

Industry Research Report on Zinc Oxide Industry

February 2024

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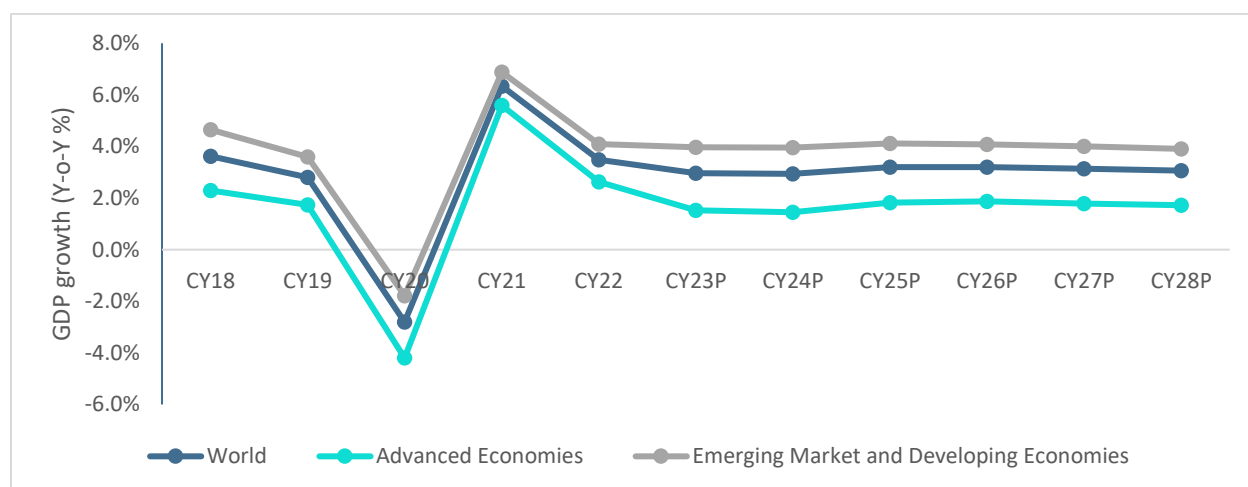
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1. Economic Outlook

1.1 Global economy outlook

As per the International Monetary Fund (IMF)'s World Economic Outlook growth projections released in January 2024, the global economic growth for CY23¹ stood at 3.1% on a year-on-year (y-o-y) basis, down from 3.5% in CY22 due to disruptions resulting from the Russia-Ukraine conflict and higher-than-expected inflation worldwide. On the other hand, the global economic growth for CY24 is projected to remain stable at 3.1%, attributed to growth resilience in major economies due to high government and private spending, rapidly subsiding inflation rates, and advanced economies easing their fiscal policies. Cost of borrowing remained high as central banks fight inflation. For the next 4 years, the IMF projects world economic growth in the range of 3.1%-3.2% on a y-o-y basis.

Chart 1: Global Growth Outlook Projections (Real GDP, Y-o-Y change in %)



Notes: P-Projection;

Source: IMF – World Economic Outlook, October 2023

Table 1: GDP growth trend comparison - India v/s Other Economies (Real GDP, Y-o-Y change in %)

	Real GDP (Y-o-Y change in %)									
	CY19	CY20	CY21	CY22	CY23P	CY24P	CY25P	CY26P	CY27P	CY28P
India	3.9	-5.8	9.1	7.2	6.3	6.3	6.3	6.3	6.3	6.3
China	6.0	2.2	8.5	3.0	5.0	4.2	4.1	4.1	3.7	3.4
Indonesia	5.0	-2.1	3.7	5.3	5.0	5.0	5.0	5.0	5.0	5.0
Saudi Arabia	0.8	-4.3	3.9	8.7	0.8	4.0	4.2	3.3	3.3	3.1
Brazil	1.2	-3.3	5.0	2.9	3.1	1.5	1.9	1.9	2.0	2.0
Euro Area	1.6	-6.1	5.6	3.3	0.7	1.2	1.8	1.7	1.5	1.3

¹ CY – Calendar Year

United States	2.3	-2.8	5.9	2.1	2.1	1.5	1.8	2.1	2.1	2.1
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P- Projections; Source: IMF- World Economic Outlook Database (October 2023)

Advanced Economies Group

The major advanced economies registered GDP growth of 2.6% in CY22, down from 5.6% in CY21, which is further projected to decline to 1.5% in CY23. This forecast of low growth reflects increased central bank interest rates to fight inflation and the impact of the Russia-Ukraine war. About 90% of advanced economies are projected to witness decline GDP growth in CY23 compared to CY22. In addition, this is further expected to decline to 1.4% in CY24.

One of the major countries from this group is the **United States**. The United States registered GDP growth of 2.1% in CY22 compared to 5.9% in CY21. Whereas, growth for CY23 and CY24 is projected at 2.1% and 1.5%, respectively. Among advanced economies group, private consumption has been stronger in the United States than in the euro area. The business investments have also been robust in the second quarter, in addition, the general government fiscal stance of United States is expected to be expansionary in CY23. However, the unemployment rate is expected to rise coupled with declining wages and savings. With this, the GDP growth is expected to soften in near term.

Further, the **Euro Area** registered GDP growth of 3.3% in CY22 compared to 5.6% in CY21. For CY23 and CY24, the growth is projected at 0.7% and 1.2%, respectively. There is divergence in GDP growth across the euro area. Wherein, Germany is expected to witness slight contraction in growth due to weak interest rate sensitive sector and slow trading demand. On the other hand, the GDP growth for France has been revised upwards on account of growing industrial production and external demand.

Emerging Market and Developing Economies Group

For the emerging market and developing economies group, GDP growth stood at 4.1% in CY22, compared to 6.9% in CY21. This growth is further projected at 4.0% in CY23 and CY24. About 90% of the emerging economies are projected to make positive growth. While the remaining economies, including the low-income countries, are expected to progress slower.

Further, in **China**, growth is expected to pick up to 5.0% with the full reopening in CY23 and subsequently moderate in CY24 to 4.2%. The property market crisis and lower investment are key factors leading to this moderation. Whereas, **India** is projected to remain strong at 6.3% for both CY23 and CY24 backed by resilient domestic demands despite external headwinds.

The **Indonesian** economy is expected to register growth of 5% both in CY23 and CY24 with a strong recovery in domestic demands, a healthy export performance, policy measures, and normalization in commodity prices. In CY22, **Saudi Arabia** was the fastest-growing economy in this peer set with 8.7% growth. The growth is accredited to robust oil production, non-oil private investments encompassing wholesale and retail trade, construction and transport, and surging private consumption. Saudi Arabia is expected to grow at 0.8% and 4.0% in CY23 and CY24, respectively. On the other hand, **Brazil** is expected to project growth of 3.1% in CY23 driven by buoyant agriculture and resilient services in the first half of CY23.

Despite the turmoil in the last 2-3 years, India bears good tidings to become a USD 5 trillion economy by CY27. According to the IMF dataset on Gross Domestic Product (GDP) at current prices, the nominal GDP has been estimated to be at USD 3.4 trillion for CY22 and is projected to reach USD 5.2 trillion by CY27. India's expected GDP growth rate for coming years is almost double compared to the world economy.

Besides, India stands out as the fastest-growing economy among the major economies. The country is expected to grow at more than 6% in the period of CY24-CY28, outshining China's growth rate. By CY27,

the Indian economy is estimated to emerge as the third-largest economy globally, hopping over Japan and Germany. Currently, it is the third-largest economy globally in terms of Purchasing Power Parity (PPP) with a ~7% share in the global economy, with China [~18%] on the top followed by the United States [~15%]. Purchasing Power Parity is an economic performance indicator denoting the relative price of an average basket of goods and services that a household needs for livelihood in each country.

Despite Covid-19's impact, high inflationary environment and interest rates globally, and the geopolitical tensions in Europe, India has been a major contributor to world economic growth. India is increasingly becoming an open economy as well through growing foreign trade. Despite the global inflation and uncertainties, Indian economy continues to show resilience. This resilience is mainly supported stable financial sector backed by well-capitalized banks and export of services in trade balance. With this, the growth of Indian economy is expected to fare better than other economies majorly on account of strong investment activity bolstered by the government's capex push and buoyant private consumption, particularly among higher income earners.

1.2 Indian Economy Outlook

1.2.1 GDP growth and Outlook

Resilience to External Shocks remains Critical for Near-Term Outlook

India's real GDP grew by 9.1% in FY22 and stood at ~Rs. 149 trillion despite the pandemic and geopolitical Russia-Ukraine spillovers. In Q1FY23, India recorded 13.1% y-o-y growth in real GDP, largely attributed to improved performance by the agriculture and services sectors. Following this double-digit growth, Q2FY23 witnessed 6.2% y-o-y growth, while Q3FY23 registered 4.5% y-o-y growth. The slowdown during Q2FY23 and Q3FY23 compared to Q1FY23 can be attributed to the normalization of the base and a contraction in the manufacturing sector's output.

Subsequently, Q4FY23 registered broad-based improvement across sectors compared to Q3FY23 with a growth of 6.1% y-o-y. The investments, as announced in the Union Budget 2022-23 on boosting public infrastructure through enhanced capital expenditure, have augmented growth and encouraged private investment through large multiplier effects in FY23. Supported by fixed investment and higher net exports, real GDP for full-year FY23 was valued at Rs. ~160. trillion registering an increase of 7.2% y-o-y.

Furthermore, in Q1FY24, the economic growth accelerated to 7.8%. The manufacturing sector maintained an encouraging pace of growth, given the favorable demand conditions and lower input prices. The growth was supplemented by a supportive base alongside robust services and construction activities. This momentum was maintained in the Q2FY24 with GDP growth at 7.6%, mainly supported by acceleration in investments. However, private consumption growth was muted due to weak rural demand and some moderation in urban demand amid elevated inflationary pressures in Q2FY24. On the supply side, a significant improvement in manufacturing and construction activities supported growth. Overall, the economy expanded by 7.7% in H1FY24 compared to 5.3% in H2FY23. As per recent Ministry of Statistics and Programme Implementation (MoSPI)'s advanced estimate release, the real GDP growth for FY24 is pegged at 7.3% and will attain a level of ~ Rs. 171.79 trillion.

GDP Growth Outlook

- Driven by resilience in urban demand and the front loading of the government's capital expenditure, the H1FY24 witnessed a strong growth. While festive cheer will support urban demand in Q3, the outlook for rural demand revival remains clouded amid monsoon deficiency and likely hit to the agricultural production.
- The recent announcements of various relief measures such as LPG price reduction and extension of Pradhan Mantri Garib Kalyan Anna Yojna (PMGKAY) are expected to provide some cushion and so far, investment demand has remained robust. However, there could be some moderation in H2FY24 as both the government and private sector may restrain their capital spending ahead of the general elections. Despite some expected moderation in the H2FY24, India's overall GDP growth for FY24 is expected to remain on a firm footing. In terms of fiscal deficit for the year, the Finance Ministry has estimated it to be at 5.1% of GDP.
- Strong credit growth, resilient financial markets, and the government's continual push for capital spending and infrastructure are likely to create a compatible environment for investments. In the Interim Budget 2024-25, significant emphasis is placed on infrastructure development with an increased capital expenditure outlay of Rs. 11,11,111 crores, amounting to 3.4% of the GDP.
- External demand is likely to remain subdued with a slowdown in global activities, thereby indicating adverse implications for exports. Additionally, heightened inflationary pressures and resultant policy tightening may pose a risk to the growth potential.

