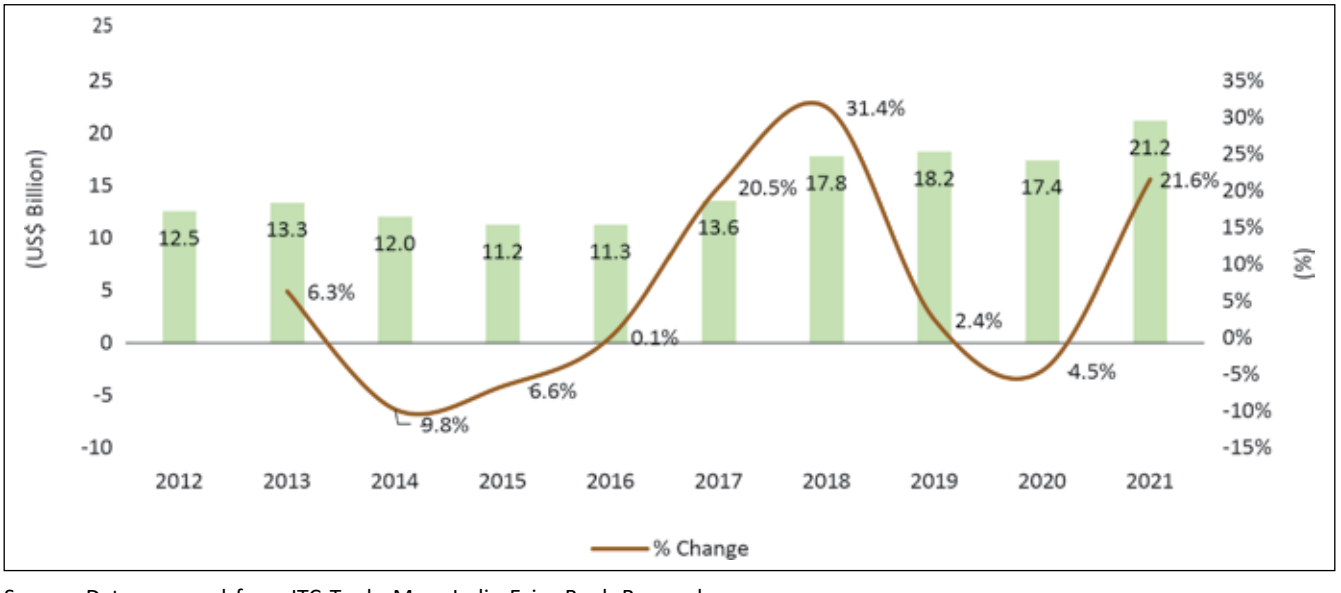
global average export growth rate of 1.9% during the period. Furthermore, the share of India's exports in world exports of HS 29 increased from 2.8% in 2012 to 4.6% in 2021. The share of China, the top exporter of HS 29 increased from 9.1% to 16.8%, during the same period. After China, the other top exporters were the USA and Ireland with a share of 8.7% and 7.5%, respectively, in global exports of organic chemicals.

Table 3.1: Chemicals Exports from India (US$ billion)

HS Code	Description	2017	2018	2019	2020	2021	AAGR (2017-21)	Share in Chemical Exports (2021)
	World Chemical and Dye Exports	**611.3**	**709.3**	**658.2**	**625.2**	**785.9**	**7.38%**	**-**
	India's Chemical and Dye Exports	**20.4**	**26.1**	**27.0**	**25.4**	**31.9**	**9.90%**	**-**
29	Organic chemicals	13.6	17.8	18.2	17.4	21.2	12.7%	66.3%
3808	Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growth regulators, disinfectants and similar products, put up for retail sale or as preparations or articles, e.g. Sulphur-treated bands, wicks and candles, and fly-papers	2.4	3.0	3.4	3.4	4.5	17.2%	14.1%
32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other coloring matter; paints and varnishes; putty and other mastics; inks	2.8	3.2	3.5	2.9	3.8	9.9%	12..0%
28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes	1.6	2.0	1.8	1.6	2.4	13.3%	7.5%

Source: Data accessed from ITC Trade Map; India Exim Bank Research

Figure 3.1: Exports of Organic chemicals (HS 29) from India

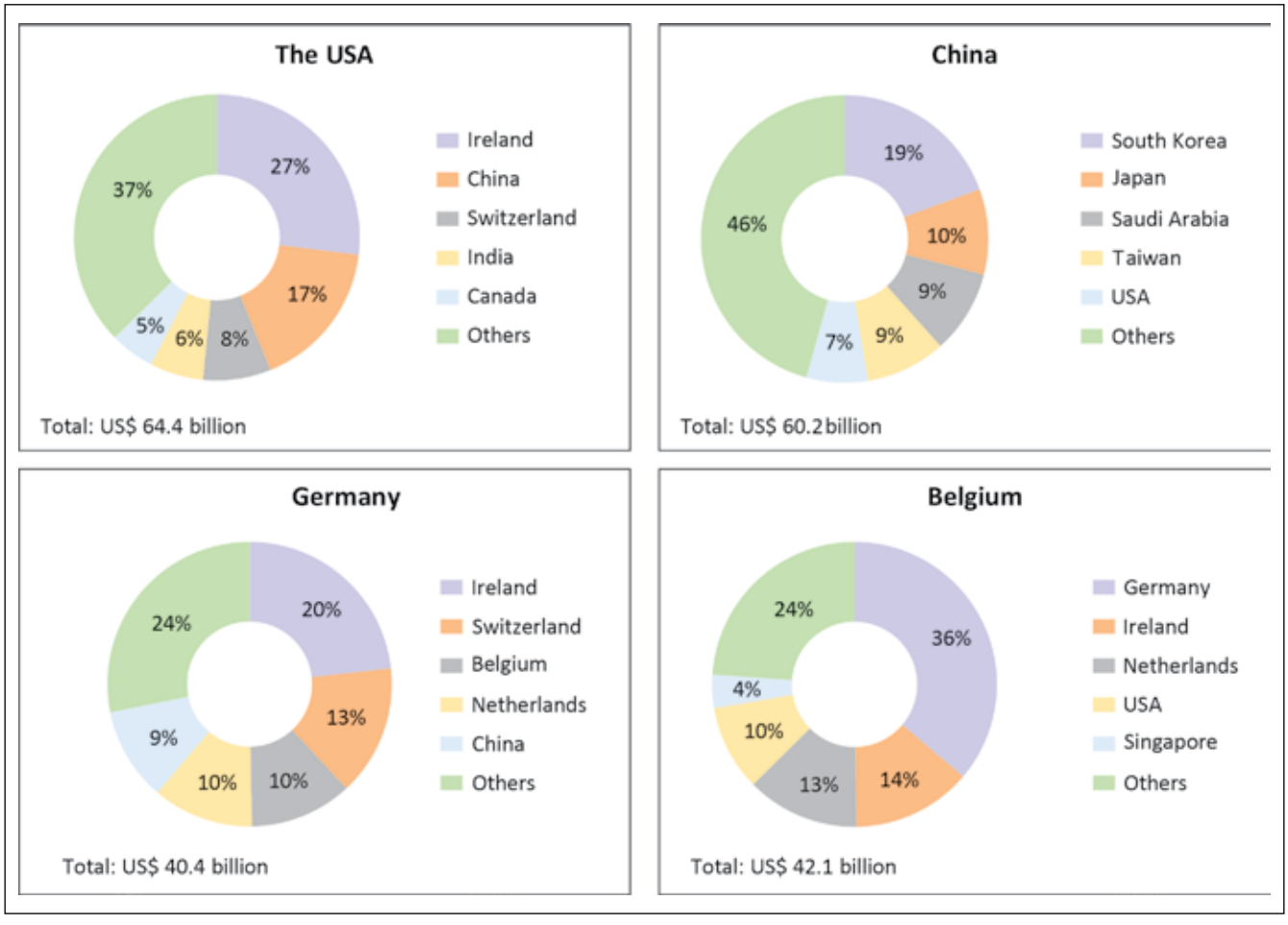


Source: Data accessed from ITC Trade Map; India Exim Bank Research

India's top export destinations for organic chemicals in 2021 were the USA (14%), China (12%), Saudi Arabia (4%), the Netherlands (4%), and Germany (4%). The USA, China, Belgium, and Germany were the leading importers of organic chemicals with a combined share of 39% in global imports in 2021. Among these top importers, only the USA imports a considerable share of its organic chemicals from India. India doesn't surface as a major supplier for other top importing countries. It may be noted that China sources organic chemicals majorly from Asian countries while European countries viz. Belgium and Germany import more from within Europe.

The top organic chemicals exported in 2021 at HS 6-digit were P-xylene with an export share of 12.3% in global exports of the commodity, benzene (18.2%) and separate chemically defined organic compounds (64.1%). The top ten exported items at HS 6-digit constituted a share of 43.6% in India's exports of organic chemicals. Notably, among the top ten exported items under HS 29, India is the leading exporter of separate chemically defined organic compounds and menthol and the second largest exporter of P-xylene and benzene.

Figure 3.2: Major Supply Sources to Top Importing Countries of Organic chemicals (HS 29) in 2021



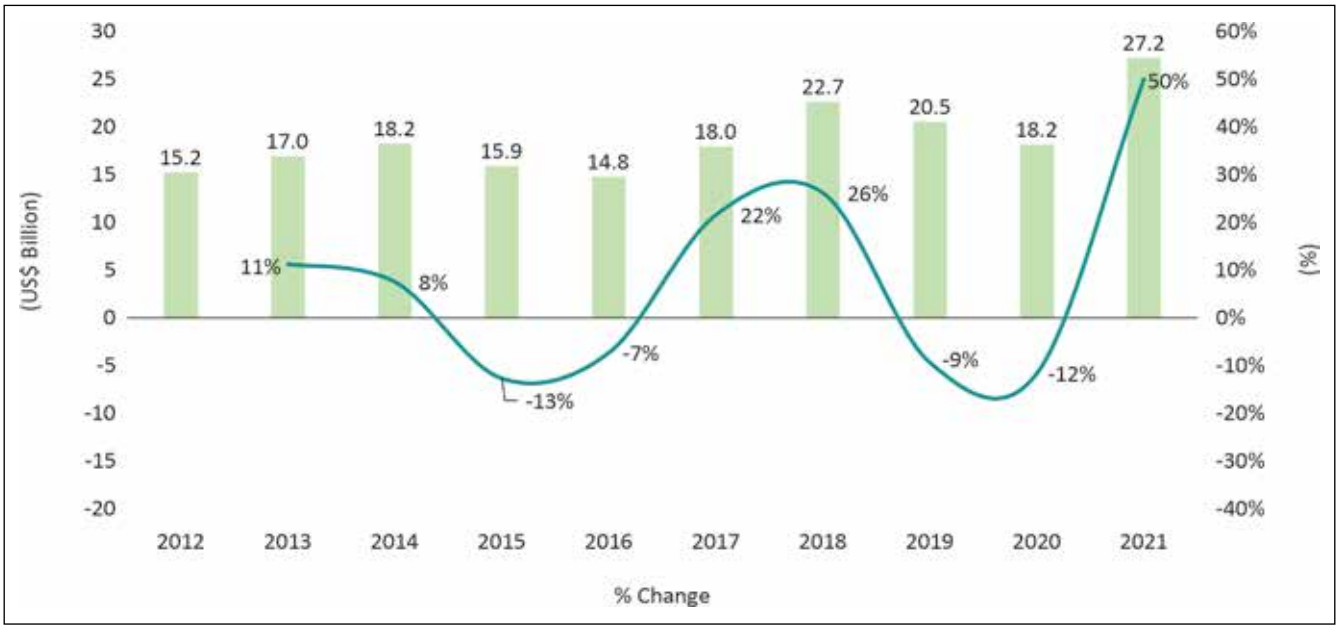
Source: Data accessed from ITC Trade Map; India Exim Bank Research

Table 3.2: Major Items of Exports of Organic Chemicals (HS 29) from India

HS Code	Description	India's Exports in 2021	Export AAGR (2012-21)	Share in World Exports
290243	P-Xylene	2077.6	23.3%	12.3%
290220	Benzene	1674.5	19.9%	18.2%
294200	Separate chemically defined organic compounds	1252.3	-6.3%	64.1%
293339	Heterocyclic compounds with nitrogen hetero atom[s] only, containing an unfused pyridine ring whether or not hydrogenated, in the structure	931.7	21.5%	7.1%
293399	Heterocyclic compounds with nitrogen hetero atom[s] only	837.6	15.9%	4.5%
293359	Heterocyclic compounds with nitrogen hetero atom[s] only, containing a pyrimidine ring, whether or not hydrogenated, or piperazine ring in the structure	736.7	24.8%	4.1%
293499	Nucleic acids and their salts, whether or not chemically defined; heterocyclic compounds	624.0	23.4%	2.8%
294190	Antibiotics (excluding penicillins and their derivatives)	490.1	-1.2%	7.6%
290611	Menthol	317.3	2.4%	40.8%
292429	Cyclic amides, including cyclic carbamates, and their derivatives; salts thereof	300.1	27.9%	4.6%
Total		**21184.10**	**6.8%**	**4.6%**

Source: Data accessed from ITC Trade Map; India Exim Bank Research

Figure 3.3: Imports of Organic Chemicals (HS 29) by India



Source: Data accessed from ITC Trade Map; India Exim Bank Research

As regards imports, India's imports of organic chemicals in 2021 amounted to US$ 27.2 billion, up from US$ 15.2 billion in 2012. Organic chemicals form an important component in India's import basket, having a share of 4.8% in the import basket in 2021. During 2012-2021, the imports registered an AAGR of 8.4%, higher than the 2.1% AAGR of world imports of organic chemicals during the same period.

It may be noted that India is the fifth largest importer of organic chemicals globally. Its share in world imports of organic chemicals has increased from 3.2% in 2012 to 5.1% in 2021, signifying India's increasing import dependence in the segment.

For the imports, India is highly dependent on China. Imports from China accounted for 43.5% of India's total imports of organic chemicals in 2021 as against 30.3%, a decade ago. The other top import partners in 2021 were the USA (7%), Saudi Arabia (5.7%), Singapore (5.2%) and South Korea (4.9%). This points at the high degree of concentration in India's import sources for organic chemicals.

Widely used in production of high-quality plastics used to manufacture automobile body panels, optical fibres, food containers and insulation material, styrene (HS 290250) was the highest imported item among the organic chemicals (HS 29) in 2021. India ranks second globally after Turkey in imports of heterocyclic compounds with nitrogen hetero atoms (HS 293399), the second largest imported commodity in organic chemicals. It may be noted that among the top ten imported items under HS 29, India was the largest importer of antibiotics, acetic acid and esters of acrylic acid, globally.

Table 3.3: Major Items of Imports of Organic Chemicals (HS 29) by India

HS Code	Description	India's Imports in 2021 (US$ million)	AAGR of India's Imports (2012-21)	India's Share in World Imports of the Commodity (2021)
290250	Styrene	1,065.8	7.4%	9.0%
293399	Heterocyclic compounds with nitrogen hetero atom[s] only	1,045.2	26.1%	5.3%
291736	Terephthalic acid and its salts	1,013.3	43.4%	15.6%
290511	Methanol "methyl alcohol"	960.0	13.3%	6.8%
294190	Antibiotics (excluding penicillin and their derivatives with a penicillanic acid structure, salts thereof)	931.1	9.3%	12.3%
291521	Acetic acid	920.9	25.3%	26.7%
293499	Nucleic acids and their salts, whether or not chemically defined; heterocyclic compounds	908.7	19.6%	2.6%
291612	Esters of acrylic acid	780.6	21.1%	13.5%
290321	Vinyl chloride "chloroethylene"	759.0	17.6%	16.5%
290110	Saturated acyclic hydrocarbons	700.3	75.2%	11.6%
Total		**27247.01**	**8.40%**	**5.1%**

Source: Data accessed from ITC Trade Map; India Exim Bank Research

In the last ten years, composition of India's import basket for organic chemicals has seen substantial changes. During these years, items such as heterocyclic compounds with nitrogen hetero-atom[s] only (HS 293399); nucleic acids and their salts, whether or not chemically defined, heterocyclic compounds (HS 293499); esters of acrylic acid (HS 291612); vinyl chloride 'chloroethylene' (290321); and saturated acyclic hydrocarbons (HS 290110) have witnessed high import demand and emerged as the top imported commodities. Some of the top imported commodities earlier viz., separate chemically defined organic compounds (294200); P-Xylene (HS 290243); ethylene glycol 'ethanediol' (HS 290531); isocyanates (HS 292910); and toluene (HS 290230) have registered decline in their share in the total imports of organic chemicals.