Prior to the Interim Budget, in December 2023, the RBI in its bi-monthly monetary policy meeting estimated a real GDP growth of 7% y-o-y for FY24 comparatively lower from MoSPI's estimate.

Table 2: RBI's GDP Growth Outlook (Y-o-Y %)

FY24P (complete year)	Q3FY24P	Q4FY24P	Q1FY25P	Q2FY25P	Q3FY25P
7.0%	6.5%	6.0%	6.7%	6.5%	6.4%

Source: Reserve Bank of India

1.2.2 Gross Value Added (GVA)

Gross Value Added (GVA) is the measure of the value of goods and services produced in an economy. GVA gives a picture of the supply side whereas GDP represents consumption.

Industry and Services sector leading the recovery charge

- The gap between GDP and GVA growth turned positive in FY22 (after a gap of two years) due to robust tax collections. Of the three major sector heads, the service sector has been the fastest-growing sector in the last 5 years.
- The **agriculture sector** was holding growth momentum till FY18. In FY19, the acreage for the rabi crop was marginally lower than the previous year which affected the agricultural performance. Whereas FY20 witnessed growth on account of improved production. During the pandemic-impacted period of FY21, the agriculture sector was largely insulated as timely and proactive exemptions from COVID-induced lockdowns to the sector

facilitated uninterrupted harvesting of rabi crops and sowing of kharif crops. However, supply chain disruptions impacted the flow of agricultural goods leading to high food inflation and adverse initial impact on some major agricultural exports. However, performance remained steady in FY22.

In FY23, the agriculture sector performed well despite weather-related disruptions, such as uneven monsoon and unseasonal rainfall, impacting yields of some major crops and clocked a growth of 4% y-o-y, garnering Rs. 22.3 trillion.

In Q1FY24, this sector expanded at a slower pace of 3.5% y-o-y growth compared to y-o-y growth a quarter ago. This further stumbled to 1.2% in Q2FY24. Overall, H1FY24 registered a 2.4% growth with weakest monsoon experience caused by El Nino conditions.

In the Interim Budget 2024-25, the government plans to boost private and public investment in post-harvest activities and expand the application of Nano-DAP across agro-climatic zones. Strategies for self-reliance in oilseeds and dairy development are to be formulated, alongside ramping up the Pradhan Mantri Matsya Sampada Yojana and establishing Integrated Aquaparks. Allocation for PM-Formalisation of Micro Food Processing Enterprises scheme has increased from Rs. 639 in FY24 to Rs. 880 crores in FY25.

Going forward, rising bank credit to the sector and increased exports will be the drivers for the agriculture sector. However, a deficient rainfall may have impact on the reservoir level, weighing on prospects of Kharif sowing. Considering these factors, the agriculture sector is estimated to attain Rs. 22.7 trillion and mark 1.8% y-o-y growth for complete FY24.

- The **industrial sector** witnessed a CAGR of 4.7% for the period FY16 to FY19. From March 2020 onwards, the nationwide lockdown due to the pandemic significantly impacted industrial activities. In FY20 and FY21, this sector felt turbulence due to the pandemic and recorded a decline of 1.4% and 0.9%, respectively, on a y-o-y basis. With the opening up of the economy and resumption of industrial activities, it registered 11.6% y-o-y growth in FY22, albeit on a lower base.

The industrial output in FY23 grew by 4.4% with estimated value Rs. 45.2 trillion owing to a rebound in manufacturing activities and healthy growth in the construction sector.

The industrial sector grew by 5.5% in Q1FY24, while Q2FY24 growth was up by 13.2% owing to positive business optimism and strong growth in new orders supported manufacturing output. The industrial growth was mainly supported by sustained momentum in the manufacturing and construction sectors. Within manufacturing, industries such as pharma, motor vehicles, metals, petroleum and pharma witnessed higher production growth during the quarter. The construction sector (13% growth in Q2FY24) benefited from poor rainfall during August and September and higher implementation of infrastructure projects. This was reflected in robust cement and steel production and power demand in Q2FY24. Overall, H1FY24 picked up by 9.3% with manufacturing and construction activities witnessing significant acceleration.

India's industrial sector is experiencing strong growth, driven by significant expansion in manufacturing, mining, and construction. This growth is supported by positive business sentiment, declining commodity prices, beneficial government policies like production-linked incentive schemes, and efforts to boost infrastructure development. These factors collectively contribute to the sustained buoyancy in industrial growth due to which the industrial growth is estimated at 7.9% on y-o-y basis registering the value of Rs. 48.9 trillion in FY24.

- The **Services sector** recorded a CAGR of 7.1% for the period FY16 to FY20, which was led by trade, hotels, transport, communication, and services related to broadcasting, finance, real estate, and professional services. This sector was the hardest hit by the pandemic and registered an 8.2% y-o-y decline in FY21. The easing of restrictions aided a fast rebound in this sector, with 8.8% y-o-y growth witnessed in FY22.

Overall, in FY23, benefitting from the pent-up demand, the service sector was valued at Rs. 20.6 trillion and registered growth of 9.5% y-o-y.

In Q1FY24, the services sector growth jumped to 10.3%. Within services, there was a broad-based improvement in growth across different sub-sectors. However, the sharpest jump was seen in financial, real estate, and professional services. Trade, hotels, and transport sub-sectors expanded at a healthy pace gaining from strength in discretionary demand. The service sector growth in Q2FY24 moderated to 5.8% partly due to the normalization of base effect and some possible dilution in discretionary demand. Considering these factors, service sector marked 8% growth in H1FY24.

With this performance, steady growth in various service sector indicators like air passenger traffic, port cargo traffic, GST collections, and retail credit are expected to support the services sector. With this, the growth of service sector is estimated at Rs. 86.2 trillion registering 7.7% growth in FY24 overall.

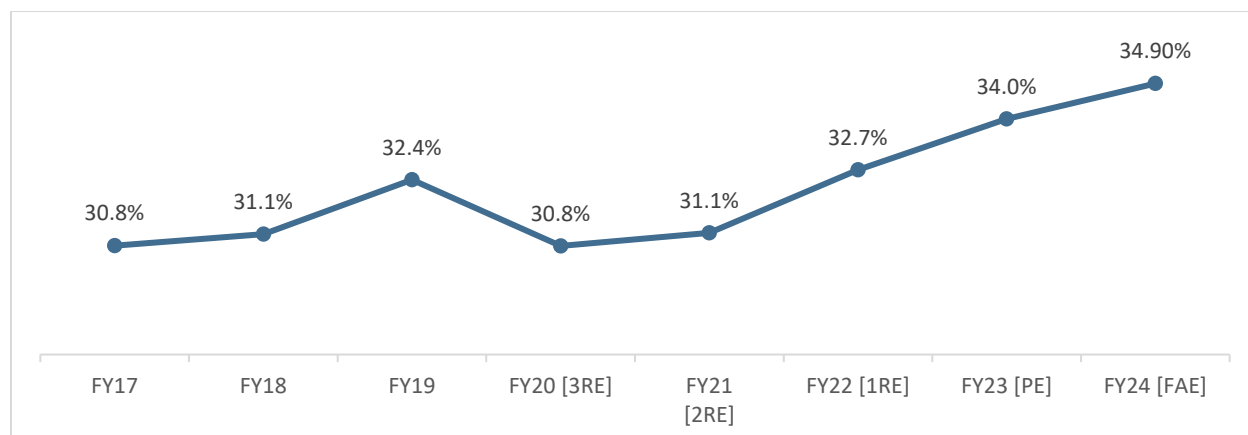
Table 3 : Sectoral Growth (Y-o-Y % Growth) - at Constant Prices

At constant Prices	FY19	FY20	FY21	FY22 (FRE)	FY23 (PE)	FY24 (FAE)
Agriculture, Forestry & Fishing	2.1	6.2	4.1	3.5	4.0	1.8
Industry	5.3	-1.4	-0.9	11.6	4.4	7.9
Mining & Quarrying	-0.9	-3.0	-8.6	7.1	4.6	8.1
Manufacturing	5.4	-3.0	2.9	11.1	1.3	6.5
Electricity, Gas, Water Supply & Other Utility Services	7.9	2.3	-4.3	9.9	9.0	8.3
Construction	6.5	1.6	-5.7	14.8	10.0	10.7
Services	7.2	6.4	-8.2	8.8	9.5	7.7
Trade, Hotels, Transport, Communication & Broadcasting	7.2	6.0	-19.7	13.8	14.0	6.3
Financial, Real Estate & Professional Services	7.0	6.8	2.1	4.7	7.2	8.9
Public Administration, Defence and Other Services	7.5	6.6	-7.6	9.7	7.2	7.7
GVA at Basic Price	5.8	3.9	-4.2	8.8	7.0	6.9

Source: MOSPI

1.2.3 Investment Trend in infrastructure:

Gross Fixed Capital Formation (GFCF), which is a measure of the net increase in physical assets, witnessed an improvement in FY22. As a proportion of GDP, it is estimated to be at 32.7%, which is the second-highest level in 7 years (since FY15). In FY23, the ratio of investment (GFCF) to GDP climbed up to its highest in the last decade at 34%. Continuing in its growth trend, this ratio is expected to reach 34.9% in FY24.

Chart 2: Gross Fixed Capital Formation (GFCF) as % of GDP (At constant prices):


PE: Provisional Estimates, RE: Revised Estimate, AE: Advanced Estimate; Source: MOSPI

Overall, support of public investment in infrastructure is likely to gain traction due to initiatives such as of Atmanirbhar Bharat, Make in India, Production-linked Incentive (PLI) scheme announced across various sectors etc.

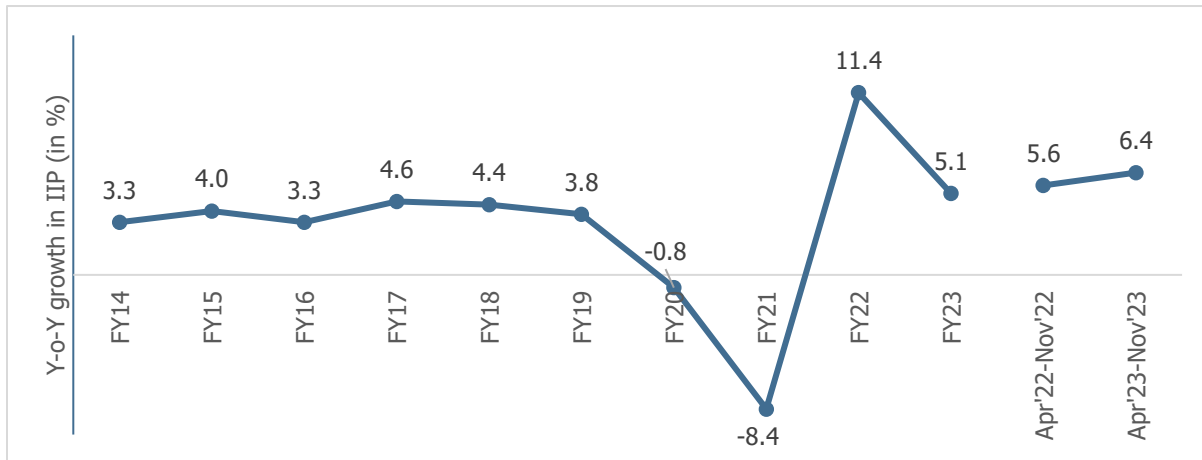
1.2.4 Industrial Growth

Improved Core and Capital Goods Sectors helped IIP Growth Momentum

The Index of Industrial Production (IIP) is an index to track manufacturing activity in an economy. On a cumulative basis, IIP grew by 11.4% y-o-y in FY22 post declining by 0.8% y-o-y and 8.4% y-o-y, respectively, in FY20 and FY21. This high growth was mainly backed by a low base of FY21. FY22 IIP was higher by 2.0% when compared with the pre-pandemic level of FY20, indicating that while economic recovery was underway, it was still at very nascent stages.

During FY23, the industrial output recorded a growth of 5.1% y-o-y supported by a favorable base and a rebound in economic activities. The period April 2023 – November 2023, industrial output grew by 6.4% compared to the 5.6% growth in the corresponding period last year. For the month of November 2023, the IIP growth slowed down to 2.4% compared to the last year primarily on account of a normalization of base.

So far in the current fiscal, while the infrastructure-related sectors have been doing well, slowing global growth and downside risks to rural demand have posed a challenge for industrial activity. Though the continued moderation in inflationary pressure offers some comfort, pain points in the form of elevated prices of select food items continue to persist.

Chart 3: Y-o-Y growth in IIP (in %)

Source: MOSPI

1.2.5 Consumer Price Index

India's consumer price index (CPI), which tracks retail price inflation, stood at an average of 5.5% in FY22 which was within RBI's targeted tolerance band of 6%. However, consumer inflation started to upswing from October 2021 onwards and reached a tolerance level of 6% in January 2022. Following this, CPI reached 6.9% in March 2022.

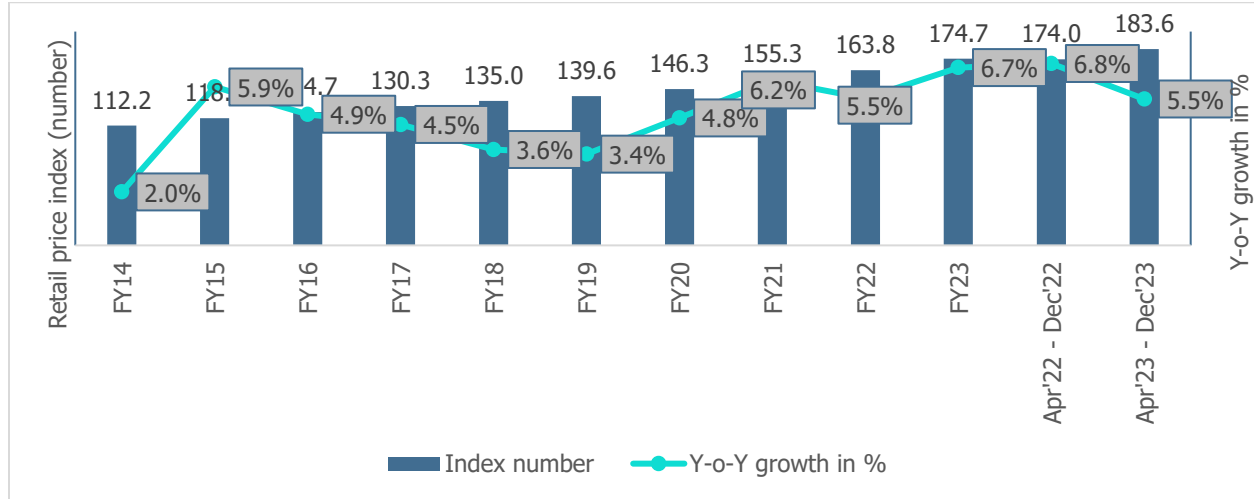
CPI remained elevated at an average of 6.7% in FY23, above the RBI's tolerance level. However, there was some respite toward the end of the fiscal wherein the retail inflation stood at 5.7% in March 2023, tracing back to the RBI's tolerance band. Apart from a favorable base effect, the relief in retail inflation came from a moderation in food inflation.

In the current fiscal FY24, the CPI moderated for two consecutive months to 4.7% in April 2023 and 4.3% in May 2023. This trend snapped in June 2023 with CPI rising to 4.9%. In July 2023, the CPI had reached the RBI's target range for the first time since February 2023 at 7.4% largely due to increased food inflation. This marked the highest reading observed since the peak in April 2022 at 7.8%. The notable surge in vegetable prices and elevated inflation in other food categories such as cereals, pulses, spices, and milk have driven this increase. Further, the contribution of food and beverage to the overall inflation had risen significantly to 65%, surpassing their weight in the CPI basket. In August 2023, the food inflation witnessed some moderation owing to government's active intervention. This was further moderated for second consecutive month in September 2023 to 5%, led by a sharp correction in vegetables prices and lower LPG prices. Helped by deflation in the fuel and light category, the retail inflation in October 2023 softened at 4.9%. This trend reversed in November 2023 due to spike in certain vegetable prices as well as sticky inflation in non-perishable food items such as cereals, pulses and spices and the CPI rose to 5.6%. In the month of December 2023, elevated food prices and an unfavourable base drove headline inflation to a four-month peak of 5.7%.

While the consistent decrease in core inflation due to falling commodity prices and diminishing demand-side pressures is encouraging, the ongoing high food inflation, potentially exacerbated by a projected

drop in Kharif production and uncertainties around Rabi sowing, remains worrisome. Despite these concerns, the favourable base effect throughout Q4FY24 and the expected easing of food price pressures with the arrival of fresh crops from January to March could help mitigate inflation risks.

Chart 4: Retail Price Inflation in terms of index numbers and Y-o-Y Growth in % (Base: 2011-12 = 100)

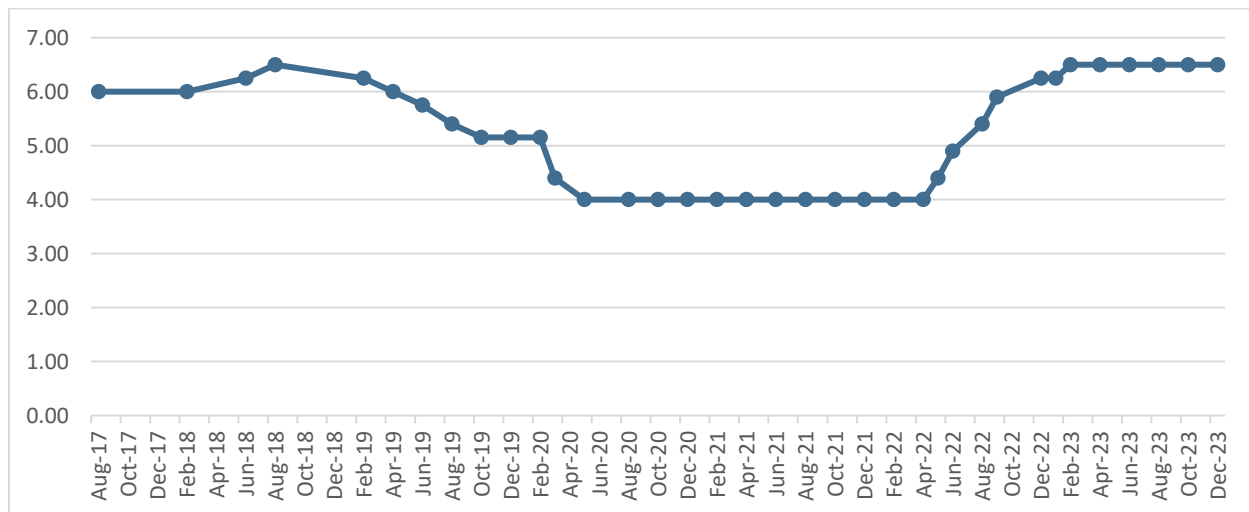


Source: MOSPI

The CPI is primarily factored in by RBI while preparing their bi-monthly monetary policy. At the bi-monthly meeting held in December 2023, RBI projected inflation at 5.4% for FY24 with inflation during Q3FY24 at 5.6%, Q4FY24 at 5.2% Q1FY25 at 5.2% , Q2FY24 at 6.5% and Q3FY24 at 6.4%.

The RBI has increased the repo rates with the rise in inflation in the past year from 4% in April 2022 to 6.5% in January 2023. Considering the current inflation situation, RBI has kept the repo rate unchanged at 6.5% in the last five meetings of the Monetary Policy Committee.

Chart 5: RBI historical Repo Rate



Source: RBI

In a meeting held in December 2023, RBI also maintained the liquidity adjustment facility (LAF) corridor by adjusting the standing deposit facility (SDF) rate of 6.25% as the floor and the marginal standing facility (MSF) at the upper end of the band at 6.75%.

Further, the central bank continued to remain focused on the withdrawal of its accommodative stance. With domestic economic activities gaining traction, RBI has shifted gears to prioritize controlling inflation. While RBI has paused on the policy rate front, it has also strongly reiterated its commitment to bringing down inflation close to its medium-term target of 4%. Given the uncertain global environment and lingering risks to inflation, the Central Bank has kept the window open for further monetary policy tightening in the future, if required.

1.2.5 Key Demographic drivers for Economic Growth

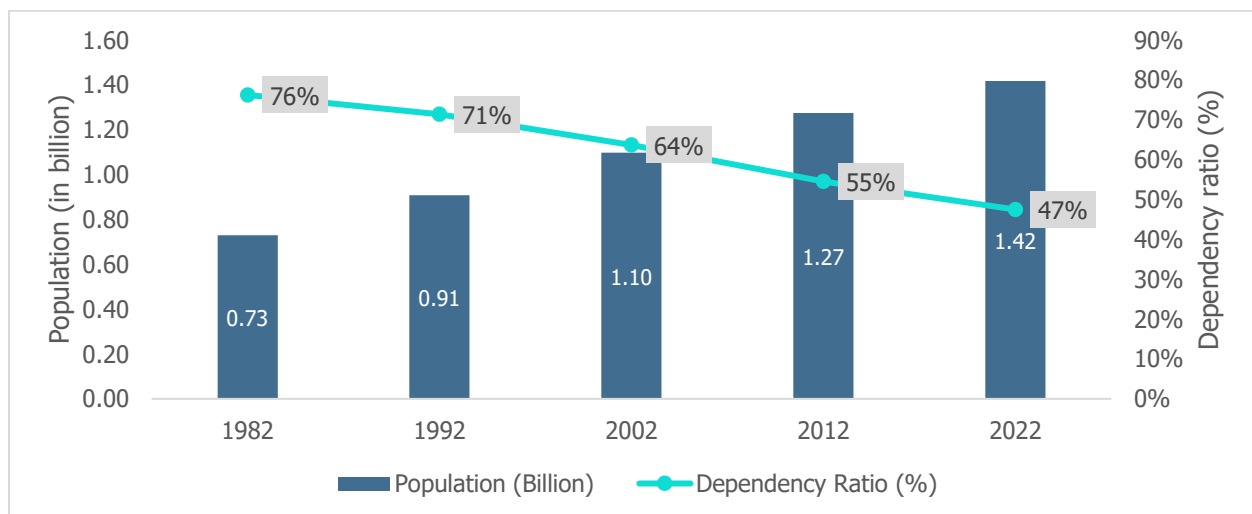
The trajectory of economic growth of India is also driven by socio-economic factors such as demographics and urbanization. Some of the key demographic drivers are:

- **Population growth and Urbanization**

The trajectory of economic growth of India and private consumption is driven by socio-economic factors such as demographics and urbanization. According to the world bank, India’s population in 2022 surpassed 1.42 billion slightly higher than China’s population 1.41 billion and became the most populous country in the world.