HS 3808: Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant growth regulators, disinfectants, and similar products, put up for retail sale or as preparations or articles, e.g., Sulphur-treated bands, wicks and candles, and fly-papers

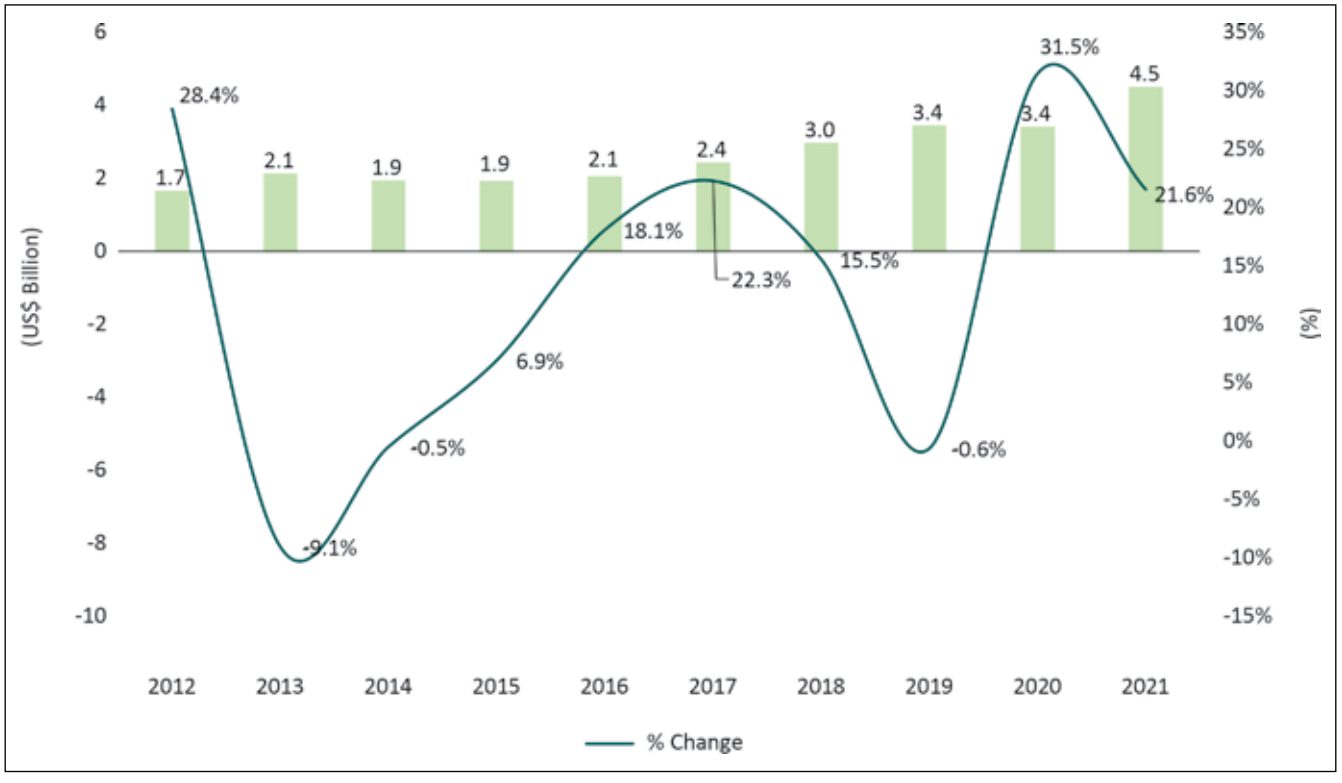
India is the fourth largest producer of agrochemicals in the world. It has emerged as one of the most dynamic generic pesticide manufacturers globally. India's export performance in the agrochemicals segment has been remarkable with an increasing trade balance.

Table 3.4: Composition of Top Ten Imports of Organic Chemicals (HS 29) by India – 2012 vs 2021

HS Code	Description	% Share in HS 29 imports in 2012	% Share in HS 29 imports in 2021
290250	Styrene	5.7%	3.9%
293399	Heterocyclic compounds with nitrogen hetero-atom[s] only	-	3.8%
291736	Terephthalic acid and its salts	4.6%	3.7%
290511	Methanol "methyl alcohol"	3.2%	3.5%
294190	Antibiotics (excluding penicillin and their derivatives with a penicillanic acid structure, salts thereof)	2.8%	3.4%
291521	Acetic acid	2.0%	3.4%
293499	Nucleic acids and their salts, whether or not chemically defined; heterocyclic compounds	-	3.3%
291612	Esters of acrylic acid	-	2.9%
290321	Vinyl chloride "chloroethylene"	-	2.8%
290110	Saturated acyclic hydrocarbons	-	2.6%
294200	Separate chemically defined organic compounds	7.3%	-
290243	P-Xylene	5.4%	-
290531	"Ethylene glycol ""ethanediol"""	4.6%	-
292910	Isocyanates	2.5%	-
290230	Toluene	2.2%	-
Total Share of Top 10 Import Items		**40.4%**	**33.3%**

Source: Data accessed from ITC Trade Map; India EXIM Bank Research

Figure 3.4: Exports of Agrochemicals such as Pesticides, Rodenticides, Fungicides etc. (HS 3808) from India



Source: Data accessed from ITC Trade Map; India Exim Bank Research

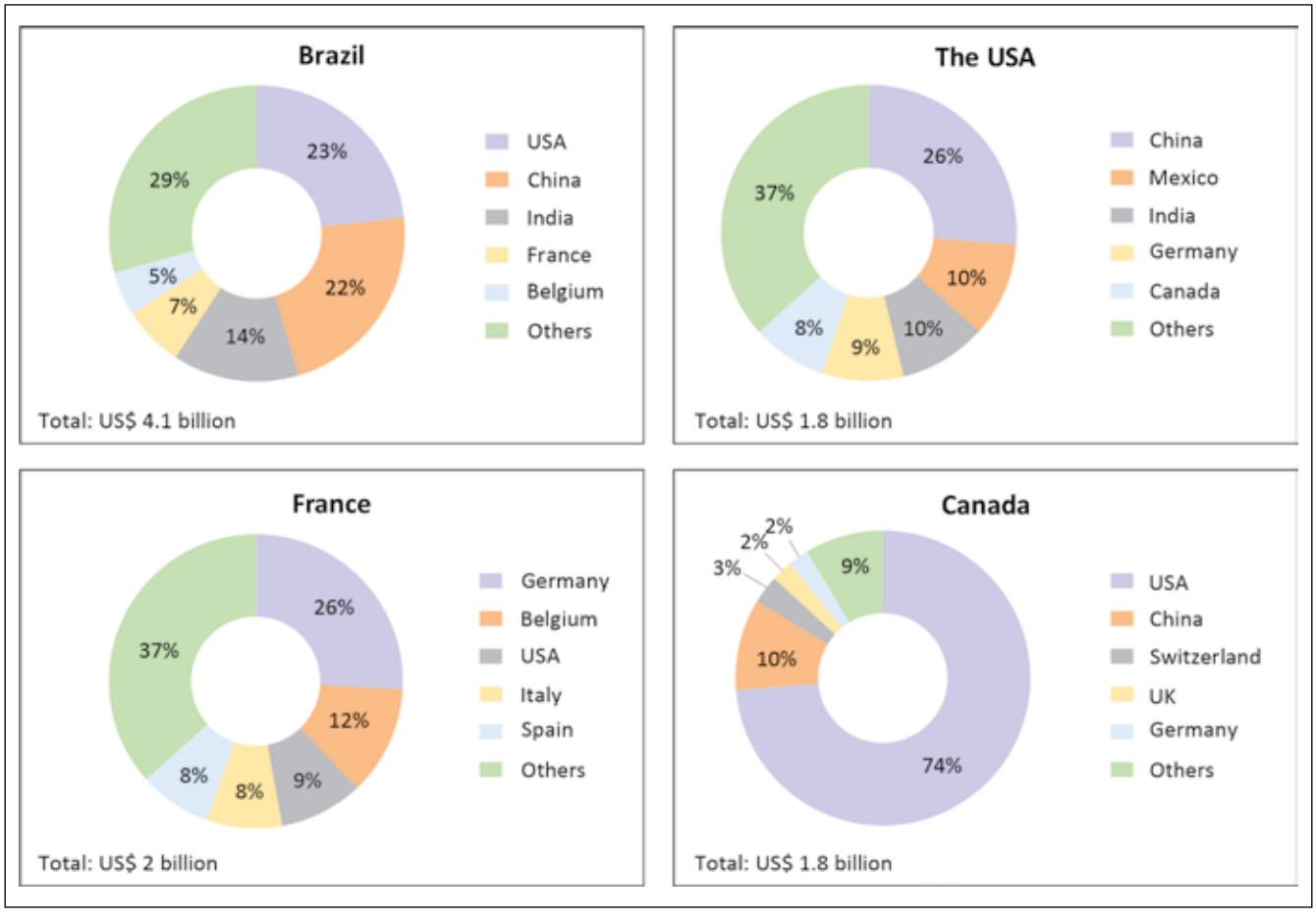
In 2021, India was the fourth largest exporter of agrochemicals falling under HS 3808 with exports of US$ 4.5 billion. India's exports accounted for 10.2% of world exports of agrochemicals such as pesticides, rodenticides, fungicides etc. (HS 3808) in 2021, a rise from 7% in 2012. During 2012-2021, exports in the segment have increased by 2.6 times with a strong AAGR of 12.5%. Globally, China is the top exporter of the product group with a share of 18.2% in world exports. The USA and France rank second and third with a share of 10.9% and 10.4%, respectively.

India's exports of agrochemicals such as pesticides, rodenticides, fungicides etc. (HS 3808) are highly concentrated in terms of markets. Brazil was India's biggest export destination with over one-fourth share in its exports in 2021. The USA was the second largest export destination accounting for 21% of India's exports of agrochemicals. The other top export destinations in 2021 were Japan (3.5%), Vietnam (3.1%) and Argentina (3.15%).

Globally, the top importers in the segment in 2021 were Brazil with an import share of 9.5%, France (4.7%), India (4.3%), The USA (4.2%) and Canada (4.2%). It may be noted that while Brazil was the top export destination for India, the USA was the top import source for Brazil in the segment. Similarly, the largest import sources for France and Canada were countries other than India.

At HS 6-digit level, it is observed that many of the product categories enjoy a considerable share in respective world exports. India's top exported product among agrochemicals such as pesticides, rodenticides, fungicides etc (HS 3808) was insecticides (HS 380891), accounting for 15% of world exports in 2021. Similarly, exports of 'herbicides, fungicides and goods of heading HS 3808, containing alpha-cypermethrin "ISO", bendiocarb "ISO" etc' (HS 380869) had a considerable share in world exports. Capacity may be further augmented in these categories to enhance India's export competitiveness.

Figure 3.5: Major Supply Sources to Top Importing Countries of Agrochemicals such as Pesticides, Rodenticides, Fungicides etc. (HS 3808) in 2021



Source: Data accessed from ITC Trade Map; India Exim Bank Research

Table 3.5: Major Items of Exports of Agrochemicals such as Pesticides, Rodenticides, Fungicides etc. (HS 3808) from India

HS Code	Description	India's exports in 2021 (US$ million)	AAGR of India's exports (2017-21)	India's share in world exports: 2021
380891	Insecticides (excluding goods of subheading 3808.50)	1666.3	24.3%	15.1%
380893	Herbicides, anti-sprouting products and plant-growth regulators (excluding goods of subheading 3808.50)	1627.3	24.0%	10.5%
380892	Fungicides (excluding goods of subheading 3808.50)	848.4	13.7%	8.5%
380869	Goods of heading 3808, containing alpha-cypermethrin "ISO", bendiocarb "ISO", bifenthrin "ISO", chlorfenapyr "ISO", cyfluthrin "ISO", deltamethrin "INN, ISO", etofenprox "INN", fenitrothion "ISO", lambda-cyhalothrin "ISO", malathion "ISO", pirimiphos-methyl "ISO" or propoxur "ISO" (excl. in packings of a net weight content <= 7,5 kg)	220.5	630.5%	27%

HS Code	Description	India's exports in 2021 (US$ million)	AAGR of India's exports (2017-21)	India's share in world exports: 2021
380899	Rodenticides and other plant protection products put up for retail sale or as preparations or articles (excluding insecticides, fungicides, herbicides, disinfectants, and goods of subheading 3808.50)	69.2	-27.9%	3.7%
380894	Disinfectants (excluding goods of subheading 3808.50)	56.1	48.7%	1.4%
Total		**4499.4**	**17.2%**	**10.2%**

Source: Data accessed from ITC Trade Map; India Exim Bank Research

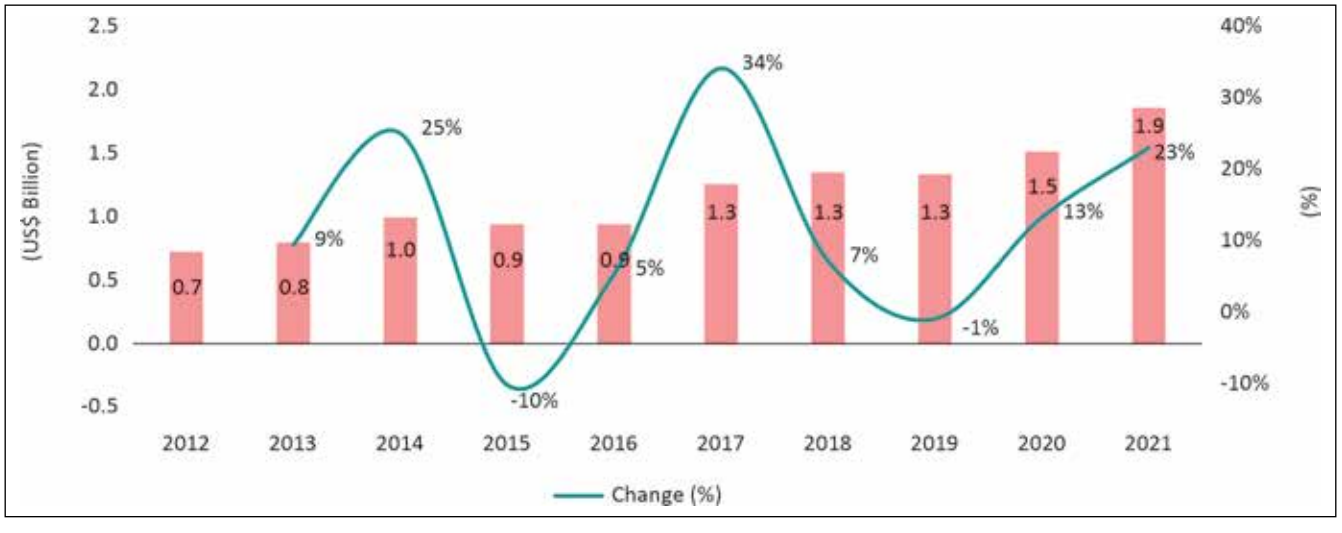
Imports of agrochemicals such as pesticides, rodenticides, fungicides etc. (HS 3808) from India in 2021 amounted to US$ 1.9 billion, up from US$ 1.5 billion in 2020 and US$ 725 million in 2012. From 2012 to 2021, the imports registered an AAGR of 11.8%, higher than the world import AAGR of 4.1% in the segment.

India is the third largest importer of agrochemicals in the world. Its share in world imports of HS 3808 has increased from 2.3% in 2012 to 4.2% in 2021

Accounting for about half of India's imports of agrochemicals such as pesticides, rodenticides, fungicides etc. (HS 3808), China was the major import source for India in 2021. Other major markets exporting to India included the USA (10.4%), Singapore (6.2%), the Netherlands (6.1%) and Germany (5.4%). India's imports primarily comprised rodenticides (35%), insecticides (27%) herbicides (22%) and fungicides (15%).

It may be noted that with a quarter of world imports, India is the largest importer of rodenticides globally. The imports of the segment grew at an AAGR of 13% during the last decade. The imports of goods of heading 3808, containing alpha-cypermethrin "ISO", bendiocarb "ISO", bifenthrin "ISO", chlorfenapyr "ISO", cyfluthrin "ISO" etc. (HS 380869) also saw a considerable rise. Its imports recorded an AAGR of 124.3% from 2017 to 2021. Given that the demand for both these products moves in line with the agricultural output, there's untapped potential for the domestic manufacturers to expand production lines and reduce the reliance on imports from China.