Age Dependency Ratio is the ratio of dependents to the working age population, i.e., 15 to 64 years, wherein dependents are population younger than 15 and older than 64. This ratio has been on a declining trend. It was as high as 76% in 1982, which has reduced to 47% in 2022. Declining dependency means the country has an improving share of working-age population generating income, which is a good sign for the economy.

Chart 6: Trend of Population vis-à-vis dependency ratio

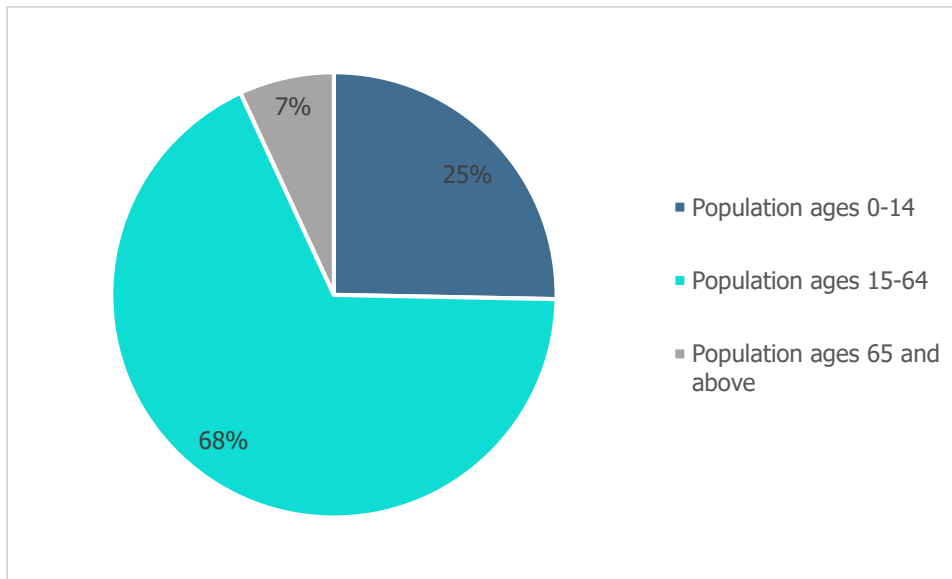


Source: World Bank Database

With an average age of 29, India has one of the youngest populations globally. With vast resources of young citizens entering the workforce every year, it is expected to create a 'demographic dividend'. India

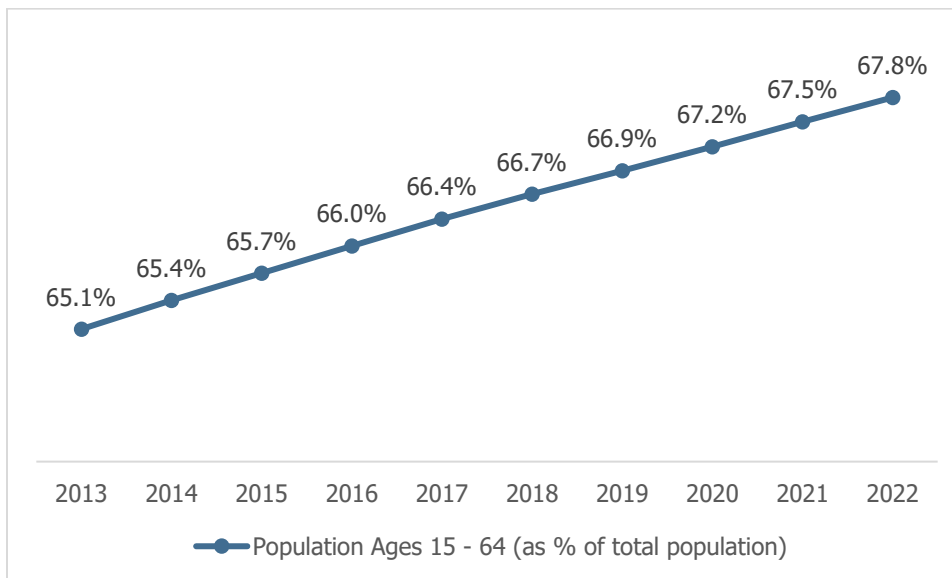
is home to a fifth of the world’s youth demographic and this population advantage will play a critical role in economic growth.

Chart 7: Age-wise break up of population



Source: World Bank Database

Chart 8: Yearly Trend - Young Population as % of Total Population

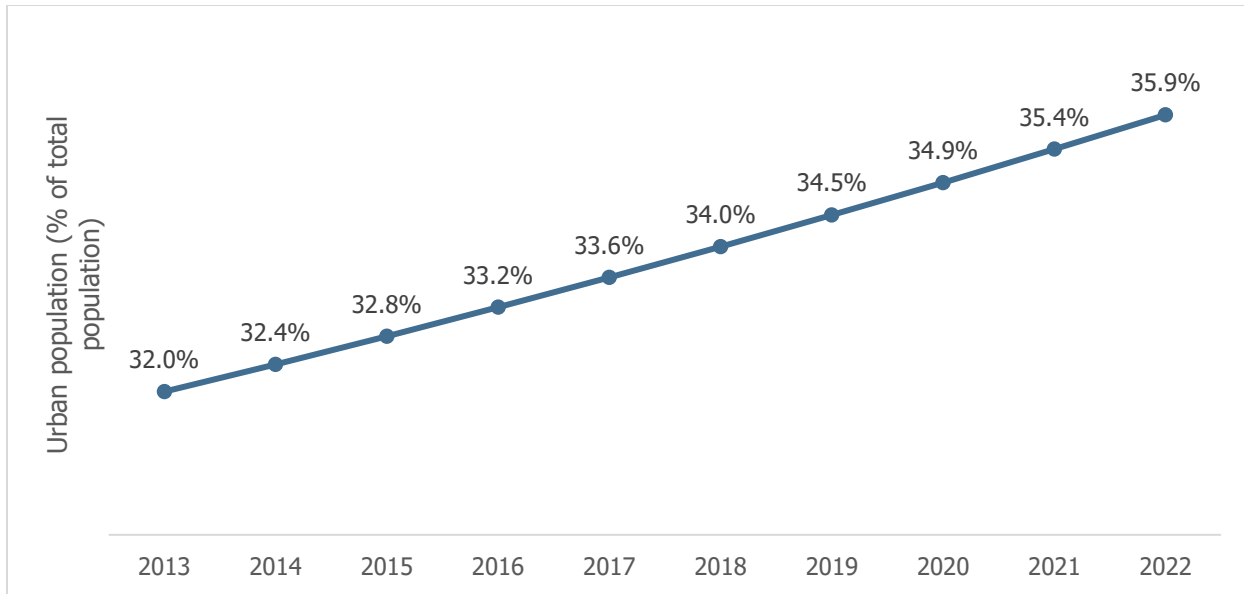


Source: World Bank Database

- Urbanization**

The urban population is significantly growing in India. The urban population in India is estimated to have increased from 403 million (31.6% of total population) in 2012 to 508 million (35.9% of total population) in the year 2022. People living in Tier-2 and Tier-3 cities have greater purchasing power.

Chart 9: Urbanization Trend in India



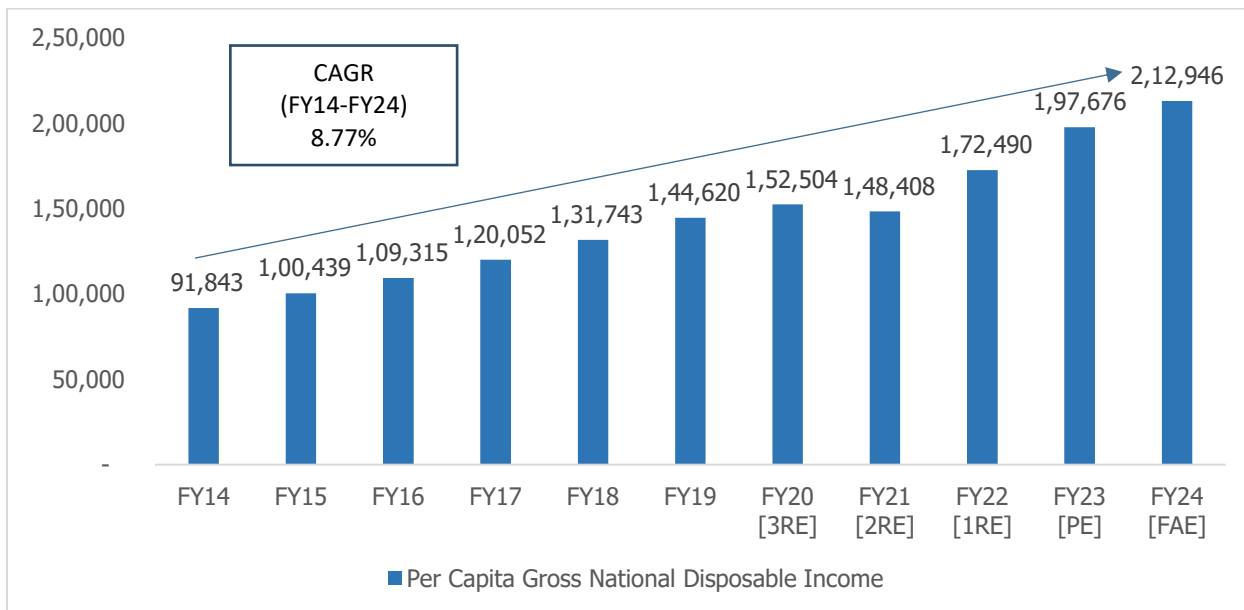
Source: World Bank database

- Increasing Per Capita Disposable Income**

Gross National Disposable Income (GNDI) is a measure of the income available to the nation for final consumption and gross savings. Between the period FY14 to FY24, per capita GNDI at current prices registered a CAGR of 8.77%. More disposable income drives more consumption, thereby driving economic growth.