Figure 3.6: Imports of Agrochemicals such as Pesticides, Rodenticides, Fungicides etc. (HS 3808) by India



Source: Data accessed from ITC Trade Map; India Exim Bank Research

Table 3.6: Major Items of Imports of Agrochemicals such as Pesticides, Rodenticides, Fungicides etc. (HS 3808) by India

HS Code	Description	India's imports in 2021 (US$ million)	AAGR of India's imports (2012-21)	India's share in world imports: 2021
380899	Rodenticides and other plant protection products put up for retail sale or as preparations or articles (excluding insecticides, fungicides, herbicides, disinfectants, and goods of subheading 3808.50)	639.3	13.3%	25.0%
380891	Insecticides (excluding goods of subheading 3808.50)	500.1	6.1%	4.8%
380893	Herbicides, anti-sprouting products and plant-growth regulators (excluding goods of subheading 3808.50)	398.0	16.7%	2.9%
380892	Fungicides (excluding goods of subheading 3808.50)	268.7	25.8%	2.7%
380869	Goods of heading 3808, containing alpha-cypermethrin "ISO", bendiocarb "ISO", bifenthrin "ISO", chlorfenapyr "ISO", cyfluthrin "ISO", deltamethrin "INN, ISO", etofenprox "INN", fenitrothion "ISO", lambda-cyhalothrin "ISO", malathion "ISO", pirimiphos-methyl "ISO" or propoxur "ISO" (excl. in packings of a net weight content <= 7,5 kg)	40.7	124.3%	5.1%
380894	Disinfectants (excluding goods of subheading 3808.50)	6.2	10.2%	0.1%
Total		**1853.1**	**11.8%**	**4.3%**

Source: Data accessed from ITC Trade Map; India Exim Bank Research

HS 32: Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints and varnishes; putty and other mastics; inks

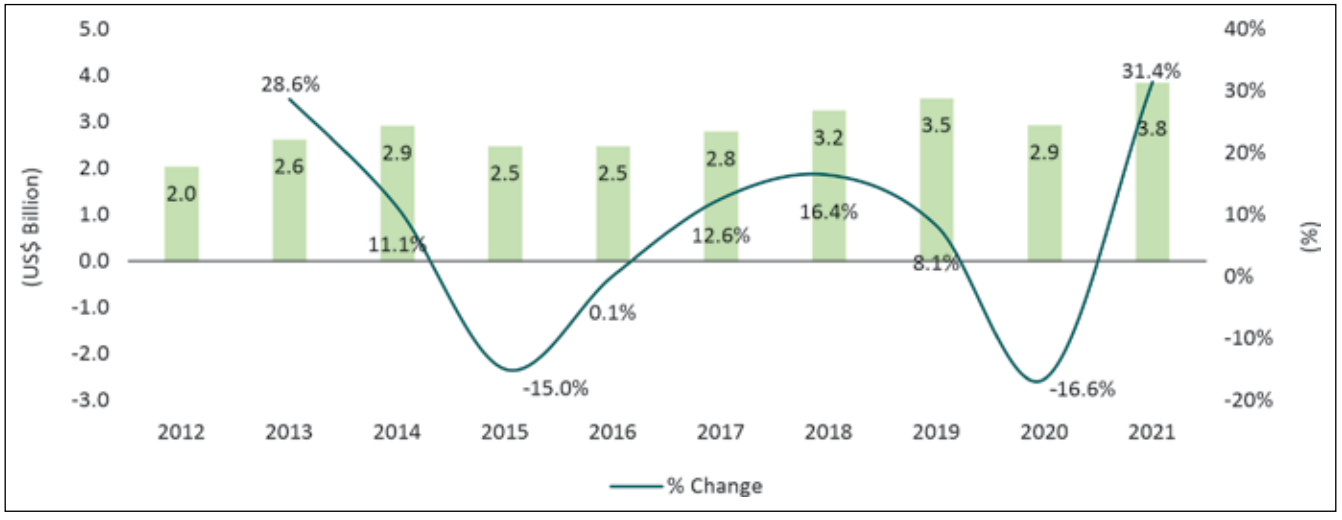
India is one of the leading dye producers in the world, accounting for 16% of the global production of dyestuffs and dye intermediates[12]. India has been successful in exporting dyes and dye intermediates to the very same countries, on which it was dependent for imports till about a decade ago. The country produces a range of dyes, such as disperse dyes, reactive dyes, vat dyes, pigments and leather dyes. This segment forms an important link in the value chain of other industries using chemicals such as textiles, leather, plastic, paper, packaging, printing inks, paints and polymers. Textile sector is a major consumer of dyestuffs and accounts for around 80% of dyestuff consumption in India[13].

Globally, India is the seventh largest exporter of tanning or dyeing extracts, tannins and their derivatives etc., accounting for 4.1% of world exports in the segment. India recorded exports amounting to US$ 3.8 billion of the products under tanning or dyeing extracts (HS 32) in 2021, an increase from US$ 2 billion in 2012. During 2012-2021, India's exports of the product group (HS 32) grew at an AAGR of 8.5%, higher than the world export AAGR of 2.3% in the segment. In 2021, the top exporting countries of tanning or dyeing extracts (HS 32) were Germany, accounting for 14.5% of global exports followed by China (11.1%), the USA (8.5%), Japan (5.8%), and the Netherlands (5.7%).

[12] IBEF

[13] TPCI

Figure 3.7: Exports of Tanning or Dyeing Extracts (HS 32) from India

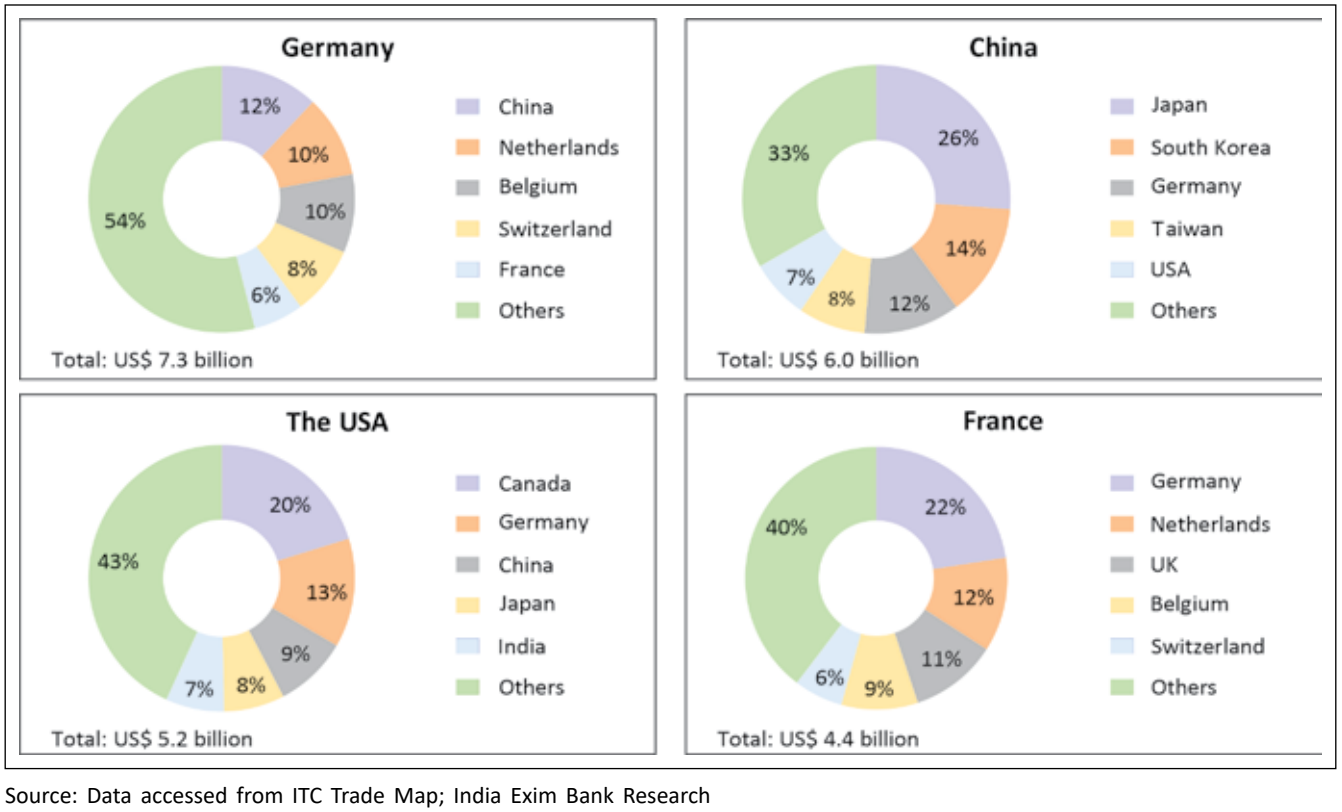


Source: Data accessed from ITC Trade Map; India Exim Bank Research

Coming to India's top export destinations, it is observed that India's export basket in tanning or dyeing extracts (HS 32) is fairly diversified. The top five export partners constituted a share of 35.6% in exports of the product group HS 32 in 2021. They were China (8.6%), the USA (8.3%), Bangladesh (7.2%), Turkey (7%) and Germany (4.5%).

The top global importing countries of tanning or dyeing extracts (HS 32) in 2021 were Germany with a share of 7.6% in world imports, China (6.3%), the USA (5.4%), France (4.6%) and the Netherlands (3.9%). It may be noted that India was among the top supplying nations of the product group only to the USA out of these countries.

Figure 3.8: Major Supply Sources to Top Importing Countries of Tanning or Dyeing Extracts (HS 32) in 2021



Source: Data accessed from ITC Trade Map; India Exim Bank Research

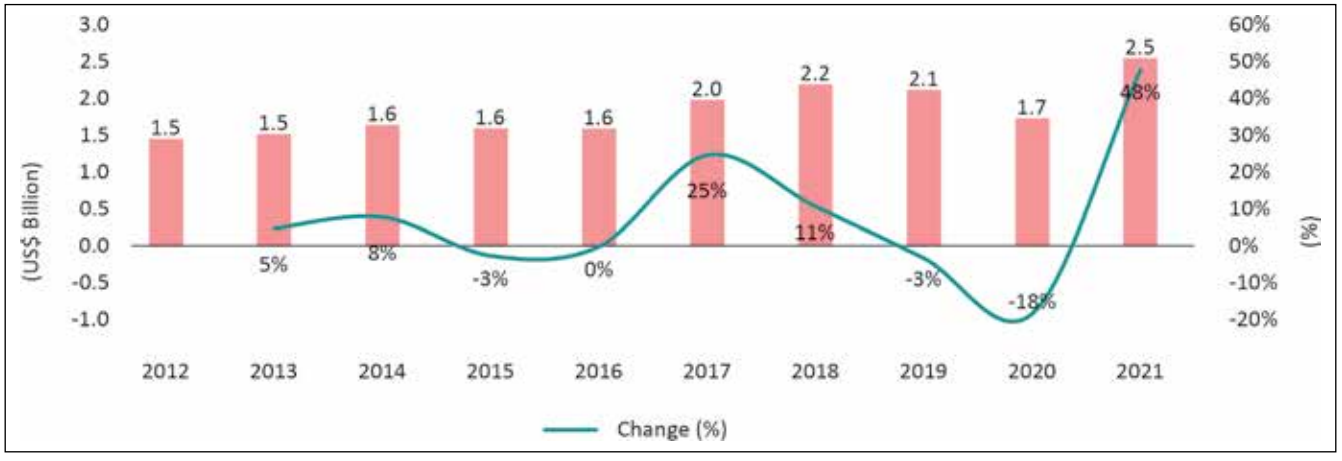
At HS 6-digit, synthetic organic pigments (HS 320417) was the largest exported commodity in 2021 by India, accounting for 17.6% of the global exports. Notably, many of the other top exported commodities from India such as synthetic organic reactive dyes (HS 320416), synthetic organic colouring matter (HS 320419), synthetic organic acid dyes (HS 320412) and direct synthetic organic dyes (HS 320414) had sizeable share in global exports of these commodities. Furthermore, other than 'pigments, including metallic powders and flakes, dispersed in non-aqueous media, in liquid or paste form, of a kind used in the manufacture of paints' (HS 321290), exports of all the top commodities exhibited positive AAGR during 2012-2021.

Table 3.7: Major Items of Exports of Tanning or Dyeing Extracts (HS 32) from India

HS Code	Description	India's Exports in 2021 (US$ million)	AAGR of India's Exports (2012-21)	India's Share in World Exports: 2021
320417	Synthetic organic pigments; preparations based on synthetic organic pigments of a kind used to dye fabrics or produce colorant preparations	987.6	7.7%	17.6%
320416	Synthetic organic reactive dyes; preparations based on synthetic organic reactive dyes of a kind used to dye fabrics or produce colorant preparations	774.0	11.8%	39.7%
320419	Synthetic organic colouring matter and preparations of the kind used for colouring any materials or for the production of prepared colours	352.5	11.4%	18.0%
320412	Synthetic organic acid dyes, whether or not metallised, and synthetic organic mordant dyes; preparations based on synthetic organic acid or mordant dyes of a kind used to dye fabrics or produce colorant preparations	285.8	9.4%	30.8%
321519	Printing ink, whether or not concentrated or solid (excluding black ink)	162.4	11.1%	3.1%
320411	Synthetic organic disperse dyes; preparations based on synthetic organic disperse dyes of a kind used to dye fabrics or produce colorant preparations	159.9	22.2%	10.8%
320414	Direct synthetic organic dyes; preparations based on direct synthetic organic dyes of a kind used to dye fabrics or produce colorant preparations	136.2	8.8%	32.1%
320415	Synthetic organic vat dyes, incl. those usable in that state as pigments; preparations based on synthetic organic vat dyes of a kind used to dye fabrics or produce colorant preparations	108.6	17.9%	14.5%
321290	Pigments, including metallic powders and flakes, dispersed in non-aqueous media, in liquid or paste form, of a kind used in the manufacture of paints; colorants and other colouring matter, not elsewhere specified put up for retail sale	92.6	-0.5%	5.9%
320413	Basic synthetic organic dyes; preparations based on basic synthetic organic dyes of a kind used to dye fabrics or produce colorant preparations	79.3	14.0%	22.9%
Total		**3843.2**	**8.5%**	**4.1%**

Source: Data accessed from ITC Trade Map; India Exim Bank Research

Figure 3.9: Imports of Tanning or Dyeing Extracts (HS 32) by India



Source: Data accessed from ITC Trade Map; India Exim Bank Research

As regards imports, in 2021, India's imports of tanning or dyeing extracts (HS 32) stood at US$ 2.5 billion, constituting 2.7% of global imports. During the last decade, India's imports grew at an AAGR of 7.8% as against the world import AAGR of 2.5% during the same period.

India's imports of tanning or dyeing extracts (HS 32) from China, its top import source have increased by 2.5 times from US$ 356 million in 2012 to 884 million in 2021. Consequently, China's share in India's imports of the product group has increased from 24.6% to 34.8%, during the last decade. This increase has been at the expense of imports from other top importing nations. The share of the USA and Germany in India's imports has declined from 10.4% and 9.6% to 6.2% and 5.7%, respectively. Imports from the other top import partners, Spain and Singapore have gone up, accounting for 5% and 4.6% of imports, respectively.

Through the granular analysis of imports, it is ascertained that 'pigments and preparations based on titanium dioxide of a kind used for colouring any material or producing colorant preparations, containing >= 80% by weight of titanium dioxide' (HS 320611) is the single most important import item under the category, accounting for 40% of imports of tanning or dyeing extracts (HS 32). Its imports are highly concentrated in terms of import sources. In 2021, China accounted for over half of India's world imports of the item, followed by Australia (11%), the USA (5.8%), Malaysia (4.8%) and Taiwan (4.7%).

Table 3.8: Major Items of Imports of Tanning or Dyeing Extracts (HS 32) by India

HS Code	Description	India's imports in 2021 (US$ million)	AAGR of India's imports (2012-21)	India's share in world imports: 2021
320611	Pigments and preparations based on titanium dioxide of a kind used for colouring any material or produce colorant preparations, containing >= 80% by weight of titanium dioxide calculated on the dry matter	1014.3	14.6%	8.7%
320890	Paints and varnishes based, incl. enamels and lacquers, on synthetic polymers or chemically modified natural polymers, dispersed or dissolved in a non-aqueous medium, and solutions of products of headings 3901 to 3913 in volatile organic solvents, containing > 50% solvent by weight	131.1	5.6%	1.5%
320710	Prepared pigments, prepared opacifiers, prepared colours and similar preparations of a kind used in the ceramic, enamelling or glass industry	116.5	13.5%	10.4%

HS Code	Description	India's imports in 2021 (US$ million)	AAGR of India's imports (2012-21)	India's share in world imports: 2021
320415	Synthetic organic vat dyes, incl. those usable in that state as pigments; preparations based on synthetic organic vat dyes of a kind used to dye fabrics or produce colorant preparations	107.9	18.4%	15.5%
321519	Printing ink, whether or not concentrated or solid (excluding black ink)	96.1	9.5%	1.5%
320417	Synthetic organic pigments; preparations based on synthetic organic pigments of a kind used to dye fabrics or produce colorant preparations	90.0	2.4%	1.5%
321410	Glaziers' putty, grafting putty, resin cements, caulking compounds and other mastics; painters' fillings	89.8	13.1%	1.2%
320649	Inorganic or mineral colouring matter, not elsewhere specified; preparations based on inorganic or mineral colouring matter of a kind used for colouring any material or produce colorant preparations, not elsewhere specified	83.3	6.9%	2.2%
320820	Paints and varnishes, incl. enamels and lacquers, based on acrylic or vinyl polymers, dispersed or dissolved in a non-aqueous medium; solutions based on acrylic or vinyl polymers in volatile organic solvents, containing > 50% solvent by weight	67.0	12.3%	1.5%
320419	Synthetic organic colouring matter and preparations of the kind used for colouring any materials or for the production of prepared colours, based thereon ; mixtures of colouring matter in subheading 3204.11 to 3204.19	52.3	7.4%	2.7%
Total		**2543.8**	**7.8%**	**2.7%**

Source: Data accessed from ITC Trade Map; India Exim Bank Research

Further, in the last ten years, composition of India's import basket for tanning or dyeing extracts (HS 32) has changed considerably. During these years, import demand for pigments and preparations based on titanium dioxide of a kind used for colouring any material or to produce colorant preparations (HS 320611) has increased substantially, evident by its increase in share in India's imports of tanning or dyeing extracts (HS 32) from 27% in 2012 to 40% in 2021. As a result, the shares of some of the top imported items, at HS 6-digit level, in India's total imports in the product category have seen a fall.