The chart below depicts the trend of per capita GNDI in the past decade:

Chart 10: Trend of Per Capita Gross National Disposable Income (Current Price)

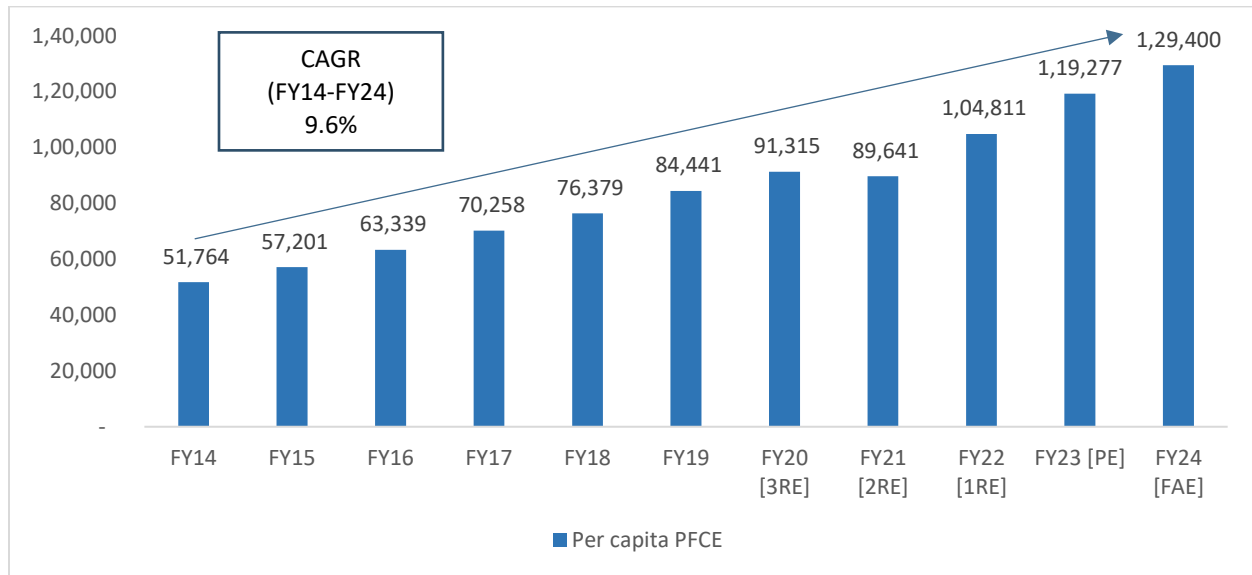


Note: 3RE – Third Revised Estimate, 2RE – Second Revised Estimates, 1RE – First Revised Estimates, PE – Provisional Estimate; Source: MOSPI

- Increase in Consumer Spending**

With increase in disposable income, there has been a gradual change in consumer spending behaviour as well. Private Final Consumption Expenditure (PFCE) which is measure of consumer spending has also showcased significant growth in the past decade at a CAGR of 9.6%. Following chart depicts the trend of per capita PFCE at current prices:

Chart 11: Trend of Per Capita Private Final Consumption Expenditure (Current Price)



Source: MOSPI

1.2.6 Concluding Remarks

The major headwinds to global economic growth are escalating geopolitical tensions, volatile global commodity prices, and a shortage of key inputs. Despite the global economic growth uncertainties, the Indian economy is relatively better placed in terms of GDP growth compared to other emerging economies. According to IMF’s forecast, it is expected to 6.3% in CY24 compared to the world GDP growth projection of 3%. The bright spots for the economy are continued healthy domestic demand, support from the government towards capital expenditure, moderating inflation, and improving business confidence.

Likewise, several high-frequency growth indicators including the purchasing managers index, auto sales, bank credit, and GST collections have shown improvement in FY23. Moreover, normalizing the employment situation after the opening up of the economy is expected to improve and provide support to consumption expenditure.

Further, as per the Indian Meteorological Department (IMD), the rainfall witnessed a deficit until September 2023. A drop-in yield due to irregular monsoons and a lower acreage can lead to a demand-supply mismatch, further increasing the inflationary pressures on the food basket. Moreover, the consumption demand is expected to pick up in Q3FY24 due to the festive season. Going forward, the rising domestic demand will be driven by the rural economy’s performance and continual growth in urban consumption. However, high domestic inflation and global headwinds pose a downside risk to domestic demand.

At the same time, public investment is expected to exhibit healthy growth as the government has allocated a strong capital expenditure of about Rs. 10 lakh crores for FY24. The private sector's intent to invest is also showing improvement as per the data announced on new project investments. However, volatile commodity prices and economic uncertainties emanating from global turbulence may slow down the improvement in private CapEx and investment cycle.

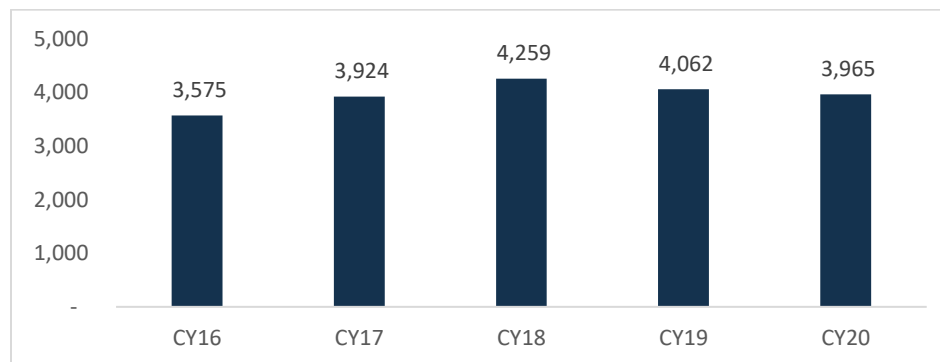
2. Chemicals and Specialty Chemicals Industry

2.1 Global overview

The importance of chemical industry has resulted in proliferation of chemicals across the globe with the industry sales growing at a Compounded Annual Growth Rate (CAGR) of 4.3% from USD 3,575 billion in (Calendar Year) CY16 to USD 4,062 billion in CY19 ²and is estimated to grow at a CAGR of 5% to 6% through CY27. This growth will largely be driven by developing markets like Asia Pacific (APAC) which are likely to grow at a higher CAGR of around 7%-8% compared to the growth in more matured markets like US and Europe which will be lower at around 2%-4%.

The industry sales are led by a handful of countries. Of USD 3,965 billion sales reported by the global chemicals industry during CY20, sales from 10 countries accounted for a significant share of 86.6% representing USD 3,434 billion of sales during the year. Sales from rest of the world contributed to 13.4% of the total sales in CY20. For CY21, the industry sales is estimated to have crossed around USD 4,100 billion and is yet to breach its CY18 high of USD 4,259 billion.

Chart 12: Trend in global chemical sales (USD billion)

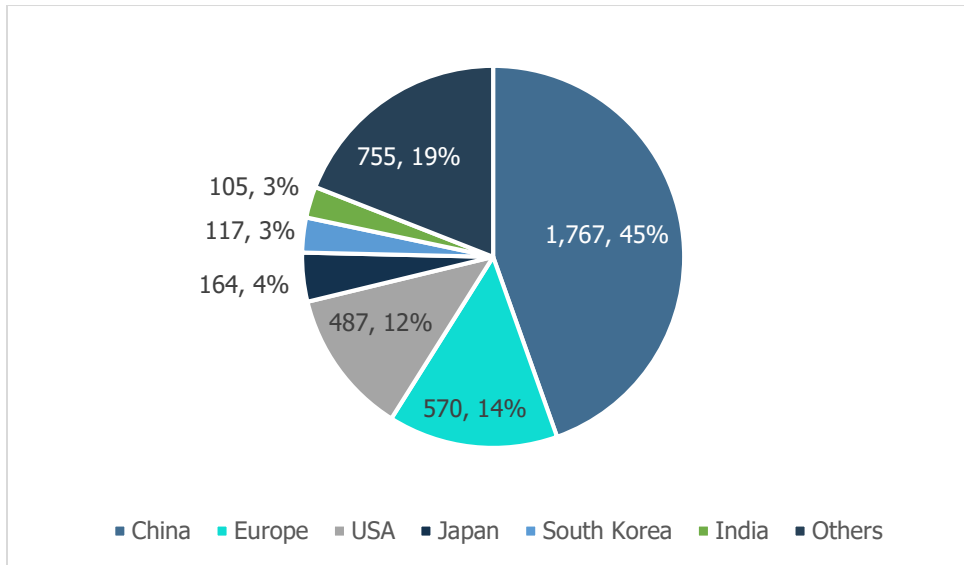


Source: CEFIC, CareEdge Research

Among the top 10 countries by chemical sales, China dominates the world chemical sales (USD 1,767 billion) with a lion's share of 44.6%. This is followed by Europe (27 nations), USA, Japan and South Korea with a share of 14.4% (USD 570 billion), 12.3% (USD 487 billion), 4.1% (USD 164 billion) and 2.9% (USD 117 billion), respectively, in 2020 sales.

India ranked sixth in terms of global chemical sales with a contribution of USD 105 billion and accounted for a share of 2.7% during the year. The other nations that formed part of the top 10 countries in global chemical sales were Taiwan, Brazil, Russia and UK with a share of 1.9%, 1.6%, 1.2% and 1.0%, respectively.

² CY20 is not considered for CAGR calculation as the year saw an impact of exceptional scenario of Covid-19 pandemic

Chart 13: Country-wise international chemical sales (USD billion)


Source: CEFIC, CareEdge Research

Segment-wise sales

The global chemical industry is primarily divided into two broad segments:

- Commodity chemicals
- Specialty chemicals

Commodity chemicals: This segment accounts for the largest share in global chemical sales and contributed around 75%-80% of the total sales.

Commodity chemicals are common chemicals that can be produced in bulk quantities by a large number of chemical manufacturers. Commodity chemicals include plastics, synthetic fibers, films, certain paints and pigments, explosives, and petrochemicals. There is limited product differentiation within the sector; products are sold for their composition. The commodities market is highly fragmented.

The end user markets include other basic chemicals, specialties, and other chemical products; manufactured goods such as textiles, automobiles, appliances, and furniture; and pulp and paper processing, oil refining, aluminum processing, and other manufacturing processes. Markets also include some non-manufacturing industries.

Specialty chemicals: This segment contributes about 20%-25% of the aggregate global chemical sales. These chemicals are low-volume but high-value compounds and are used for specific purposes rather than general applications. Some of the specialty chemicals involve agrochemicals and fertilizers, paints and coatings, dyes and pigments etc.

The specialty chemicals market is characterized by high value-added, low volume chemical production. These chemicals are used in a wide variety of products, including fine chemicals, additives, advanced polymers, adhesives, sealants and specialty paints, pigments, and coatings. The specialty market is extremely fragmented.

Similar to the commodity sector, the specialty sector is affected by high costs of energy and feedstock. Intangible value issues include heightened emphasis on research, customer migration to alternative products, and the impact of regulations on products.

Production of specialty chemicals involves the usage of zinc oxide and thus growth in demand for specialty chemicals will augur well for the zinc oxide industry.

Zinc oxide is an inorganic compound, white in colour and insoluble in water and finds its applications in various end user industries like rubber, rubber made products (like tyre, footwear, gloves, eraser etc.), ceramics, paints, fertilizers, pharma, personal care, cosmetics, agrochemicals, nutraceuticals, batteries, additives, feed, specialty chemicals among others.

Key user industries of chemicals

- **Agriculture**

Fertilizers, pesticides, fungicides and herbicides used for protection of plants and crops are products made from chemicals. Other chemical based products like Polyvinyl Chloride (PVC) and High Density Polyethylene (HDPE) are used to make irrigation pipes, rigid sheets. Also, Low Density Polyethylene (LDPE) film/sheet linings are used in lining of various sizes of ponds for water conservation. Even packaging of agricultural products is difficult without the usage of plastics. Thus, chemical based products are almost used at all stages in agriculture.