While imports of glaziers' putty, grafting putty, resin cements, caulking compounds and other mastics; painters' fillings (HS 321410), paints and varnishes, incl. enamels and lacquers, based on acrylic or vinyl polymers (320820), and synthetic organic colouring matter and preparations of the kind used for colouring any materials or for the production of prepared colours (320419) have gone up substantially leading to these products surfacing in the top ten imported items, the shares of pigments and preparations based on titanium dioxide of a kind used for colouring any material or produce colorant preparations (HS 320619), synthetic organic disperse dyes (HS 320411), paints and varnishes, incl. enamels and lacquers based on synthetic or chemically modified natural polymers (HS 320990) and ink, whether or not concentrated or solid (excluding printing ink) (HS 321590) have contracted over the years.

Widely used across industries like pharmaceuticals, cosmetics and manufacture of paints, the import demand for pigments and preparations based on titanium dioxide of a kind used for colouring any material or produce colorant preparations (HS 320611) has mostly risen on account of its unique qualities of being resistant to discoloration under UV light in exposed locations, underscoring its importance in the construction sector as well.

Table 3.9: Composition of Top Ten Imports of Tanning or Dyeing Extracts (HS 32) by India – 2012 vs 2021

HS Code	Description	% Share in HS 32 imports in 2012	% Share in HS 32 imports in 2021
320611	Pigments and preparations based on titanium dioxide of a kind used for colouring any material or produce colorant preparations, containing >= 80% by weight of titanium dioxide calculated on the dry matter	27%	40%
320890	Paints and varnishes based, incl. enamels and lacquers, on synthetic polymers or chemically modified natural polymers, dispersed or dissolved in a non-aqueous medium, and solutions of products of headings 3901 to 3913 in volatile organic solvents, containing > 50% solvent by weight	6%	5%
320710	Prepared pigments, prepared opacifiers, prepared colours and similar preparations of a kind used in the ceramic, enamelling or glass industry	4%	5%
320415	Synthetic organic vat dyes, incl. those usable in that state as pigments; preparations based on synthetic organic vat dyes of a kind used to dye fabrics or produce colorant preparations	3%	4%
321519	Printing ink, whether or not concentrated or solid (excluding black ink)	6%	4%
320417	Synthetic organic pigments; preparations based on synthetic organic pigments of a kind used to dye fabrics or produce colorant preparations	5%	4%
321410	Glaziers' putty, grafting putty, resin cements, caulking compounds and other mastics; painters' fillings	-	4%
320649	Inorganic or mineral colouring matter, not elsewhere specified; preparations based on inorganic or mineral colouring matter of a kind used for colouring any material or produce colorant preparations, not elsewhere specified	4%	3%
320820	Paints and varnishes, incl. enamels and lacquers, based on acrylic or vinyl polymers, dispersed or dissolved in a non-aqueous medium; solutions based on acrylic or vinyl polymers in volatile organic solvents, containing > 50% solvent by weight	-	3%
320419	Synthetic organic colouring matter and preparations of the kind used for colouring any materials or for the production of prepared colours, based thereon; mixtures of colouring matter in subheading 3204.11 to 3204.19	-	2%
320619	Pigments and preparations based on titanium dioxide of a kind used for colouring any material or produce colorant preparations, containing < 80% by weight of titanium dioxide calculated on the dry matter	5%	-
320411	Synthetic organic disperse dyes; preparations based on synthetic organic disperse dyes of a of a kind used to dye fabrics or produce colorant preparations	4%	-
320990	Paints and varnishes, incl. enamels and lacquers, based on synthetic or chemically modified natural polymers, dispersed or dissolved in an aqueous medium	3%	-
321590	Ink, whether or not concentrated or solid (excluding printing ink)	3%	-

Source: Data accessed from ITC Trade Map; India Exim Bank Research

HS 28: Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes

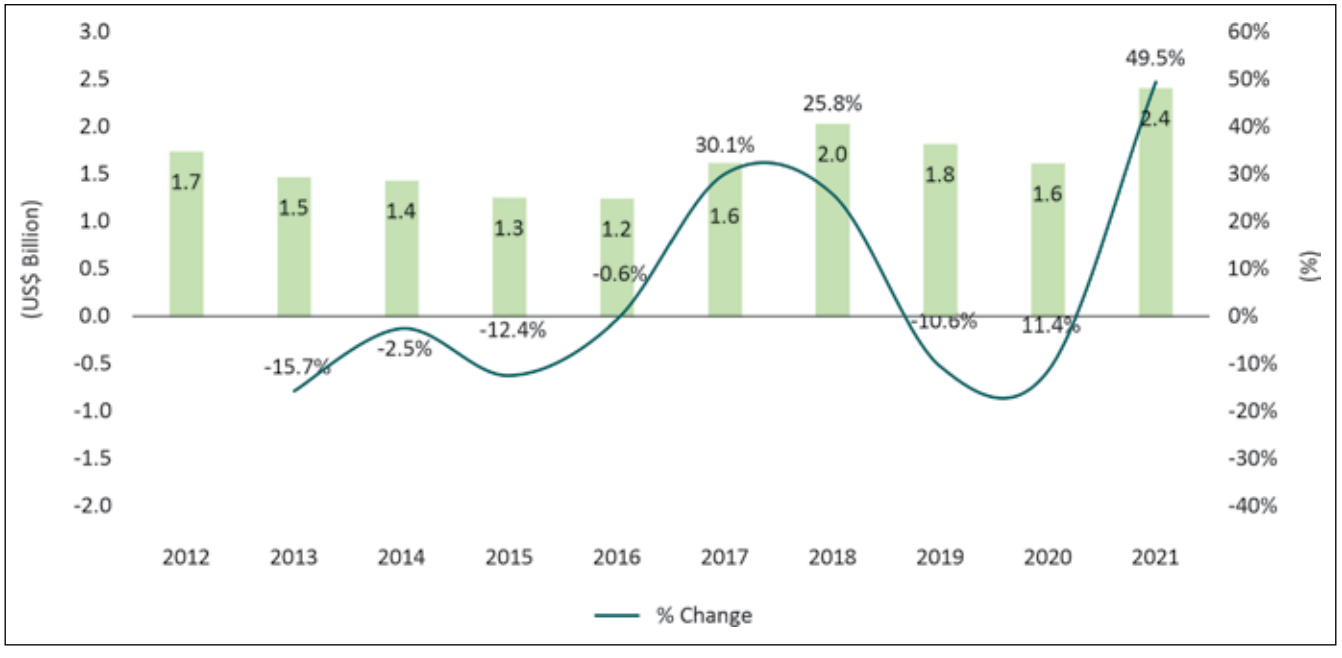
Inorganic chemicals are substances of mineral origin that do not contain any carbon atom such as nitrate, fluoride and metals. They are mostly used in detergents, soaps, and fertilizers. Major inorganic chemicals produced in India are carbon black, titanium dioxide and calcium carbide.

Exports of inorganic chemicals (HS 28) from India in 2021 amounted to US$ 2.4 billion, up from US$ 1.7 billion in 2012. During 2012-2021, the exports of inorganic chemicals (HS 28) registered a moderate AAGR of 6%. In 2021, India ranked as the fourteenth largest exporter of inorganic chemicals with a share of 1.5% in global exports. China was the leading exporter of inorganic chemicals with a share of 15% in global exports in 2021. The other top exporting countries were Germany (9%), the USA (9%), Japan (6%) and South Korea (5%).

India's exports of inorganic chemicals are concentrated towards a few markets. The UAE accounted for 27% of India's exports of inorganic chemicals in 2021. The other top destinations were the USA (12%), China (9%), Bangladesh (6%), and Oman (6%). In 2021, China was the largest importer of inorganic chemicals, importing 9.6% of global supply. The USA (8.9%), and South Korea (7%) were the other top importers. It may be noted that although India exports to these nations, the quantum is low because of which India doesn't stand out as the top exporting partners for any of these large importers. In fact, India was itself the fourth largest importer of inorganic chemicals in 2021.

Unlike other segments, none of the items among the top 10 exported items at HS 6-digit under organic chemicals had a sizeable share in global exports in 2021. Exports of sodium hydroxide "caustic soda" in aqueous solution "soda lye or liquid soda" (HS 281512) saw high volatility during the last decade with an overall rise in exports from US$ 1.1 million in 2012 to US$ 71 million in 2021. Exports of compounds, inorganic or organic, of rare-earth metals, of yttrium or of scandium or of mixtures (HS 284690) saw a remarkable rise from US$ 0.05 million to US$ 48 million during the period.

Figure 3.10: Exports of Inorganic Chemicals (HS 28) from India



Source: Data accessed from ITC Trade Map; India Exim Bank Research

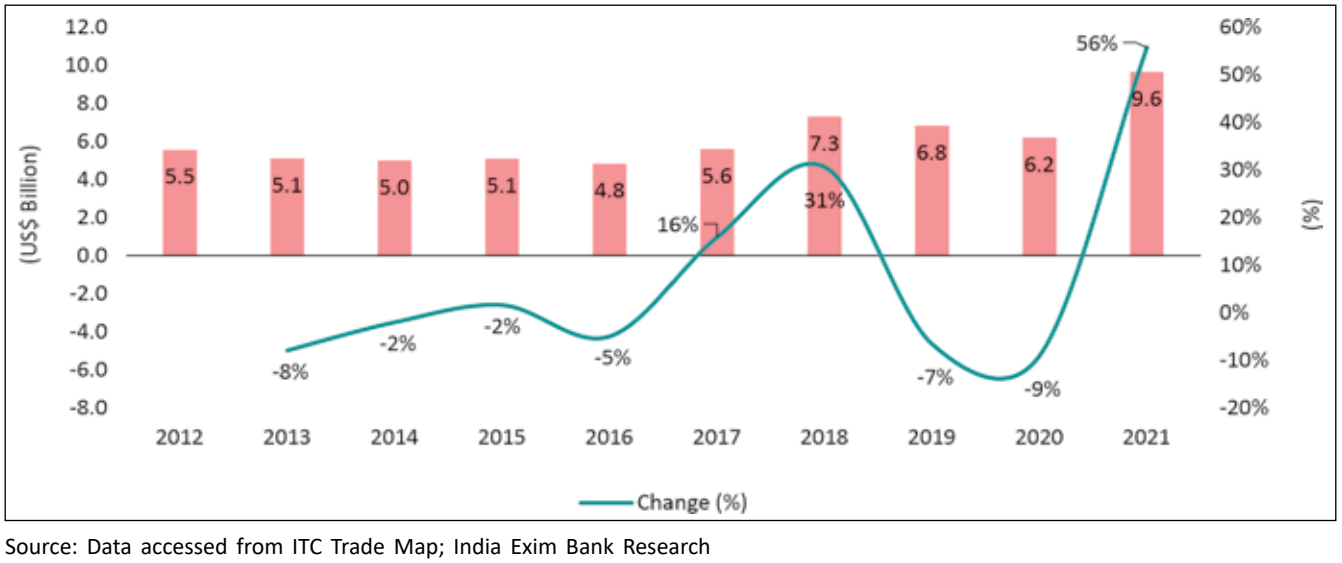
Table 3.10: Major Items of Exports of Inorganic Chemicals (HS 28) from India

HS Code	Description	India's exports in 2021 (US$ million)	AAGR of India's exports (2012-21)	India's share in world exports: 2021
281820	Aluminium oxide (excluding artificial corundum)	568.0	9.7%	3.9%
280300	Carbon (carbon blacks and other forms of carbon, n.e.s.)	261.9	9.7%	4.6%
283329	Sulphates (excluding of sodium, magnesium, aluminium, nickel, copper, barium and mercury)	74.8	14.5%	5.5%
281122	Silicon dioxide	72.4	45.8%	2.3%
281512	"Sodium hydroxide ""caustic soda"" in aqueous solution ""soda lye or liquid soda"""	71.0	1234.7%	1.9%
281511	"Sodium hydroxide ""caustic soda"" solid"	68.8	15.7%	11.4%
283620	Disodium carbonate	67.2	28.0%	1.9%
282300	Titanium oxides	62.9	0.1%	7.4%
282739	Chlorides (excluding ammonium, calcium, magnesium, aluminium, nickel and mercury chloride)	57.7	9.9%	8.2%
284690	Compounds, inorganic or organic, of rare-earth metals, of yttrium or of scandium or of mixtures	48.3	136.0%	2.8%
Total		**2409.7**	**5.8%**	**1.50%**

Source: Data accessed from ITC Trade Map; India Exim Bank Research

India is a net importer of inorganic chemicals. Imports amounted to US$ 9.6 billion in 2021, thereby resulting in a trade deficit of US$ (-) 7.2 billion. During 2012-2021, India's imports of inorganic chemicals (HS 28) rose at an AAGR of 8.1% as against the world import AAGR of 2% in the segment. Japan has emerged as the top import source for imports of inorganic chemicals with its share in India's imports witnessing a rise from 2% in 2012 to 17% in 2021. This may be attributed to the tariff concessions given by India to Japan under their Comprehensive Economic Partnership Agreement. Share of China on the other hand, has reduced from 13% in 2012 to 9% in 2021. The other top import sources in 2021 were Morocco (9%), Jordon (7%) and Vietnam (6%).

Figure 3.11: Imports of Inorganic Chemicals (HS 28) by India



Source: Data accessed from ITC Trade Map; India Exim Bank Research

At HS 6-digit, phosphoric acid and polyphosphoric acids (HS 280920) was the largest imported commodity under HS 28. Its imports stood at US$ 2.3 billion resulting in a sizeable share of 40% in global imports of the commodity. The chemical is used as a component in fertilizers, detergents, many household cleaning and water treatment products besides being used as food additive in soft drinks and other food items. Imports of inorganic or organic compounds of precious metals (HS 284390) were also considerable and accounted for over a quarter share in global imports.

In the last ten years, composition of India's import basket has transformed substantially. Even though phosphoric acid, polyphosphoric acids, whether or not chemically defined (HS 280920) remained the highest imported item in the group, its share in total imports of inorganic chemicals declined gradually from 31% in 2012 to 24% in 2021, as other items like inorganic or organic compounds of precious metals, whether or not chemically defined (HS 284390) and aluminium oxide (excluding artificial corundum) (HS 281820) gained prominence.

Table 3.11: Major Items of Imports of Inorganic Chemicals (HS 28) by India

HS Code	Description	India's imports in 2021 (US$ million)	AAGR of India's imports (2012-21)	India's share in world imports: 2021
280920	Phosphoric acid, polyphosphoric acids, whether or not chemically defined	2332.9	5.4%	39.4%
284390	Inorganic or organic compounds of precious metals, whether or not chemically defined	1879.0	45.0%	25.8%
281410	Anhydrous ammonia	1316.1	6.5%	13.5%
281820	Aluminium oxide (excluding artificial corundum)	1034.9	23.7%	7.7%
280300	Carbon (carbon blacks and other forms of carbon, n.e.s.)	245.7	12.5%	4.1%
280469	Silicon containing < 99,99% by weight of silicon	200.6	391.0%	4.4%
280700	Sulphuric acid; oleum	189.6	40.5%	8.7%
280470	Phosphorus	161.3	13.6%	24.7%
283650	Calcium carbonate	140.9	14.5%	13.8%
283620	Disodium carbonate	134.4	-0.3%	3.5%
Total		**9639.0**	**8.1%**	**6.2%**

Source: Data accessed from ITC Trade Map; India Exim Bank Research

Table 3.12: Composition of Top Ten Imports of Inorganic Chemicals (HS 28) by India – 2012 vs 2021

HS Code	Description	% Share in total HS 28 imports in 2012	% Share in total HS 28 imports in 2021
280920	Phosphoric acid; polyphosphoric acids, whether or not chemically defined	31.2%	24.2%
284390	Inorganic or organic compounds of precious metals, whether or not chemically defined	2.2%	19.5%
281410	Anhydrous ammonia	21.6%	13.7%
281820	Aluminium oxide (excluding artificial corundum)	5.9%	10.7%
280300	Carbon (carbon blacks and other forms of carbon)	3.5%	2.5%
280469	Silicon containing < 99,99% by weight of silicon	-	2.1%

HS Code	Description	% Share in total HS 28 imports in 2012	% Share in total HS 28 imports in 2021
280700	Sulphuric acid; oleum	1.7%	2.0%
280470	Phosphorus		1.7%
283650	Calcium carbonate		1.5%
283620	Disodium carbonate	2.9%	1.4%
280120	Iodine	2.9%	
281512	"Sodium hydroxide" "caustic soda" in aqueous solution "soda lye or liquid soda"	2.1%	
280461	Silicon containing >= 99,99% by weight of silicon	1.4%	

Source: Data accessed from ITC Trade Map; India Exim Bank Research

Revealed Comparative Advantage

Revealed Comparative Advantage are used to identify categories of exports in which an economy has a comparative advantage by way of comparison of the country's trade scenario with the world scenario. The basic assumption underlying the concept of revealed comparative advantage is that the trade profile reflects the inter-country differences in terms of relative costs as well as non-price aspects. As per Balassa's (1965) measure, index for country 'i', commodity 'j' is:

$$RCA_{ij} = (X_{ji}/X_i) / (X_{jw}/X_w)$$

Where,

X_{ji}: exports of commodity j from country i

X_i: total exports from country i

X_{jw}: total exports of commodity j from world

X_w: total exports from world

The RCA index ranges from 0 to infinity, with 1 as the break-even point. That is, an RCA value of less than 1 means that the product does not have a comparative advantage, while a value above 1 indicates that the product has a comparative advantage.

The Normalized Revealed Comparative Advantage (NRCA) index has been demonstrated capable of revealing the extent of comparative advantage that a country has in a commodity more precisely and consistently than other alternative RCA indices in the literature. NRCA can be defined in the following manner

$$NRCA_{ij} = (RCA_{ij} - 1)/ (RCA_{ij} + 1)$$

NRCA ranges from -1 to 1 with 0 as the breakeven point. That is, an NRCA value of less than 0 means that the product has no export comparative advantage, while a value above 0 indicates that the product has a comparative advantage. The extent of comparative advantage/disadvantage can be gauged from the proximity of the NRCA values to the extreme data points, viz. +1 and -1.

Broadly, the competitiveness indicators for the sub-groups of Chemicals industry in 2021 stood as follows:

Table 3.13: Chemicals Industry – Competitiveness Indicators

HS Code	Description	RCA	NRCA
29	Organic chemicals	2.40	0.41
32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other coloring matter; paints and varnishes; putty and other mastics; inks	2.26	0.39
28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes	0.85	-0.08

HS Code	Description	RCA	NRCA
3808	Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growth regulators, disinfectants and similar products, put up for retail sale or as preparations or articles, e.g. Sulphur-treated bands, wicks and candles, and fly-papers	5.69	0.70

Source: Data accessed from ITC Trade Map; India Exim Bank Research

It may be inferred from the table that India's relative comparative advantage stands the highest in exports of insecticides, rodenticides, fungicides, herbicides etc. among all the chemical sub-groups. India also enjoys fair relative comparative advantage in exports of organic chemicals and tanning or dyeing extracts. However, in inorganic chemicals, India's exports are found to be not competitive with the NRCA being negative.

Table 3.14: Comparison of Chemical Industry's Competitiveness Indicators

HS Code	Description	NRCA			
		2012	2015	2018	2021
29	Organic chemicals	0.29	0.31	0.41	0.41
32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other coloring matter; paints and varnishes; putty and other mastics; inks	0.24	0.35	0.39	0.39
28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes	-0.07	-0.17	-0.08	-0.08
3808	Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growth regulators, disinfectants and similar products, put up for retail sale or as preparations or articles, e.g. Sulphur-treated bands, wicks and candles, and fly-papers	0.57	0.58	0.66	0.70

Source: Data accessed from ITC Trade Map; India Exim Bank Research

Comparison of the chemical industry's NRCA values from 2012 to 2021 indicates that India's export competitiveness in organic chemicals; tanning or dyeing extracts; and insecticides, rodenticides, fungicides, herbicides etc. has increased over the years. However, in the last four years, the export competitiveness of organic chemicals and tanning or dyeing extracts has stagnated. On the other hand, inorganic chemicals' export competitiveness has deteriorated from 2012 to 2021.

HS 28: Inorganic chemicals; organic or inorganic compounds of precious metals, of rare-earth metals, of radioactive elements or of isotopes

At the HS 6-digit level, India enjoyed a relative comparative advantage in all the top ten export items in the inorganic chemicals group in 2021. Exports of aluminium oxide, the largest exported item under the group were concentrated with the UAE, Oman and China.

Table 3.15: Competitiveness of the Top 10 Export Items under Inorganic Chemicals (HS 28)

HS Code	Description	Exports in 2021 (US$ Million)	NRCA	Major Export Destinations
281820	Aluminium oxide (excluding artificial corundum)	568.0	0.37	UAE (51%), Oman (15%), China (9%)
280300	Carbon (carbon blacks and other forms of carbon, n.e.s.)	261.9	0.44	UAE (22%), Sri Lanka (18%), Vietnam (13%)
283329	Sulphates (excluding of sodium, magnesium, aluminium, nickel, copper, barium and mercury)	74.8	0.50	The USA (15%), Brazil (15%), the UK (5%)
281122	Silicon dioxide	72.4	0.13	Belgium (9%), Vietnam (8%), Slovakia (7%)
281512	“Sodium hydroxide “”caustic soda”” in aqueous solution “”soda lye or liquid soda””””	71.0	0.03	Saudi Arabia (25%), South Africa (25%), Indonesia (18%)
281511	“Sodium hydroxide “”caustic soda”” solid”	68.8	0.73	Tanzania (14%), Kenya (11%), Nigeria (10%)
283620	Disodium carbonate	67.2	0.04	Bangladesh (55%), Indonesia (10%), Philippines (10%)
282300	Titanium oxides	62.9	0.61	Taiwan (26%), China (20%), Japan (18%)
282739	Chlorides (excluding ammonium, calcium, magnesium, aluminium, nickel and mercury chloride)	57.7	0.64	The USA (38%), Germany (17%), Indonesia (9%)
284690	Compounds, inorganic or organic, of rare-earth metals, of yttrium or of scandium or of mixtures	48.3	0.22	Japan (40%), Vietnam (37%), China (8%)

Source: Data accessed from ITC Trade Map; India Exim Bank Research

HS 29: Organic chemicals

All the top ten exported items under organic chemicals (HS 29) had a positive NRCA demonstrating high export competitiveness. Notably, the top three exported items under organic chemicals namely, p-xylene (HS 290243), benzene (HS 290220) and separate chemically defined organic compounds (HS 294200) had a high NRCA. Menthol (HS 290611) is another notable commodity having a high NRCA of 0.92. China is the major destination for exports of menthol, accounting for 72% of India’s exports.

Table 3.16: Competitiveness of the Top Ten Export Items under Organic Chemicals (HS 29)

HS Code	Description	Exports in 2021 (US$ Million)	NRCA	Major Export Destinations
290243	P-Xylene	2077.6	0.74	China (41%), The USA (15%), Malaysia (14%)
290220	Benzene	1674.5	0.82	Saudi Arabia (45%), Belgium (10%), China (10%)
294200	Separate chemically defined organic compounds	1252.3	0.95	The USA (8.8%), Brazil (6.3%), China (5.2%)
293339	Heterocyclic compounds with nitrogen hetero-atom[s] only, containing an unfused pyridine ring whether or not hydrogenated, in the structure	931.7	0.60	The USA (10%), Germany (9%), China (8.5%)
293399	Heterocyclic compounds with nitrogen hetero-atom[s] only	837.6	0.43	The USA (10%), Switzerland (8%), China (6.5%)
293359	Heterocyclic compounds with nitrogen hetero-atom[s] only, containing a pyrimidine ring, whether or not hydrogenated, or piperazine ring in the structure	736.7	0.39	The USA (32%), Singapore (10%), Canada (10%)
293499	Nucleic acids and their salts, whether or not chemically defined; heterocyclic compounds	624.0	0.22	Japan (12%), China (11%), the USA (7%)
294190	Antibiotics (excluding penicillin and their derivatives)	490.1	0.62	Bangladesh (12%), China (8%), Turkey (7%)
290611	Menthol	317.3	0.92	China (72%), the USA (6%), Japan (3%)
292429	Cyclic amides, including cyclic carbamates, and their derivatives; salts thereof	300.1	0.44	Norway (21%), the USA (14%), China (7%)

Source: Data accessed from ITC Trade Map; India Exim Bank Research

HS 32: Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other coloring matter; paints and varnishes; putty and other mastics; inks

All the top ten export items under tanning or dyeing extracts (HS 32), enjoy relative comparative advantage. It may be noted that synthetic organic reactive dyes (HS 320416) which ranks second in terms of exports had the highest NRCA of 0.91 among all the products falling under HS 32. India's exports accounted for 40% of global exports of the commodity

Table 3.17: Competitiveness of the Top Ten Export Items for Tanning or Dyeing extracts (HS 32)

HS Code	Description	Exports in 2021 (US$ Million)	NRCA	Major Export Destinations
320417	Synthetic organic pigments; preparations based on synthetic organic pigments of a kind used to dye fabrics or produce colorant preparations	987.6	0.81	USA (13.2%), China (13%), Netherlands (6%)
320416	Synthetic organic reactive dyes; preparations based on synthetic organic reactive dyes of a kind used to dye fabrics or produce colorant preparations	774.0	0.91	Turkey (20.3%), Bangladesh (17.1%), Honduras (7.7%)
320419	Synthetic organic colouring matter and preparations of the kind used for colouring any materials or for the production of prepared colours, based thereon	352.5	0.82	USA (13.6%), China (9.2%), Germany (4.7%)
320412	Synthetic organic acid dyes, whether or not metallised, and synthetic organic mordant dyes; preparations based on synthetic organic acid or mordant dyes of a kind used to dye fabrics or produce colorant preparations	285.8	0.89	Italy (20.3%), China (11%), USA (8.7%)
321519	Printing ink, whether or not concentrated or solid (excluding black ink)	162.4	0.27	Bangladesh (14.9%), Germany (9.7%), UAE 99.7%)
320411	Synthetic organic disperse dyes; preparations based on synthetic organic disperse dyes of a kind used to dye fabrics or produce colorant preparations (excluding preparations of heading 3207, 3208, 3209, 3210, 3213 and 3215)	159.9	0.71	China (15.9%), Turkey (15.7%), Honduras (12.7%)
320414	Direct synthetic organic dyes; preparations based on direct synthetic organic dyes of a kind used to dye fabrics or produce colorant preparations	136.2	0.89	Netherlands (13.7%), Italy (10%), China 98.9%)
320415	Synthetic organic vat dyes, incl. those usable in that state as pigments; preparations based on synthetic organic vat dyes of a kind used to dye fabrics or produce colorant preparations	108.6	0.78	China (16.4%), Germany (11.5%), Bangladesh (11.2%)
321290	Pigments, incl. metallic powders and flakes, dispersed in non-aqueous media, in liquid or paste form, of a kind used in the manufacture of paints; colorants and other colouring matter, n.e.s. put up for retail sale	92.6	0.53	Germany (42.2%), USA (29.8%), Poland (3.5%)
320413	Basic synthetic organic dyes; preparations based on basic synthetic organic dyes of a kind used to dye fabrics or produce colorant preparations	79.3	0.85	China (14.4%), USA (10.4%), Italy (4.1%)

Source: Data accessed from ITC Trade Map; India Exim Bank Research

HS 3808: Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growth regulators, disinfectants and similar products, put up for retail sale or as preparations or articles

At HS 6-digit level, India exports ten commodities under the product group. Out of these, goods of heading 3808, containing alpha-cypermethrin "ISO", bendiocarb "ISO", bifenthrin "ISO", chlorfenapyr "ISO", cyfluthrin "ISO" etc. (HS 380869) has the highest NRCA of 0.87. India constitutes a share of 27% in world exports of this commodity. Three of the ten products exported under the product group have a negative NRCA indicating low export competitiveness. These are disinfectants, put up in forms or packings for retail sale or as preparations or articles (HS 380894), goods of heading 3808, containing alpha-cypermethrin "ISO", bendiocarb "ISO", bifenthrin "ISO", chlorfenapyr "ISO", cyfluthrin "ISO", deltamethrin "INN, ISO" etc. (HS 380859), and DDT "ISO"clofenotane "INN", in packings of a net weight content <= 300 g (HS 380852). Brazil, the USA and Nepal were some of the top export destinations for agrochemicals in 2021.

Table 3.18: Competitiveness of the Top Ten Export Items for Agrochemicals such as Pesticides, Rodenticides, Fungicides etc. (HS 3808)

HS Code	Description	Exports in 2021 (US$ Million)	NRCA	Major Export Destinations
380891	Insecticides, put up in forms or packings for retail sale or as preparations or articles	1666.3	0.79	Brazil (40.7%), USA (13.8%), Vietnam (3.2%)
380893	Herbicides, anti-sprouting products and plant-growth regulators, put up in forms or packings for retail sale or as preparations or articles	1627.3	0.71	USA (36.1%), Brazil (15.9%), Japan (7.7%)
380892	Fungicides, put up in forms or packings for retail sale or as preparations or articles	848.4	0.65	Brazil (22.1%), USA (9.5%), France (4.8%)
380869	Goods of heading 3808, containing alpha-cypermethrin "ISO", bendiocarb "ISO", bifenthrin "ISO", chlorfenapyr "ISO", cyfluthrin "ISO", deltamethrin "INN, ISO", etofenprox "INN", fenitrothion "ISO", lambda-cyhalothrin "ISO", malathion "ISO", pirimiphos-methyl "ISO" or propoxur "ISO" (excl. in packings of a net weight content <= 7,5 kg)	220.5	0.87	USA (20.5%), Brazil (15.2%), China (13.9%)
380899	Rodenticides and other plant protection products put up for retail sale or as preparations	69.2	0.34	USA (14.9%), Nepal (8.3%), Brazil (6.7%)
380894	Disinfectants, put up in forms or packings for retail sale or as preparations or articles	56.1	-0.12	Vietnam (38.5%), Singapore (19.6%), Nepal (6.6%)

HS Code	Description	Exports in 2021 (US$ Million)	NRCA	Major Export Destinations
380862	Goods of heading 3808, containing alpha-cypermethrin "ISO", bendiocarb "ISO", bifenthrin "ISO", chlorfenapyr "ISO", cyfluthrin "ISO", deltamethrin "INN, ISO", etofenprox "INN", fenitrothion "ISO", lambda-cyhalothrin "ISO", malathion "ISO", pirimiphos-methyl "ISO" or propoxur "ISO", in packings of a net weight content > 300 g but <= 7,5 kg	5.8	0.02	Ukraine (27.9%), Russia (16.9%), Nigeria (12.1%)
380859	Goods of heading 3808, containing alpha-cypermethrin "ISO", bendiocarb "ISO", bifenthrin "ISO", chlorfenapyr "ISO", cyfluthrin "ISO", deltamethrin "INN, ISO", etofenprox "INN", fenitrothion "ISO", lambda-cyhalothrin "ISO", malathion "ISO", pirimiphos-methyl "ISO" or propoxur "ISO" (excl. in packings of a net weight content <= 7,5 kg)	2.8	-0.12	Nepal (42.5%), Mexico (28.3%), Malaysia (10.8%)
380861	Goods of heading 3808, containing alpha-cypermethrin "ISO", bendiocarb "ISO", bifenthrin "ISO", chlorfenapyr "ISO", cyfluthrin "ISO", deltamethrin "INN, ISO", etofenprox "INN", fenitrothion "ISO", lambda-cyhalothrin "ISO", malathion "ISO", pirimiphos-methyl "ISO" or propoxur "ISO", in packings of a net weight content <= 300	2.3	0.37	Tanzania (41.9%), Ethiopia (41.1%),
380852	DDT "ISO"clofenotane "INN", in packings of a net weight content <= 300 g	0.7	-0.42	South Africa (99.6%)

Source: Data accessed from ITC Trade Map; India Exim Bank Research

Product Identification based on Competitiveness

In order to identify products on the basis of their competitiveness, the four-quadrant analysis has been undertaken based on the HS Code classification at 6-digit level whilst calculating their NRCA and mapping them against the AAGR of global imports of all products.