- **Apparels**

Apparels are made of natural, man-made and blended fibres. While natural fibre does not involve chemicals, blended and man-made fibres involve the usage of chemicals. The common man-made fibres that are based out of chemicals include polyester, nylon, rayon and spandex. Polyester for example is made of key raw materials, Purified Terephthalic Acid (PTA) and Mono Ethylene Glycol (MEG). Blended yarn involves integrating fibres of various lengths, origins, thickness or colour to prepare yarn. It also helps in reducing the cost by integrating expensive fibres with the not so expensive ones. Also, synthetic dyes in various shades are produced using chemicals applied to apparels.

- **Automobile uses and transport**

The chemical products provide the benefit of being light weight, design-friendly, flexible and durable to automobile bodies and components. Various chemical products find application in transport and automobile uses. For example, synthetic rubber is usually used for aircraft and bicycle tyres and also automobile vehicles and motorcycles. Styrene Butadiene Rubber (SBR), a common synthetic rubber, is used for belts, tyres and hoses as it has great abrasion resistance and durability. High Density Polyethylene (HDPE) gasoline tanks in automobiles help in prevention of fires as its excellent shape resistance does not allow leak in case of a collision.

- **Computers and electronics**

Chemical based plastics have benefitted the computers and electronics industry as well. The LCD flat screens generally used in televisions and computer monitors involve application of liquid crystalline plastics that uses 65% less electricity compared to screens with cathode ray tubes. The new refrigerators are insulated with thermal efficient plastic foam with interiors created of durable, easy to clean plastics.

Polystyrene plastic is used in making of refrigerator trays and linings. Plastics are used in making of cable sheathing and small internal components that are not visible like micro-chips. Polyester plastic is used in switches and electrical insulation and also polyethylene plastic find its application in electrical insulation among others.

- **Construction**

Chemical based products have changed the construction industry as durability, flexibility, great strength to weight ratio, cost-effectiveness, rust resistance and low maintenance are the advantages associated with them. They are used in construction that involves seals, windows, doors, pipes, cables, floor coverings and insulation. PVC and polyethylene are normally used in making of large pipes for sewage, drainage and potable water and cabling.

Chemicals supports making of sealers for concrete. Sealers improve the water tightness of concrete making it easy to clean and also preventing the concrete from damaging which caused by toxic spills. For example, plasticisers, also known as water-reducing admixture products decrease the volume of water required in concrete mix. Paint used in construction consists of synthetic binders (involves resins like acrylics, vinyl-acrylics, polyesters, epoxy resins etc.) that enables it to stick to surfaces and impacts paint's strength, longevity, gloss and flexibility. Also, solvents adjust paint's viscosity and other chemical based additives modify surface tensions, improve flow and finished appearance among others.

Another product, asphalt which is a by-product of crude oil refining is used on roads, streets, footpaths, airport runways, playgrounds etc. Asphalt pavements are considered to be safe, smooth, cost-effective and durable.

- **Food**

Food additives derived from chemicals are primarily divided into food flavourings, food colourings and food preservatives. Food flavourings involve wide usage of chemical butyric acid which when converted into butyric esters develops aroma and taste in food and beverages. Glycerine a chemical based food additive has a double effect of food flavouring and preservative. Food dyes derived from petroleum are used to add colour to the food.

- **Healthcare and cosmetics**

Chemicals find their usage in healthcare products. Resins and plastics are used to make artificial limbs and joints. They are also used in medical facilities for storing blood and vaccines, disposable syringes and other one-time use medical equipment. Chemical based products also find application in cosmetics. Mineral waxes and synthetic waxes made from chemicals are used in creams to provide thickening and emulsifying properties and are also used in lipsticks and lip balms, baby products, make up, nail care, skincare, hair care, fragrance and sunscreen among others.

Key trends in global chemicals industry

- **Shift in preference from China to India**

China has been focusing on pollution control and has been encouraging stricter environment norms for some years now. This has resulted in temporary close down or shutdown of various plants across various industries including chemicals in China. Consequently, such regulations provided an opportunity to India as some global manufacturers that source chemicals from China may look for other sources to avoid any major disturbances in their supply chain and to set up their manufacturing facilities. In addition to this, trade conflicts like the US-China trade war which has affected global supply chains, has also provided a chance to other nations including India to take advantage of such affairs. Moreover, some countries are expected to reduce their dependence on China in the post-Covid era, which is also expected to enhance the opportunities for India's chemicals industry both in terms of sales and production facilities.

- **Growth in environment friendly chemicals**

Environmental concern has become a major challenge in this 21st century. Therefore, sustainable development and use of eco-friendly products has increased in the past few years across all major industries.

In the chemicals industries usage of green chemicals has increased manifold. Green chemicals are eco-friendly bio degradable products providing high performance. They are easy to manufacture, use and dispose. Manufacturing industries uses large amounts of harmful chemicals in their production process, thereby causing alarming effects on the environment. Therefore, number of steps have been taken to make manufacturing processing greener. These include use of green chemicals, greener fiber, greener dyes, greener solvents and elimination of hazardous chemicals.

2.2 India overview

The Indian chemicals industry is widely diversified to include more than 80,000 commercial products. This includes basic chemicals and its products, petrochemicals, fertilizers, paints, varnishes, gases, soaps, perfumes and toiletry and pharmaceuticals. Chemicals industry is significantly important for agricultural and industrial development of India. The industry serves as a building block for several downstream industries, such as textiles, papers, paints, varnishes, soaps, detergents, pharmaceuticals, etc.

According to the Government of India's Department of Chemicals and Petrochemicals, chemical and chemical products sector (industry division 20 of NIC 2008), accounted for 1.42% of the Gross Value Added (GVA) for all economic activity in 2020-21 at constant prices (at 2011-12 prices). The share of GVA in the manufacturing sector during 2020-21 is about 7.98%.

The size of the Indian chemical industry (industry division 20 of NIC 2008), in terms of value of output in the year 2020-21 was around Rs 9.87 lakh crore (about USD 132 billion). The size of chemical industry, including pharmaceuticals, in terms of value of output in the year 2020-21 was around Rs 14.3 lakh crore (about USD 193 billion). During last six years, i.e. within 2014-15 to 2019-20, real growth rate in output of chemical industry excluding pharmaceuticals industry was 8.1% which was 8.2% for chemical industry

including pharmaceutical industry. Growth in value of output for manufacturing sector during the same period was 6.3%.

In 2021, in terms of trade as per the Government of India's Department of Chemicals and Petrochemicals, India ranks 12th in the world exports of chemicals (excluding pharmaceutical products) and ranks 5th in the world imports of chemicals (excluding pharmaceutical products). India's exports of chemicals (excluding pharmaceutical products) was USD 36.6 billion in 2020. India's share in world exports of chemicals (excluding pharmaceutical products) was 2.4% in 2021. India's imports of chemicals (excluding pharmaceutical products) was USD 53.1 billion in 2020. India's share in world imports of chemicals (excluding pharmaceutical products) was 3.4% in 2020.

Chemical sector in India broadly includes major chemicals and petrochemicals. During 2021-22, major chemical production stood at 12.5 million tonnes and petrochemicals output was at 44.5 million tonnes, respectively, as per the Government of India's Department of Chemicals and Petrochemicals.

Of the total chemical market size in India, specialty chemicals account for about 20%-25% of the industry size. The specialty chemicals industry is expected to grow at a faster rate compared to that of overall chemical industry size in India. This will be on account of demand of specialty chemicals from segments like agrochemicals, food additives, construction chemicals, electronic chemicals, water chemicals, polymer additives, dyes and pigments, surfactants among others.

2.1.1 Indian Chemical Industry

Major chemicals in India are broadly divided into 5 segments as mentioned below:

- a. Alkali chemicals:** This segment comprises of 3 products that include soda ash, caustic soda and liquid chlorine.
- b. Inorganic chemicals:** Inorganic chemicals are mineral substances that do not have carbon in their structure.
- c. Organic chemicals:** This segment comprises of 20 products. Of these, majority of output comes from ethyl acetate, chloro methanes, formaldehyde among others.
- d. Pesticides and Insecticides:** This segment comprises of 43 products. Of these, mancozab, 2, 4-D, acephate, profenofos technical are major contributors towards the overall output of pesticides and insecticides.
- e. Dyes and Pigments:** This segment comprises of 15 products. Of these, reactive dyes, organic pigment and disperse dyes accounts for about 70% of the aggregate dyes and pigments segment output.

To give a broader picture of the major chemical production in India, share-wise details of each of the 5 segments in aggregate major chemicals production during the year 2021-22 is mentioned in the table below.

Table 4: Segment-wise production volume and percentage share of major chemicals during 2021-22

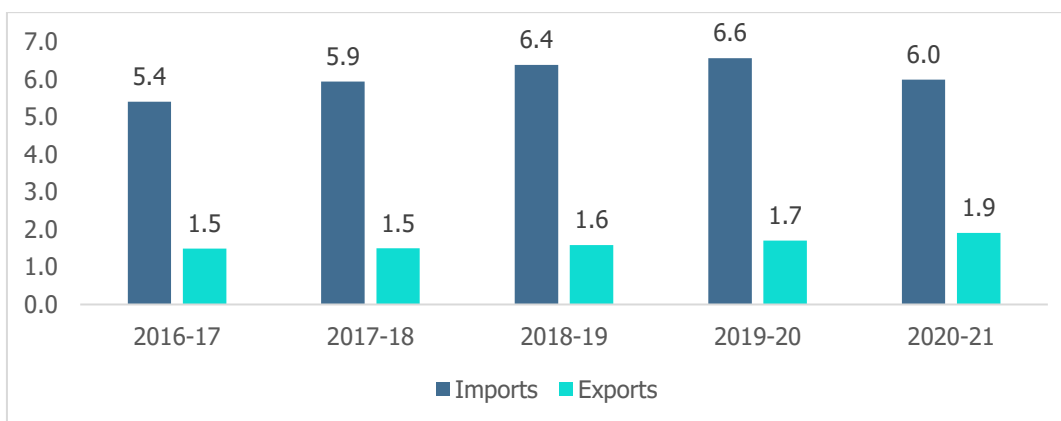
Segment	Production volume of each segment in total major chemicals production during 2021-22 (million tonnes)	% share of each segment in total major chemicals production during 2021-22
Alkali chemicals	9.00	71.54
Inorganic chemicals	1.00	7.95
Organic chemicals	1.95	15.50
Pesticides	0.29	2.31
Dyes & pigments	0.34	2.70
Aggregate	12.58	100

Source: Department of Chemicals and Petrochemicals, Government of India (GoI), CareEdge Research

The production of major chemicals in India on an aggregate basis grew at a CAGR of 3.4% from 11.0 million tonnes in 2017-18 to 12.58 million tonnes in 2021-22. The rise in output is mainly backed by 4.3% CAGR in production of alkali chemicals (the largest segment accounting for about 72% of the total major chemical output in 2021-22) as mentioned in above table.