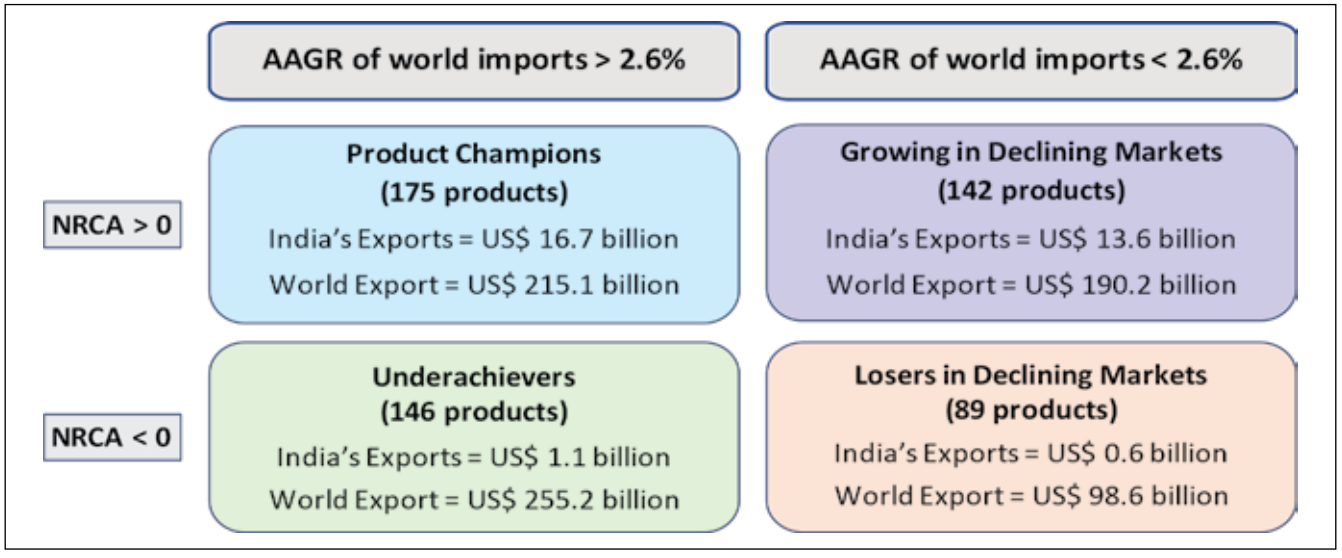
The analysis in this section considers two major determinants for gauging India's Chemical industry's performance in overseas markets at a granular level, namely the NRCA for products; and Annual Average Growth Rate (AAGR) for imports. Based on these two considerations, a four-quadrant matrix is prepared for product identification.

The quadrants are drawn by comparing the overall AAGR of global imports for all products during 2012-21 (which was 2.6%), to the NRCA of the products in 2021. This exercise aims to identify products whose imports over the period 2012-21 have performed better than the global average for all products during this period, implying that the share of such products in the world import basket has witnessed an increase, a reflection of their rising demand and dynamism.

India had exports in 552 items in 2021 at HS 6-digit level, under the four major groups- inorganic chemicals (HS 28), organic chemicals (HS 29), tanning or dyeing extracts (HS 32) and agrochemicals such as pesticides, rodenticides, fungicides etc. (HS 3808). These products have been taken into consideration for classification of products based on competitiveness in the chemical industry. These 552 items include 171 items from inorganic chemicals (HS 28), 327 items from organic chemicals (HS 29), 44 items from tanning or dyeing extracts (HS 32) and remaining 10 items from agrochemicals such as pesticides, rodenticides, fungicides etc. (HS 3808).

Based on the analysis, out of the 552 products, 175 are classified as product champions (refer to the annexure for group-wise list), 142 as growers in declining markets, 146 as underachievers and 89 as losers in declining markets.

Figure 3.12: Four Quadrant Analysis of Chemical Industry



Source: India Exim Bank Research

Table 3.19: Export Value of Various Categories of products

Category	HS 28		HS 29		HS 32		HS 3808		Total	
	No. of Products	Value in US$ Million	No. of Products	Value in US$ Million	No. of Products	Value in US$ Million	No. of Products	Value in US$ Million	No. of Products	Value in US$ Million
Product Champions	31	958.2 (40%)	131	10633.1 (50%)	7	1513 (39%)	6	3591.3 (80%)	175	16695.6 (52%)
Growing in Declining Market	37	1167.5 (48%)	89	9,497.8 (45%)	15	2104.8 (55%)	1	848.4 (19%)	142	13618.5 (43%)
Losers in Declining Market	40	73.9 (3%)	36	384.1 (2%)	13	89.2 (2%)	0	0	89	547.2 (2%)
Underachievers	63	210 (9%)	71	669 (3%)	9	136.2 (4%)	3	59.6 (1%)	146	1074.8 (3%)
Total	**171**	**2409.6**	**327**	**21184**	**44**	**3843.2**	**10**	**4499.3**	**552**	**31936.1**

Source: India Exim Bank Research

Focus Products

Product Champions [Product Import AAGR > World Import AAGR; Positive NRCA]:

- These products have the maximum potential, as the world import demand for these products has shown robust AAGR over the period 2012-21, while India's exports of these products to the world have also remained competitive, reflecting a positive NRCA values for such products.
- In the analysis, there are 175 products at HS 6-digit level which could be classified as Product Champions, out of which 31 products were from inorganic chemicals group (HS 28); 131 products from organic chemicals (HS 29); 7 products from tanning or dyeing extracts (HS 32); and 6 products from agrochemicals such as pesticides, rodenticides, fungicides etc. (HS 3808).
- Thus, among the product groups, competitiveness of agrochemicals such as pesticides, rodenticides, fungicides etc. (HS 3808) as a whole is strong whereas competitiveness of inorganic chemicals (HS 28) needs to be enhanced.

- The total value of the exports of identified Product Champions stood at US$ 16.7 billion in 2021. The global exports of these commodities in 2021 stood at US$ 215.1 billion. This points at the huge export market that could be tapped.
- For this category, out of the 175 products, 64% by value belonged to organic chemicals (HS 29) followed by 22% from agrochemicals such as pesticides, rodenticides, fungicides etc. (HS 3808), and 9% and 6% from tanning or dyeing extracts (HS 32) and inorganic chemicals (HS 28), respectively.

Underachievers [Product Import AAGR > World Import AAGR; Negative NRCA]:

- Underachievers are those set of products whose global market is increasing but India's exports have not been competitive enough to tap it. The global import demand of these identified products has exhibited significant growth over the period under consideration, while NRCA of these products appears negative.
- In the analysis, 146 products came under this category at the HS 6-digit level, out of which 63 products belong to the inorganic chemicals group (HS 28); 71 products to organic products group (HS 29); 9 products to tanning or dyeing extracts group (HS 32) and 3 products to agrochemicals such as pesticides, rodenticides, fungicides etc. (HS 3808). As these products exhibit growing import demand, there is incentive for the industry to work towards increasing competitiveness in these products.
- The total value of India's exports of products identified as underachievers was US$ 1.1 billion. Comparing India's export value with the global export value of US$ 255.2 billion in these products sheds light on the opportunities that the industry is missing by not strengthening export capabilities in these commodities.
- In terms of value, organic chemicals (HS 29) accounted for 62% of the exports in the category. Inorganic chemicals (HS 28) accounted for 20% of the exports and tanning or dyeing extracts (HS 32) and agrochemicals such as pesticides, rodenticides, fungicides etc. (HS 3808) accounted for 13% and 6% of the exports, respectively.
- Although organic products (HS 29) is the top performing sector in terms of exports, the analysis point out that there is considerable scope to further boost exports in the sector.

Diversifiable Products

Growers in Declining Markets [Product Import AAGR < World Import AAGR; Positive NRCA]:

- Products falling under this category are those which have exhibited growth in exports but in a declining market where demand is waning. Here, the identified products have a positive NRCA for India.
- In the analysis, 142 products came under this category at the HS 6-digit level, out of which 37 products were from inorganic chemicals (HS 28); 89 products from organic chemicals (HS 29); 15 products from tanning or dyeing extracts (HS 32) and 1 product from agrochemicals such as pesticides, rodenticides, fungicides etc. (HS 3808).
- The total export value of products identified under the category however is substantial at US$ 13.6 billion, that is 43% of India's total chemical exports. The global export value of these products stood at US$ 190.2 billion.
- In terms of value, organic chemicals (HS 29) accounted for 70% of the total exports in the category, followed by tanning or dyeing extracts (HS 32) (15%), inorganic chemicals (HS 28) (9%) and agrochemicals such as pesticides, rodenticides, fungicides etc. (HS 3808) (6%).

Losers in Declining Markets [Product Import AAGR < World Import AAGR; Negative NRCA]:

- India's Chemical industry does not exhibit competitiveness in these products, and they also registered weak global import growth during the period under consideration.

- In the analysis, 89 products came under this category at the HS 6-digit level, out of which 40 products were from inorganic chemicals (HS 28), 36 products from organic chemicals (HS 29), 13 products from tanning or dyeing extracts (HS 32). No product from agrochemicals such as pesticides, rodenticides, fungicides etc. HS 3808 was identified in this category.
- The total value of India's exports under this category stood at US$ 0.6 million as against the global export value of US$ 98.6 billion.
- While inorganic chemicals (HS 28) had the greatest number of products falling under the category, in terms of value of exports, organic chemicals (HS 29) had the highest share of 70%, followed by tanning or dyeing extracts (HS 32) (16%) and inorganic chemicals (HS 28) (14%).

The chapter highlights that while the chemical industry in India has exhibited steady export growth in the last decade, the exports are not commensurate with the rising imports. Within the chemicals sector, few categories such as organic chemicals and agrochemicals stand out in terms of their export performance. Going forward, there is need to further boost exports in these categories and build export capabilities in the other categories viz. tanning and dyes extracts and inorganic chemicals. The chapter also identifies the products that hold high export potential and where India already demonstrates high export competitiveness. Focus may be given on these products called 'product champions' to accelerate export growth in the short to medium run.

4 Exploring Indian Chemical Industry's Growth Potential

The chemical industry plays an integral role in India's industrial development and trade. The industry has contributed consistently towards value creation and has strong presence globally. However, there are myriad opportunities that are yet to be capitalized on by the chemical industry in India.

As observed in the Study, the low per capita consumption and low penetration levels in the user industries in India suggests that there is huge untapped opportunity for chemical companies in the long term. Further, with India's trade deficit in chemicals widening to US$ (-) 9.4 billion in 2021, opportunities exist to substitute imports by developing technology and knowhow and operating at economies of scale.

From 2012 to 2021, India's chemical exports grew at a CAGR of 6.6%. Assuming that the chemical exports continue to grow at the same rate, the exports would touch US$ 56.8 billion by 2030 (business as usual scenario). The Study also considers an optimistic scenario wherein it is assumed that India achieves its export target of US$ 2 trillion in goods and services i.e US$ 1.2 trillion in merchandise exports by 2030 (merchandise exports made up about 60% of India's total exports in 2021). Under the optimistic scenario, it is assumed that the chemical sector would grow at the same CAGR during 2022-30, like the overall merchandise exports, i.e., 13.2%; in that case, the Indian chemical exports are expected to touch about US$ 97.4 billion by 2030.

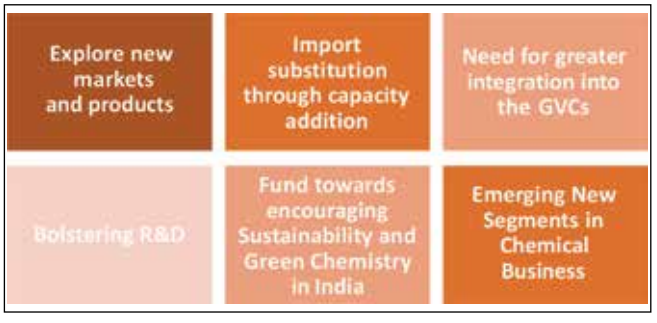
Table 4.1: India's Chemical Industry Export Target

Year	Scenario	Export (US$ Billion)	Required CAGR
2021	Observed	31.9	-
2030	Business-as-usual	56.8	6.6%
2030	Optimistic	97.4	13.2%

Source: Data accessed from ITC Trade Map; India Exim Bank Research

For achieving the target of about US$ 97.4 billion worth of chemical exports by 2030, this section proposes select strategies that could be adopted, which would enable capacity and capability creation amongst Indian chemical industry. These have been broadly elucidated in the exhibit below:

Figure 4.1: Select Strategies



Explore new markets and products

The demand for chemicals is highly dynamic. Mature products in one region may be innovative products in another. Besides, as the chemical industry directly or indirectly touches over 95% of all manufactured products, consumption trends in other industries directly affect the demand for chemicals. Among the top 20 importing countries for chemicals across the four chemical groups identified in this Study[14], countries having the highest import growth during the last decade have been listed in Table 4.2. These are highly lucrative markets which India needs to explore.

[14] HS 28: Inorganic chemicals; HS 29: Organic chemicals; HS 32: Tanning or dyeing extracts; and HS 3808: Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant growth regulators etc.

For inorganic chemicals (HS 28), the top growing markets are found to be Poland, Vietnam, South Korea, Mexico, and Thailand. India's current exports to these markets form a paltry share in the global imports of the latter. In 2021, the share of India in the imports of Poland was 0.3%. Similarly, India accounted for 3.5%, 0.5%, 0.4% and 2.3%, respectively, of global imports of HS 28 for Vietnam, South Korea, Mexico, and Thailand. India's top export destinations in 2021 were UAE (18%), the USA (8%), China (6%), Bangladesh (4%) and Oman (4%). Since India's trade deficit in inorganic chemicals has increased to (-) US$ 7.2 billion in 2021, it is important to provide an impetus to exports by exploring new markets. The markets as identified in Table 4.2 should thus be focused on.

Similarly, for organic chemicals there is potential for India to increase its exports to top growing import markets viz., Ireland, Turkey, Russia, Spain, and Belgium.

In tanning or dyeing extracts (HS 32), the lucrative markets are Vietnam, Belgium, Poland, the Netherlands, and China.

Coming to insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growth regulators, disinfectants and similar products (HS 3808), it has been seen that India enjoys high export competitiveness in the segment. Furthermore, India's exports to the USA and Brazil already enjoy a considerable share in their imports. Possibilities may be explored for boosting export to other top growing markets as well.

Table 4.2: Potential Markets for Boosting India's Chemical Exports

Country	AAGR of imports (2012-21)	Total Imports from the World in 2021 (US$ billion)	Share in World Imports in 2021	Imports from India in 2021 (US$ billion)	India's share in Imports
HS 28: Inorganic Chemicals					
Poland	15.0%	3.4	2.2%	0.01	0.3%
Vietnam	13.3%	2.3	1.4%	0.08	3.5%
South Korea	8.8%	11.0	7%	0.05	0.5%
Mexico	8.1%	3.6	2.3%	0.01	0.4%
Thailand	7.1%	2.7	1.7%	0.06	2.3%
HS 29: Organic Chemicals					
Ireland	15.3%	12.21	2.3%	0.20	1.6%
Turkey	9.0%	9.34	1.8%	0.54	5.8%
Russia	7.3%	5.85	1.1%	0.42	7.3%
Spain	4.5%	14.21	2.7%	0.84	5.9%
Belgium	4.4%	42.05	7.9%	0.66	1.6%
HS 32: Tanning or Dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints and varnishes; putty and other mastics; inks					
Vietnam	10.8%	2.00	2.1%	0.07	3.6%
Belgium	7.6%	3.26	3.4%	0.06	1.9%
Poland	5.5%	2.40	2.5%	0.05	2.0%
Netherlands	4.7%	3.70	3.9%	0.09	2.3%
China	4.6%	6.04	6.3%	0.38	6.3%

Country	AAGR of imports (2012-21)	Total Imports from the World in 2021 (US$ billion)	Share in World Imports in 2021	Imports from India in 2021 (US$ billion)	India's share in Imports
HS 3808: Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growth regulators, disinfectants and similar products, put up for retail sale or as preparations or articles					
Australia	11.1%	1.21	2.8%	0.02	2.0%
USA	10.8%	1.85	4.2%	0.18	9.6%
Brazil	8.2%	4.12	9.4%	0.57	13.7%
Canada	6.5%	1.84	4.2%	0.02	1.3%
Russia	6.4%	0.81	1.8%	0.02	2.00%

Source: Data accessed from ITC Trade Map; India Exim Bank Research

With respect to venturing into new products, it is to be noted that the Study has classified 146 products as 'underachievers' i.e., the items in which the Indian chemical industry seems to be having relatively less competitiveness although their global demand has grown considerably over the last decade. This essentially reflects that the share of such products in world imports has increased, reflecting their growing demand. India needs to improve its competitiveness in these products to give a significant push to the overall chemical exports. Based on the export value, select underachiever items for each product group are given in Table 4.3. It may be worthwhile to focus on building export capabilities in these items.

Table 4.3: Select Focus Items identified as Underachievers

HS Code	Description	India's Exports in 2021 (US$ Million)	India's Share in World exports
HS 28 Inorganic Chemicals			
284330	Gold compounds, inorganic or organic, whether or not chemically defined	29.363	1.3%
281830	Aluminium hydroxide	20.318	1.3%
284210	Double or complex silicates of inorganic acids or peroxoacids, incl. aluminosilicates whether or not chemically defined	12.275	1.3%
283699	"Carbonates and peroxocarbonates" "percarbonates"; commercial ammonium carbonate containing ammonium carbamate	11.538	1.1%
282590	Bases, inorganic, and metal oxides, hydroxides and peroxides, n.e.s.	9.539	0.9%
HS 29: Inorganic Chemicals			
293379	Lactams (excluding 6-hexanelactam "epsilon-caprolactam", clobazam "INN", methyprylon "INN"etc.)	159.874	1.0%
291612	Esters of acrylic acid	38.968	0.7%
290539	Diols (excluding ethylene glycol "ethanediol" and propylene glycol "propane-1,2-diol")	34.814	1.1%
292910	Isocyanates	34.173	0.6%
293719	Polypeptide hormones, protein hormones and glycoprotein hormones, their derivatives	30.203	0.2%

HS Code	Description	India's Exports in 2021 (US$ Million)	India's Share in World exports
HS 32: Tanning or Dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints and varnishes; putty and other mastics; inks			
320890	Paints and varnishes based, incl. enamels and lacquers, on synthetic polymers or chemically modified natural polymers, dispersed or dissolved in a non-aqueous medium, and solutions of products of headings 3901 to 3913 in volatile organic solvents, containing > 50% solvent by weight (excluding those based on polyesters and acrylic or vinyl polymers and solutions of collodion)	35.3	0.4%
320611	Pigments and preparations based on titanium dioxide of a kind used for colouring any material or produce colorant preparations, containing >= 80% by weight of titanium dioxide calculated on the dry matter (excluding preparations of heading 3207, 3208, 3209, 3210, 3212, 3213 and 3215)	26.5	0.2%
321410	Glaziers' putty, grafting putty, resin cements, caulking compounds and other mastics; painters' fillings	16.7	0.2%
320820	Paints and varnishes, incl. enamels and lacquers, based on acrylic or vinyl polymers, dispersed or dissolved in a non-aqueous medium; solutions based on acrylic or vinyl polymers in volatile organic solvents, containing > 50% solvent by weight	14.3	0.3%
321590	Ink, whether or not concentrated or solid (excluding printing ink)	14.2	0.3%
HS 3808: Insecticides, rodenticides, fungicides, herbicides, anti-sprouting products and plant-growth regulators, disinfectants and similar products, put up for retail sale or as preparations or articles			
380894	Disinfectants, put up in forms or packings for retail sale or as preparations or articles	56.066	1.4%
380859	Goods of heading 3808 containing one or more of the following substances: alachlor (ISO); aldicarb (ISO); aldrin (ISO); azinphos-methyl (ISO); binapacryl (ISO); camphechlor (ISO) (toxaphene); captafol (ISO); carbofuran (ISO); chlordane (ISO); chlordimeform (ISO); chlorobenzilate (ISO); dieldrin (ISO, INN); 4,6-dinitro-o-cresol (DNOC (ISO)) or its salts; dinoseb (ISO), its salts or its esters; endosulfan (ISO); ethylene dibromide (ISO) (1,2-dibromoethane); ethylene dichloride (ISO) (1,2-dichloroethane); fluo	2.812	1.4%
380852	"DDT" "ISO" "clofenotane" "INN", in packings of a net weight content <= 300 g	0.731	0.7%

Source: Data accessed from ITC Trade Map; India Exim Bank Research

India's competitive edge may broadly be captured in either being cost effective (price competitiveness) or in terms of better quality. It is thus vital to work on the key parameters such as cost of input materials and utilities, costs of labour, labour productivity, logistics and operating surplus. The Indian chemical industry may explore global opportunities either through acquisition of companies abroad or through greenfield projects (which will have a certain gestation period). It may also look to tap booming markets through deeper integration in GVCs, by providing trade-based support to exporters and through enhanced marketing strategies, among others.

Import substitution through capacity addition

Exporting a product in reasonable quantity corroborates that India does have the capacity to produce the same, however, with limited capacity, the country is unable to fulfil its domestic demand. For these items, the country has to rely on the imports. This holds true, in particular, for p-xylene (HS 290243); heterocyclic compounds with nitrogen hetero-atom[s] only (HS 293399); separate chemically defined organic compounds (HS 294200); nucleic acids and their salts, whether or not chemically defined, heterocyclic compounds (HS 293499); antibiotics (excluding penicillins and their derivatives with a penicillanic acid structure, salts thereof) (HS 294190); aluminium oxide (excluding artificial corundum) (HS 281820); carbon (carbon blacks and other forms of carbon, not elsewhere specified) (HS 280300); disodium carbonate (HS 283620);synthetic organic vat dyes, incl. those usable in that state as pigments; preparations based on synthetic organic vat dyes of a kind used to dye fabrics or produce colorant preparations (HS 320415);, and synthetic organic pigments; preparations based on synthetic organic pigments of a kind used to dye fabrics or produce colorant preparations (HS 320417), collective imports of which constituted around 13% of total imports by the chemical industry, and at the same time, collective exports of these items were 23% of the total exports by the chemical industry in 2021. A situation like this is reflected directly with the rising GL-Index[15]. This essentially indicates how the domestically produced chemicals do not belong to the grade/quality that is required for consumption, thereby explaining the imports of the same set of products that are exported in large quantities.

The analysis undertaken in the previous chapter indicates that while India's export of chemicals has been gradually increasing, the country still has a deficit in chemical sector on the trade account. India's exports of chemicals in 2021 stood at US$ 31.9 billion whereas imports touched US$ 41.3 billion, an indication of strong domestic demand for chemical products. Thus, there are chemical products which India is both exporting and importing, as indicated by the Intra-Industry Trade (IIT) or the GL-Index.

It is argued that the rising index for inter-industry trade, implies reallocation of productive resources from import competing industries to those industries in the domestic country that have the comparative cost advantage. In the context of intra-industry trade, it is more likely that reallocation of resources takes place from inefficient to efficient product lines within an industry.

$$\text{GL-Index} = 1 - \frac{|Xi-Mi|}{Xi+Mi}$$

where X_i and M_i refer to the export and import of the commodity, respectively.

The GL-index takes values between 0 and 1, where 0 means that all trade is inter-industry while 1 means that all trade is intra-industry. Since the GL-index is calculated as IIT divided by total trade, the GL-index is interpreted as IIT's share in total trade.

[15] Grubel-Lloyd Index measures the degree of trade within the same branch at the product level, i.e., the intra-industrial trade. Intra-industry trade arises if a country simultaneously imports and exports similar types of goods or services.

Table 4.4: GL-Index for India's Chemical Industry

HS Code	Chemical Group	2017	2018	2019	2020	2021
28	Inorganic Chemicals	0.45	0.44	0.42	0.41	0.40
29	Organic Chemicals	0.86	0.88	0.94	0.98	0.88
32	Tanning or dyeing extracts	0.84	0.81	0.75	0.74	0.79
3808	Agrochemicals such as Insecticides, rodenticides, fungicides etc.	0.70	0.61	0.55	0.61	0.59
Total		**0.86**	**0.88**	**0.94**	**0.96**	**0.87**

Source: Data accessed from ITC Trade Map; India Exim Bank Research

As can be seen, the GL-Index for the chemical sector as a whole stood at 0.86 in 2017 and after showing an upward trend from 2018-2020, it has declined to 0.87. Nevertheless, the index depicts prevalence of high intra-industry trade. Intra-industry trade between countries produces economic gains as it allows businesses to learn and innovate on particular products, thereby encouraging specialization. It is observed that increase in RCA leads to higher intra-industry trade. Thus, the low GL-index of exports of inorganic chemicals may be partly attributed to its weak export competitiveness as noted in Chapter 3. The unfavourable trade balance for India in chemicals highlights the need for import substitution through capacity additions.

It is important to note that the need for capacity additions is felt strongly, particularly with reference to the rising chemical imports from China in the last ten years. Total imports of inorganic chemicals (HS 28), organic chemicals (HS 29), tanning or dyeing extracts (HS 32) and agrochemicals such as Insecticides, rodenticides, fungicides etc. (HS 3808) from China have increased by 2.5 times during the last decade, from US$ 5.9 billion in 2012 to US$ 14.6 billion in 2021.

Furthermore, optimum utilization of exiting capacity is also required. The capacity utilization rate of inorganic chemicals stands at 63%. Given that the segment has witnessed rising imports coupled with moderate export growth, present capacity needs to be optimally utilized. Capacity utilization in pesticides and dyes and pigments is also low.

Table 4.5: Capacity Utilization in India's Chemical Industry

Chemical Group	Installed Capacity (in lakh tonnes)	Production (in lakh tonnes)	Capacity Utilization Rate
Inorganic chemicals	15.6	9.8	63%
Organic chemicals	26.6	19.1	72%
Pesticides	3.7	2.6	69%
Dyes and pigments	5.3	3.3	61%

Source: Chemical and Petrochemical Statistics at a Glance – 2021; India Exim Bank Research

Measures need to be taken to identify the gaps in production and installed capacity and ensure optimum utilization of the same.

Need for greater integration into the Global Value Chains (GVCs)

Manufacturing in the 21st century is a lot more globalized with production, trade, and investment being increasingly organized, within the GVCs, where different stages of production are located across different economies of the world. In the current global scenario, countries are specializing at various stages of the value chains, rather than establishing a whole new production plant. A commodity in the current times, changes many hands before it reaches the final consumers. Hence, there is a strong trend towards the international dispersion of value chain

activities such as design, production, marketing, distribution, etc. In short, a GVC essentially is a sequence of all functional activities required in the process of value creation, involving more than one country.

However, it is to be noted that while GVCs are source of gains for many economies, gains from GVC participation are not automatic. The benefits of GVC depend on the level of operations that any economy is undertaking.

The Economic Survey of India FY 2020 noted that China's remarkable export performance vis-à-vis India is driven primarily by deliberate specialization at large scale in labour intensive activities, especially "network products", where production occurs across GVCs operated by multi-national corporations.

Figure 4.2: Forward Linkages in 'Chemical and Pharmaceutical Products': India and China (in %)

Source: OECD TiVA database; India Exim Bank Research

The analysis from OECD's Trade in value added (TiVA) database shows that for the parameter 'Domestic value added in exports of intermediate products as a share of total gross exports[16]', China's value has remained above 60% for the last two decades for the industry segment 'chemical and pharmaceutical products'. The same for India is under 50%. The parameter reveals the share of industry exports that consists of domestic value added destined for further processing within direct partners' economies – either to meet partners' final demand or to be embodied in exports by direct partners.

[16] Shows forward linkages

It may also be observed that India has been having an increased dependence (backward linkage) on China for some critical inputs used by the chemical and pharmaceutical industry. During 2012-2021, while India's import of chemicals from the rest of the world increased at an AAGR of 8.3%, the imports from China grew at an AAGR of 11.8%, making up for about 35% of India's total chemical imports in 2021. It is recommended that in order to reduce the import dependence from China and boost the chemical exports from India, greater focus should be laid on enhancing India's integration into the GVCs, enabling domestic manufacturers to specialize across various stages of production.

In this regard, it is important to specify that the GOI in 2020 announced the Production Linked Incentive (PLI) Scheme for promotion of domestic manufacturing of critical Key Starting Materials (KSMs)/ Drug Intermediates (Dis) and Active Pharmaceutical Ingredients (APIs). Further, in September 2022, GOI also granted in-principle approval for three bulk drug parks in Himachal Pradesh, Gujarat, and Andhra Pradesh.

Bolstering R&D

The high value-added products of the chemicals industry continuously open up new fields of application, paving the way to progress and innovation in other industries. Typical examples are health, food, consumer goods, aerospace and car manufacturing, telecommunications, electrical engineering, and electronics. While the industry's R&D efforts are typically aimed at commercialization of research results, societal benefits typically outweigh the private financial returns from innovation. This fact highlights the need for investments across R&D and innovative practices like Green Chemistry to go together.

It may be noted that the total R&D investments in the chemical sector stand at merely 0.3% of total sales[17]. Apart from sustaining growth in the domestic market, R&D activities are equally crucial for the home-grown

[17] National Petrochemicals Awards Guidelines, Department of Chemicals & Petrochemicals

players to have a larger pie of the global markets as well.

For the investments across R&D and innovative practices in the chemical industry to be beneficial, it is important that it is supported by protection of intellectual property rights. For instance, in the US, the basic chemicals industry is characterized by above-average patent intensity. This builds a valid case-in-point for the protection of intellectual property rights in India's chemical sector as well. It should be noted that chemical products also fuel innovations and patents in other industries, such as, photovoltaic cells for electricity production, lightweight vehicle parts, germ-resistant coatings for medical instruments and more.

The FDI in chemical sector in both FY 21 (US$ 0.8 billion) and FY 22 (US$ 0.97 billion) was recorded at just under US$ 1 billion. In the previous three years, the FDI was much higher, although under US$ 2 billion. This is despite the policy allowing for 100% FDI in the sector under the automatic route. The FDI inflows to the chemical sector in FY 22, even though showed a slight improvement over the previous year, were significantly lower than the US$ 4 billion achieved in FY 12. It may be noted that in the first two quarters of FY 23, the FDI in chemical sector has already crossed US$ 1.3 billion mark.

Investments in the Indian chemical industry assumes greater importance on the two fronts – technology and innovation. Technological development may be achieved by the chemical industry at two levels. In the bulk products segment, the chemical industry should undertake process innovation with the objective of reduction in cost of production. In addition, the industry needs to invest in technological resources that would lead to specialized product development. Liberalization process has already increased the possibility of intra-firm transfer of technology and management practices in the form of consolidation within the economy as also from developed countries through foreign direct investment.

In order to increase innovation, more dedicated regional clusters for chemical industry should be created and similarly, more universities focused on chemical engineering (e.g. ICT, IIT Mumbai) should be shortlisted to develop innovation hubs for the chemical industry.

A suitable fund may be constituted by the Government on the lines of the Technology Upgradation Fund as available to the textile industry, or provision of accelerated depreciation as available to the solar energy sector. The fund can also be utilized to access designs, patents, processes, and technology. Such an initiative will make the industry, particularly the SMEs, more robust and self-reliant.

Fund towards encouraging Sustainability and Green Chemistry in India

Over the past century, even though chemistry has constantly improved the general quality of life by enabling the production of a wide range of items, this achievement has come at a price – collective human health and a threat to the global environment. Relevant across the life cycle of chemical products, green chemistry is an approach that could be considered towards manufacturing chemical products to reduce or eliminate chemical perils. The goal of green chemistry is to create better and safer chemicals while identifying the safest and most efficient ways to manufacture them and to mitigate wastes.

It has been noted that the usual chemical production is typically energy intensive, inefficient, and toxic-resulting in significant energy use, and generation of hazardous waste. One of the principles of green chemistry is to prioritize the use of alternative and renewable materials including the use of agricultural waste or biomass and non-food-related bio-products. In general, chemical reactions with these materials are significantly less hazardous than when conducted with petroleum products. A transformation to green chemistry techniques would result in safer workplaces for industry workers, greatly reduced risks to fence line communities and safer products for consumers. Since green chemistry processes are more efficient, companies would consume less raw materials and energy as well as save money on waste disposal.

To accelerate the uptake of green chemistry, it is important to enhance market dynamics by continuing to build a comprehensive, ongoing understanding of green chemistry enablers, market drivers and obstacles. It is equally important to support conducive policies by designing and advocating for innovative state and federal policies that increase the supply of and demand for green chemistry solutions. These policies could address the problems across broad domains of funding, training, and streamlining the permit for green chemistry products.

Government should look at announcing a production-linked incentive (PLI) scheme for chemicals and petrochemicals industries for those companies engaged in Sustainability and Green Chemistry in India. Alternatively, a suitable fund may be constituted by the Government on the lines of the Technology Upgradation Fund as available to the textile industry. This will enable Indian companies to provide raw materials to industries in a sustainable manner, and also bolster domestic manufacturing and exports.

Box 4.1: Uses of Green Chemistry

Green chemistry builds on conventional chemistry and engineering by applying 12 fundamental principles that guide the molecular design of sustainable chemical products and processes. Adhering to these principles prevents pollution and waste, leads to synthesis of chemicals in less hazardous and more efficient ways, promotes the use of renewable feedstocks and leads to the design of safer chemicals. Widely applicable across areas like pharmaceuticals, cleaning products and other household items, the three most notable examples include – computer chips, biodegradable plastics and paints.

Computer Chips

- Many chemicals, and much water and energy are needed to manufacture computers. It is estimated that to make one computer chip, it takes 630 times the weight of the chip in source materials to make that one chip (in comparison, the ratio for manufacturing a vehicle is 2:1).
- The new age advances in green chemistry include a new process that uses supercritical carbon dioxide in one of the steps of chip preparation, significantly reducing the chemicals, energy and water needed in the production process.
- Further, there are also mechanisms where chicken feathers are being used in this field. The protein, keratin, in the feathers is used to make a fiber form that is both light and tough enough to withstand mechanical and thermal stresses. The result is a feather-based printed circuit board that works at twice the speed of traditional circuit boards. While this technology is still in the works for commercial purposes, the research has led to other uses of feathers as source material, including for biofuel.