2.3 Trend in trade of major chemicals in India

India continued to remain net importer of major chemicals as shown in the below chart.

Chart 14: Trend in trade of major chemicals in India (in million tonnes)


Source: Department of Chemicals and Petrochemicals, GoI, CareEdge Research

While the imports of major chemicals grew at a CAGR of 2.6%, exports of major chemicals increased by a faster 6.4%. The gap between India's major chemical exports and imports indicates the country's significant dependence on inbound shipments.

2.3.1 Segment-wise percentage share of major chemicals in India's trade

Imports: India relies heavily on import of organic chemicals as can be seen in the below chart as it accounted for a major share of 62% in overall major chemical imports during FY21. This was followed by 20% and 16% share of import of inorganic chemicals and alkali chemicals, respectively. Higher proportion of alkali chemicals in total production is believed to have resulted in lower share of alkali chemicals in total imports. Imports of pesticides and dyes & pigments each accounted for 1% of the overall major chemical imports during FY21.

Exports: Dyes & pigments and pesticides segments accounted for a significant share of 27% and 25%, respectively, in total exports of major chemicals during FY21. It is noteworthy to mention that the high share of these segments in overall exports is despite their small contribution in total major chemical production. The export share of alkali chemicals, inorganic chemicals and organic chemicals ranged between 10%-22% during FY21.

2.4 Segment-wise growth drivers

Chemicals form the foundation for manufacturing a wide range of products including textiles, paper, pharmaceutical products, plastics, synthetic rubber to agrochemicals. The specific factors driving growth of end-user sectors is set to drive and keep the demand up for the overall industry. Factors such as low per capita consumption including agrochemicals, likely growth in demand from paints, textiles and diversified manufacturing base would act as key drivers for the growth of the industry. The key end-user sectors driving growth include:

- a. Consumer Product Manufacturers:** Chemicals are used in the manufacture of a wide range of consumer products ranging from cosmetics, body care, hair care, and home care products. Expected growth in higher disposable income and change in lifestyle will support demand for these consumer products thus auguring well for the growth of chemicals industry. Increased awareness in personal detergents, higher disposable income, increase in consumption of consumer products and wider access to consumer products due to the growth in retail sector has resulted in higher consumption of soaps & detergents. Consequently, demand for soda ash from soap & detergent manufacturers have gone up.
- b. Agriculture applications:**
 - **Fertilizer Manufacturers:** Some inorganic chemicals like ammonia, sulphuric acid, and phosphorus are widely used in fertilizer manufacturing. Since the Green Revolution, fertilizer consumption has picked up due to a combination of socio-economic factors like higher subsidies by government, increased affordability of farmers and wider availability.
 - **Pesticide Manufacturers:** Increased awareness about advantages of using pesticides, growth in the number of farmers able to afford pesticides and growth in access has helped push demand for pesticides in the country. In addition, India has emerged as major manufacturing hub for pesticides due to its low-cost advantage, building up exports contribution as well.

c. Industrial applications

- **Glass Manufacturers:** Indian market for glass products has increased steadily on the back of higher demand for automobiles, commercial and residential space, as well as for rigid packaging products.
 - **Metal Manufacturers:** India is the second largest producer and one of the largest producers of aluminum in the world. The metal facilities involve usage of chemicals to form and fabricate them. Thus, growth in metals industry drives application of chemicals.
 - **Miscellaneous Industrial Applications:** Chemicals are also used in industrial applications such as food processing, bleaching agent in textiles, water treatment, rubber recycling, and synthesis of certain pharmaceutical compounds. An increase in these user industries drives the usage of chemicals.
- d. Auto industry:** The automobile industry involves application of chemicals in adhesives, paints, tyres, glass, plastics, metals etc. that are used in manufacturing of a vehicle. Thus, an uptick in India's automobile industry capex on account of an expected improvement in demand will push up the consumption of chemicals in India.

Apart from these specific sectors driving demand, certain macro socio-economic factors have been aiding the growth of chemicals industry which is summarized below:

- Per capita consumption of most of the chemicals is much lower than global average, thus, it is expected that the demand growth will be primarily driven by domestic consumption, backed by strong sentiments among key end-user industries as discussed above.
- Domestic demand is further strengthened by higher discretionary spending by the newly emerged affluent middle class. The increased focus on lifestyle, hygiene, asset creation, health infrastructure access etc. is likely to keep the demand up from the consumer end.
- Rising disposable income, median age of population, urbanisation and growing penetration and demand from rural markets.
- Shift in international markets towards Asia as the world's chemicals manufacturing hub.

2.5 Regulations governing the industry

In chemicals sector, 100% Foreign Direct Investment (FDI) in India is allowed under the automatic route (except in the case of certain hazardous chemicals). Manufacture of most chemical products, inter-alia, covering organic / inorganic, dyestuffs & pesticides is de-licensed. The entrepreneurs need to submit only Industries Entrepreneur Memorandum (IEM) with the Department of Industrial Policy & Promotion provided location of the project falls outside standard urban area limits of metropolitan cities and municipal cities. Only the following items are covered in the compulsory licensing list because of their hazardous nature as required by international conventions.

- Hydrocyanic acid & its derivatives
- Phosgene & its derivatives
- Isocyanates & di-isocyanates of hydrocarbons

2.5.1 Draft Chemicals (Management & Safety) Rules

In August 2020, India released the fifth draft of Chemicals (Management & Safety) Rules. The draft rules come up with a new Registration, Evaluation, Authorisation and Restriction of chemicals (REACH) model like that of EU-REACH, Korea-REACH among others. These rules shall come into force on the date of their publication in the Official Gazette.

These rules are covered under the following 6 chapters:

1. Definitions, objectives and scope
2. Committees and Chemical Regulatory Division
3. Notification, registration, and restrictions on use
4. Manufacture, storage and import
5. Labelling and packaging
6. Chemical accidents
7. Miscellaneous

The objectives and scope of the rules include:

- a. These rules provide for notification, registration and restrictions on use of substances, mixtures and intermediates placed in Indian territory.
- b. These rules also provide for procedures for the manufacture, storage, handling and import of priority substances and preparedness and management of chemical accidents related to priority substances, as identified under these rules.
- c. These rules also provide for the constitution of technical expert group to provide guidance on management of chemical accidents, specifically relating to chemical remediation, antidote identification etc, and to supplement the role of existing bodies and authorities responsible for managing chemical accidents.
- d. The objective of these rules is to ensure a high level of protection to human health and the environment.
- e. These rules apply to all substances, substances in mixtures and intermediates that are manufactured, imported, placed or intended to be placed in Indian territory.
- f. These rules do not apply to substances in articles except when-
 - i. the substance is present in the articles in quantities prescribed by the Division, where applicable, and
 - ii. the substance may be released from the articles under normal or reasonably foreseeable conditions of use.
- g. The following shall be exempt from the scope of these rules:
 - o Radioactive substances,
 - o Substances under customs supervision, not being placed in Indian territory,
 - o Substances stored in customs free zones with aim of re-exporting,
 - o wastes, having no commercial value,
 - o Substances used for the purposes of defence,
 - o Substances used as food or feeding stuff for human beings or animals, including human or animal nutrition,
 - o Substances set out in Schedule II, and
 - o Any other substance as the Division may notify from time to time.

Explanatory note: Where a substance used for a specific purpose is exempted under Rule 3(7), only such quantities of the substances as are being used for the said purpose, are exempted from the application of these rules. Any manufacturer, importer or downstream user using any quantities of the same substance for any other purpose will not be exempt from the application of these rules.

2.6 Outlook

The chemicals industry has demonstrated its resilience during the Covid-19 pandemic. However, for India to retain advantage and strengthen position in the global supply chain; it is imperative that:

- Government continues to focus on improving the ease of doing business in India and provides the adequate policy support by way of necessary incentives for the sector.
- Private players step up the investments towards R&D activities and towards development of local manufacturing capabilities in order to reduce their dependence on overseas markets, such as China.
- All stakeholders join hands to act responsibly and ensure that the industry continues to be cognizant of its impact on the environment be it in terms of reduction of carbon footprint, reduction of energy consumption, conservation of natural resources like water or minimisation of effluents and wastes that are discharged.

The per capita consumption of chemicals in India is much lower than the western countries, which indicates the prospects the industry has in terms of growth. In coming years, India is expected to rise as both, a manufacturing capital for valued goods and a consumer-driven economy from a broader perspective. The industry is likely to benefit from the improvement in investment climate, speedy approval of projects and proposed reform measures that would translate into higher industrial activity, and in turn higher demand for chemicals.

Several factors such as rising demand for specialty chemicals and pharmaceuticals segment, low per capita consumption including agrochemicals, likely growth in demand from paints, textiles and diversified manufacturing base are expected to drive the growth of chemicals industry.

In terms of competition, the Indian chemical industry remains behind the Asian counterparts. In order to be competitive at global level, India will have to address the key issues pertaining to inadequate infrastructure and lack of availability of low-cost feedstock for production. The industry can leverage new technologies and explore alternative feedstock options such as coal gasification, syngas, and pet coke to mitigate the issue of feedstock availability in the sector.

Government has included this sector as priority sector under the ambitious 'Make in India' initiative of the government. 'Make in India' has played a pivotal role in driving some of the key initiatives to stimulate growth in the chemicals industry. The government has already taken some crucial steps to create favourable conditions, in terms of policies and infrastructure, to attract global and domestic investments in the Indian chemicals industry. The results of these initiatives can be seen in the increasing interest displayed by major companies to expand their business in this sector.

In terms of production volumes, the major chemicals are estimated to increase at a CAGR of 2%-4% by 2026-27. This will be backed by higher demand from specialty chemicals compared to that of commodity chemicals. In addition to this, China plus one strategy will also drive the demand from chemicals in India in the domestic as well as international market.

Rising trade tension among US and China has opened the doors for Indian players on the global level. Moreover, Make in India initiative boosts the country to increase manufacturing base and become self-reliant. All this has made Indian chemical companies have a cost advantage. This, in turn, has opened doors to capture global market by exporting chemicals. Besides, high availability of skilled labor makes manufacturing of specialty chemicals in the country cost-effective. Therefore, Indian specialty chemical companies have the opportunity to increase their revenues.

Apart from these factors, the Production Linked Incentive (PLI) schemes announced by the Government for some sectors like automobile and auto components (around Rs 83,000 crore), schemes including PLI scheme for electronics manufacturing (around Rs 55,000 crore) will augur well for chemicals used in these industries. As a result, the industries which are directly not a part of PLI scheme is also expected to witness an increase in their demand on account of PLI schemes.

Key trends in Indian chemicals industry

- **Increase in capital expenditure**

One of the key trends in Indian chemicals industry is increase in capital expenditure. India has emerged as a cost-effective alternative to China when it comes to manufacturing facilities. This has provided Indian chemical companies an opportunity to increase their revenues. In addition to this, low cost labor and easily available raw material provides an edge to Indian chemical companies. To cater to the high demand, there is rise in the capital expenditure by them.

- **Growth in research and development by chemical companies**

Manufacturing chemical products requires huge investment on research and development. Indian chemical companies invest towards research and development to capture the untapped market. In addition to this, companies are required to spend on research and development to survive the competition in the market.