Biodegradable Plastics

Industry players are developing plastics made from renewable, biodegradable sources. Successes include:

- New food containers made from a method where microorganisms convert corn starch into a resin that is just as strong as the rigid petroleum-based plastic used for containers such as water bottles and yogurt pots.
- Fully biodegradable bags made of a compostable polyester film with cassava starch and calcium carbonate. The bags are tear-resistant, puncture-resistant, waterproof, printable and elastic; as well as able to disintegrate into water, CO2, and biomass in industrial composting systems

Paints

Oil-based paints containing synthetic resin made from dicarboxylic acid (known as alkyd paints), give off organic compounds. These volatile compounds evaporate from the paint as it dries and have environmental impacts. Improvements in this area include:

- Replacing fossil-fuel-derived paint resins and solvents with a mixture of soya oil and sugar cuts hazardous volatiles by half. These bio-based oils are used to replace petroleum-based solvents, creating safer paints with less toxic waste.
- Water-based acrylic alkyd paints with low volatile organic compounds that can be made from recycled soda bottle plastic, acrylics, and soybean oil. In 2010, enough of these paints were manufactured to eliminate more than 362,874 kg of volatile organic compounds.

Source: ACS Green Chemistry Institute

Emerging New Segments in Chemical Business

As the traditional chemical industry progresses there are new areas of chemical businesses that are emerging. This ranges from speciality chemicals to high end nanotechnology, to further value added chemical products. The key will be to define a formula that enables an organization to determine what constitutes an opportunity and whether it is worth pursuing, based on possible effectiveness.

The COVID-19 pandemic had a mixed, or rather largely positive, impact on the specialty chemicals segment[18]. For instance, in the flavours and fragrance segment, surge in demand for flavours (packaged foods) as well as fragrances (sanitizers and soaps) had benefited the segment. In the surfactant segments, increased demand for disinfectants, cleaning agents and detergents supported the demand growth and also set the tone for the sectoral growth in the medium term. Also, even before the pandemic, it has been seen that in India, specialty chemicals have increased considerably in construction, automotive, electronics and water treatment industries. This positive growth is expected to accelerate in the years to come given the boom in these industries.

Another emerging area in the chemical industry is rubber chemicals which are showing tremendous signs of growth. The boom in the automobile industry and rising demand for industrial products like belts, hoses, etc. are expected to trigger the requirements for rubber chemicals. The need for high performance tyres is on the rise and that augurs well for the specialty rubber chemicals industry. In fact, innovation in rubber chemicals is adding immense value to tyres. Today, radial tyres are in great demand, as these offers higher mileage and lower rolling resistance as compared to basic tyres. This in turns lowers the fuel consumption significantly, and hence gives greater return on investment for transporters in the long run thereby reducing carbon footprint. While the tyre industry is a major demand driver, the non-tyre components like window profiles, seals, belts, hoses, and various other moulded products also form a sizeable chunk.

[18] Indian Specialty Chemicals Industry Biggest Beneficiary of the Global Paradigm Shift: FICCI 2020

5 Outlook: Road Ahead for Indian Chemical Industry

India's economy has risen at an average pace of nearly 5.5% during the past ten years, making it one of the leaders in the world. Similar, to the global economy, the impact of the COVID-19 pandemic on the Indian economy was severe as the Indian economy then shrank by 6.6% in FY 21. In FY 21, when the index of industrial production (IIP) for the manufacturing sector fell by almost 10%, the Indian chemical manufacturing industry fell by only 2% in comparison.

The resilience of the Indian chemical industry comes from its size and diversity. In terms of the global sale of chemicals, India has one of the major chemical markets and is ranked sixth globally and fourth in Asia. Around 2.5% of the world's chemical sales come from India, while producing more than 80,000 chemical products which are used in a variety of end-use industries, such as textiles, automotives, agriculture, packaging, pharmaceuticals, healthcare, construction, and electrical and electronics.

The industry's export performance over the years has been robust. During 2017-2021, the exports witnessed an AAGR of 9.9%, higher than the world chemical export AAGR of 7.4%. During the same period, imports of chemicals increased at a higher AAGR of 14.1% to US$ 41.3 billion. While this has led to increasing trade deficit in the sector, it also shows the growing disposable income and demand of chemicals in India. This provides a huge opportunity to the domestic chemical industry.

However, as regards trade of chemicals in recent times, exports have mellowed down during the first 7 months of FY 2023 largely due to slow down in global economy. Exports of chemicals during April – October 2022, were recorded at US$ 17.9 billion, contracting by 4.4% as compared to the corresponding period of the previous year. The decline is attributed to considerable fall in exports of agrochemicals such as pesticides, insecticides etc. (HS 3808) and tanning and dye extracts (HS 32).

Amidst the potential for growth in exports of chemicals, the recent slew of FTAs being signed by India, provides significant opportunity for the industry. For example, under the India-UAE Comprehensive Economic Partnership Agreement (CEPA), UAE will be phasing out import tariffs for a number of sectors such as pharmaceuticals and petrochemicals, among others. This would stimulate demand for chemicals both as an intermediate and final product. the Other FTAs like the India-Australia Economic Cooperation (ETCA) and other probable ones with UK, EU and Canada would present further opportunities for the chemical industry.

Besides, the Government has been implementing industry friendly policies to invite investments in the chemical industry. This would not only allow India to cater to the domestic demand but also the rising global demand. The industry allows 100% FDI under the automatic route except for the hazardous chemicals. In fact, in FY 22, the FDI into chemicals sector was recorded at US$ 966 million, up from US$ 847 million in FY 21. It may be noted that in the first six months of FY 23, the FDI into chemicals sector has already crossed the US$ 1 billion mark.

Even the domestic capital expenditure has been displaying a robust growth trend. As per the CMIE,

the new projects announced in the chemicals and chemical products industry were worth ₹ 1.8 trillion in FY 22, up from ₹ 0.7 trillion in FY 21 and ₹ 1.6 trillion in FY 20. The CMIE forecasts indicate that the value of projects commissioned could reach ₹ 401 billion in FY 23 and further to ₹ 578 billion in FY 24, from ₹ 332 billion in FY 22.

The success of the chemical industry in the recent years could be attributed to the government initiatives and policies for this industry. In order to boost India's drug security, Government of India launched PLI scheme for Key Starting Materials (KSMs)/ Drug Intermediates (DIs) and Active Pharmaceutical Ingredients (APIs) with an outlay of ₹ 6,940 crore in 2020. In 2022, the GOI also gave an approval to three states (Himachal Pradesh, Gujarat, and Andhra Pradesh) in India to set up bulk drug parks under the government scheme for 'Promotion of Bulk Drug Parks'. This would directly and positively impact the Indian chemical industry. The Government is also planning a PLI scheme worth ₹ 10,000 crore for the chemicals and petrochemicals industries. Overall, Government is plugging the loopholes in the industry and at the same time, inviting the investments to make India a global leader.

However, it will be equally important for the chemical industry players to evaluate the changing trends and demands of the customers. India has been successful in tapping the opportunities in segments such as specialty chemicals which, in fact, performed well during the pandemic. As per Crisil, India is expected to double its global specialty chemicals market share by 2026 to 6% from the current 3%. But there are also issues related to sustainability which will have to be addressed in the medium to long run. Chemical players are increasingly implementing sustainability and green chemistry programmes by continuously enhancing their products, technologies, and processes and collaborating closely with their clients and suppliers throughout their value chains.

There are other changing trends in the industry as well. For instance, the players are incorporating digitalization methods in their supply chains and pricing strategies. This can offer competitive advantages to the firms through improved management systems in the operations. It may also be noted that with the supply chains being affected heavily during the pandemic, the global players are increasingly looking at China plus one strategy and India could be a key player in catering to the global demand.

Given such immense perceived potential, the India Exim Bank's Study projects chemical exports in an optimistic scenario to touch US$ 97.4 billion by 2030. Chemicals here includes organic chemicals, inorganic chemicals, insecticides and pesticides, and dyes and pigments.

Further, as the income of Indian middle class is also growing at a fast pace and there is a growing demand for the segments such as specialty chemicals from the end user industries like food processing, personal care, and home care. Further, sectors like automotives, water treatment, textiles, fragrances, and construction which significantly depend upon the chemicals sector will also be important drivers of the chemicals industry. The adequate expansion plans of the Indian chemical players along with the diversification towards the environment friendly production can go a long way in positioning India as a world leader in the chemicals industry.

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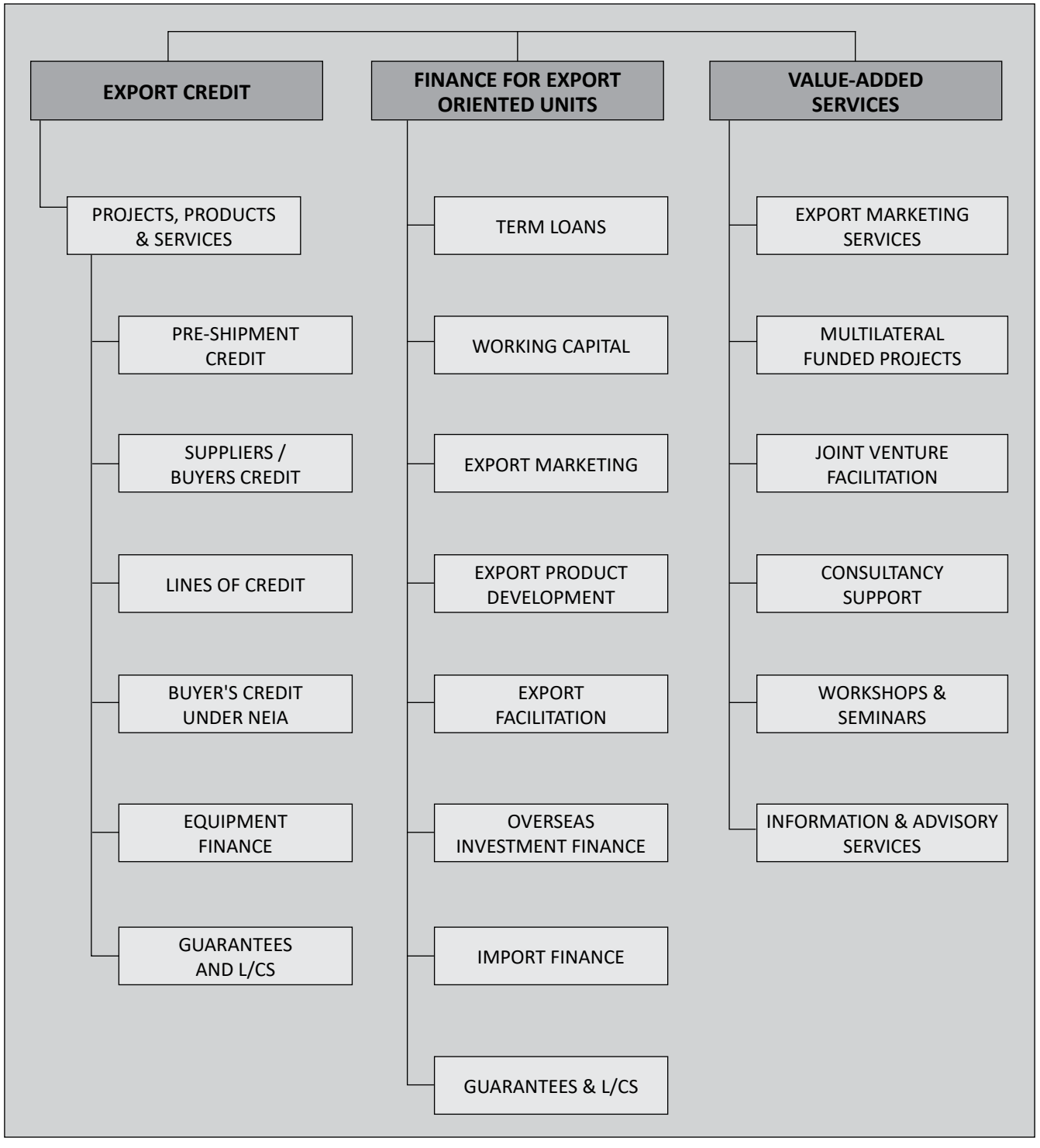
Bank's Major Programmes



EXPORT-IMPORT BANK OF INDIA

HEAD OFFICE

Centre One Building, 21st Floor, World Trade Centre Complex, Cuffe Parade, Mumbai 400 005.
Phone: (91 22) 22172600 ● Fax : (91 22) 22182572
E-mail : ccg@eximbankindia.in ● Website: www.eximbankindia.in

LONDON BRANCH

5th Floor, 35 King Street, London EC2V 888 United Kingdom
Phone : (0044) 20 77969040 ● Fax : (0044) 20 76000936 ● E-Mail : eximlondon@eximbankindia.in

DOMESTIC OFFICES

Ahmedabad
Sakar II, 1st Floor,
Next to Ellisbridge Shopping Centre,
Ellisbridge P. O., Ahmedabad 380 006
Phone : (91 79) 26576843
Fax : (91 79) 26577696
E-mail : eximahro@eximbankindia.in

Bengaluru
Ramanashree Arcade, 4th Floor,
18, M. G. Road,
Bengaluru 560 001
Phone : (91 80) 25585755
Fax : (91 80) 25589107
E-mail : eximbro@eximbankindia.in

Chandigarh
C- 213, Elante offices, Plot No. 178-178A,
Industrial Area phase 1,
Chandigarh 160 002
Phone : (91 172) 4629171
Fax : (91 172) 4629175
E-mail : eximcro@eximbankindia.in

Chennai
Overseas Towers, 4th and 5th Floor,
756-L, Anna Salai, Chennai 600 002
Phone : (91 44) 28522830/31
Fax : (91 44) 28522832
E-mail : eximchro@eximbankindia.in

Guwahati
NEDFi House, 4th Floor, GS Road,
Dispur, Guwahati 781 006
Phone : (91 361) 2237607 /609
Fax : (91 361) 2237701
E-mail : eximgro@eximbankindia.in

Hyderabad
Golden Edifice, 2nd Floor,
6-3-639/640, Raj Bhavan Road,
Khairatabad Circle, Hyderabad 500 004
Phone : (91 40) 23307816
Fax : (91 40) 23317843
E-mail : eximhro@eximbankindia.in

Kolkata
Vanijya Bhawan, 4th Floor,
(International Trade Facilitation Centre),
1/1 Wood Street, Kolkata 700 016
Phone : (91 33) 68261301
Fax : (91 33) 68261302
E-mail : eximkro@eximbankindia.in

Mumbai
8th Floor, Maker Chamber IV,
Nariman Point,
Mumbai 400 021
Phone : (91 22) 22861300
Fax : (91 22) 22182572
E-mail : eximmro@eximbankindia.in

New Delhi
Office Block, Tower 1, 7th Floor,
Adjacent Ring Road, Kidwai Nagar (E)
New Delhi - 110 023
Phone : (91 11) 61242600 / 24607700
Fax : (91 11) 20815029
E-mail : eximndo@eximbankindia.in

Pune
No. 402 & 402(B), 4th floor, Signature Building,
Bhamburda, Bhandarkar Rd.,
Shivajinagar, Pune - 411 004
Phone : (91 20) 26403000
Fax : (91 20) 25648846
E-mail : eximpro@eximbankindia.in

OVERSEAS OFFICES

Abidjan
5th Floor,
Azur Building,
18-Docteur Crozet Road,
Plateau,
Abidjan,
Côte d'Ivoi re
Phone : (225) 2720242951
Fax : (225) 2720242950
Email : eximabidjan@eximbankindia.in

Addis Ababa
House No. 46,
JakRose Estate Compound,
Woreda 07,
Bole Sub-city,
Addis Ababa,
Ethiopia.
Phone : (251) 118222296
Fax : (251) 116610170
Email : aaro@eximbankindia.in

Dhaka
Madhumita Plaza, 12th Floor,
Plot No. 11, Road No. 11, Block G,
Banani, Dhaka, Bangladesh - 1213.
Phone : (88) 01708520444
E-mail : eximdhaka@eximbankindia.in

Dubai
Level 5, Tenancy IB, Gate Precinct Building No. 3,
Dubai International Financial Centre,
PO Box No. 506541, Dubai, UAE.
Phone : (971) 43637462
Fax : (971) 43637461
E-mail : eximdubai@eximbankindia.in

Johannesburg
2nd Floor, Sandton City Twin Towers East,
Sandhurst Ext. 3, Sandton 2196,
Johannesburg, South Africa.
Phone : (27) 113265103
Fax : (27) 117844511
E-mail : eximjro@eximbankindia.in

Singapore
20, Collyer Quay, #10-02,
Tung Centre, Singapore 049319.
Phone : (65) 65326464
Fax : (65) 65352131
E-mail : eximsingapore@eximbankindia.in

Washington D.C.
1750 Pennsylvania Avenue NW,
Suite 1202,
Washington D.C. 20006,
United States of America.
Phone : (1) 2022233238
Fax : (1) 2027858487
E-mail : eximwashington@eximbankindia.in

Yangon
House No. 54/A, Ground Floor,
Boyarnyunt Street, Dagon Township,
Yangon, Myanmar
Phone : (95) 1389520
E-mail : eximyangon@eximbankindia.in

Centre One Building, 21st Floor, World Trade Centre Complex, Cuffe Parade, Mumbai-400 005.

Ph.: (9122) 22172600 | Fax: (9122) 22182572

E-mail: ccg@eximbankindia.in | Website: www.eximbankindia.in, www.eximmitra.in

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