- **Rise of environment-friendly chemicals**

Another key trend of Indian chemicals industry is the rise in environment-friendly chemicals. Green chemicals are eco-friendly bio degradable products providing high performance and are easy to manufacture, use and dispose. The rising concern among companies to make the manufacturing process eco-friendly has increased the usage of green chemicals. Rising focus on sustainable development adds up to the use of green chemicals. Though usage of green chemicals at the initial stage is expensive, but in the long term it is cost effective as there is significant price reduction due to continued usage.

- **Growth in application of specialty chemicals**

The past two decades have seen a significant shift in the specialty chemicals industry and as the specialty chemical applications increases; specifically, due to growth in end-use industries like automotive, rubber industry, ceramics, pharmaceuticals & cosmetics, paints & coatings, agrochemicals, nutraceuticals, animal feed and batteries in the Indian market, the demand for chemicals like zinc oxide will grow exponentially.

High entry barriers in Indian specialty chemicals industry

- **Complex manufacturing process**

The manufacturing process of specialty chemicals is complex and requires deep understanding. In addition to this, the manufacturing process also requires high investment in research and development. Not all companies have the capacity to bear high R&D cost making it difficult for them to enter the industry.

- **Stringent vendor approval process**

Specialty chemical products have to undergo through strict approval process. Getting approvals is not only costly but also takes a very long time. This creates a barrier for the new entrants. The manufacturers need to ensure high product quality and hence have changed their sourcing strategy from having low cost suppliers to focus on scalability, reliability of supplies, infrastructure, product quality and systems. Large manufacturing companies want to deal with suppliers who have an existing track record. For any change in suppliers, manufacturers have a lengthy and expensive process of testing the product and its impact on the quality of end product.

- **Supplier customer relationship**

Customers select their suppliers after critically evaluating them and therefore choose to have a long-term relationship with them as the cost to change the suppliers involves huge cost.

- **Stringent quality requirement**

Stringent quality requirement is another factor that hinders the entry of new entrants in the specialty chemicals industry. Specialty chemical products have to undergo various quality tests to ensure that their usage is safe and eco-friendly.

3. Zinc Oxide Industry

Zinc oxide is an inorganic compound, white in colour and insoluble in water. The chemical formula for zinc oxide is ZnO. Zinc oxide is present in the earth's crust as mineral zincite and usually contains manganese and other impurities. Hence for commercial use it is synthetically made. Zinc oxide has a lot of properties that makes it desirable to various end user industries. It is used as an additives to various products like rubber, ceramics, cosmetics, food supplements, plastics, paints, sealants, batteries, animal feed, etc.

Zinc oxide is the best activator for sulphur vulcanization for rubber companies and without the use of zinc oxide, rubber products cannot meet safety standards. Apart from rubber, the properties of zinc oxide make it an essential component in various other applications like paints, pharmaceuticals and agriculture etc. Various experiments have taken place globally to reduce zinc oxide usage in some applications. However, the efficiency of the alternatives is still in study phase and not yet implemented.

Zinc oxide is produced from two types of raw materials namely zinc metal and zinc scrap (dross). The availability of raw materials impacts zinc oxide prices and production. Zinc oxide produced from zinc metal is of high quality and is the preferred material for production of zinc oxide for purity level of 99.9%. This raw material is used to produce high quality zinc oxide for end user industries like pharmaceuticals and other specialty applications.

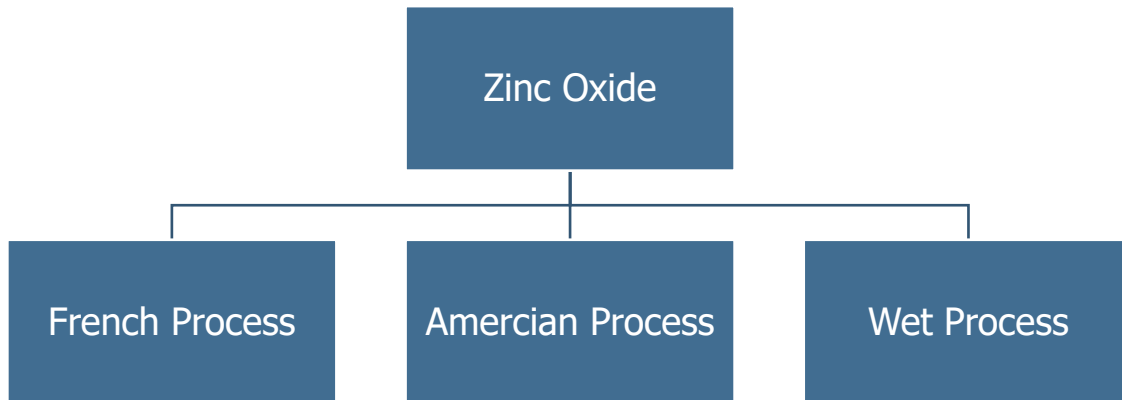
Zinc scrap includes two main types: Zinc dross and Zinc ash

- Zinc dross is the scrap that remains after steel is galvanized. This scrap is generated by large steel mills like SAIL, JSW Steel, Tata Steel etc. and by several other galvanizers across the country and globally. The overall availability of zinc dross is far less than the total requirement in India. As a result, a significant quantity of zinc dross is imported in India.
- In addition to zinc dross, another by-product is generated during the galvanizing process which is called zinc ash. Zinc ash is used as a raw material to make zinc sulphate, zinc borate, zinc carbonate and various other zinc based chemical derivatives. Similar to the procurement of zinc dross which is a challenge, the availability of zinc ash is also a challenge.
- The sourcing of zinc dross and ash is a big challenge and domestic availability is not sufficient. Hence developing a strong supply chain poses a big issue for players in zinc oxide and sulphate industry.

3.1 Production Process

Zinc oxide is made through three processes for commercial uses namely, indirect process, direct process and wet chemical process. Globally, French process is the dominant technology and all the major producers in Americas, Europe and Asia have adopted this process. This is because zinc oxide produced from this process is of better quality and has acceptability in all end user applications.

Production processes to manufacture zinc oxide



French process: The indirect process is also known as French process. Here the metallic zinc is melted in silicon carbide / graphite bonded crucibles vapor. It then reacts with oxygen in air to give zinc oxide. Most of the world's zinc oxide is manufactured through the French process as zinc oxide produced through French process has use in all applications and its chemical properties are more conducive.

American process: The direct process, also known as American process, starts with diverse contaminated zinc composites. The zinc precursors are reduced by heating with a source of carbon to produce zinc vapor and then oxidized as in indirect process. Since it is produced from impure zinc and zinc ores, the purity level of zinc oxide is also of lower quality compared to indirect process. Due to this the usability of zinc oxide produced through this process is very restricted and it is slowly reducing as end user application sectors are reluctant to use the product for a variety of reasons like quality, limited supply etc.

Wet process: In the wet chemical process, it starts with aqueous solutions of zinc salts which is precipitated. The solid precipitate is then calcined at high temperatures. A small amount of industrial production is through the wet process. The zinc oxide produced by this technology is slight off-white / yellowish in colour.

Grades of Zinc Oxide

Commercial grades of zinc oxide are divided by purity and by particle size. These categories are due to the difference in the manufacturing process.

Zinc Oxide is not a plain vanilla product where one size fits all. Each industry segment has its own peculiarities in terms of specifications and within each industry, each customer also has different specifications and requirements. The purity range of zinc oxide ranges from 98.50% to 99.90% and within this range various customers have various other specifications with respect to impurities.

Hence, there is an extremely high degree of customization which is required not just in operating parameters but also in plant design and engineering which has to be factored while building new plants.

The usage of zinc dross is gradually reducing in the West (like Europe and North America) and is shifting towards Asia. Thus, the zinc oxide manufacturers in Asia who has the ability to use scrap material for majority of end user segments adds as an advantage as it helps in lowering costs. This ability requires technological expertise and demands higher Research & Development by such zinc oxide manufacturers.

3.2 Active Zinc Oxide

Active zinc oxide has larger specific surface area and chemical activity. Active zinc oxide is a good choice for highly specialized applications in a few end user industries. It is a more expensive product than the conventional zinc oxide.

Due to its high chemical activity, it is extensively used in electronics, petroleum and environmental protection industries. Active zinc oxide has emerged as an important semi-conductor and future material for fabrication of low cost, high performance electronic and optoelectronic devices like transparent conductive films, solar cells, LEDs. The global demand for active zinc oxide is actively pushed by electronics industries.

The properties like fineness, chemical purity and particle shape can be adjusted as required for zinc oxide and it has photochemical effect and better UV shielding performance at 98% which is much higher than normal zinc oxide. Since the proportion of metals in active zinc oxide is very low, it does not leave pigment stains and the product is not affected during production.

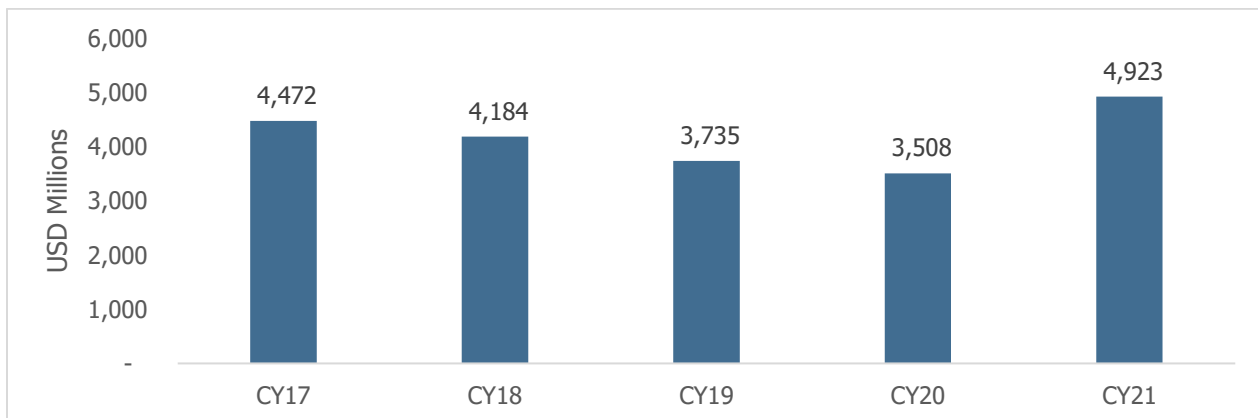
3.3 Global Zinc Oxide Industry

The global zinc oxide market is organized and is fairly consolidated. Production capacities, process of production, grades of ZnO and variety of application segments are some of the factors through which the key players control the market.

3.3.1 Overall Global Market size

During the five-year period CY17 to CY21, the global zinc oxide market size grew from USD 4,472 million in CY17 to USD 4,923 million in CY21 and increased at a CAGR (compound annual growth rate) of 2.4% backed by demand from end user industries.

Chart 15: Global market size of zinc oxide (USD million)



Source: CareEdge Research

During CY20, the industry witnessed decline to USD 3,508 million due to Covid-19 restrictions and lockdown which affected demand from user industries during the year. The situation however improved in CY21, registering around 40% growth to USD 4,923 million, on account of better economic activities backed by lower Covid-19 cases across various regions.

In terms of production, the global output of zinc oxide has been in the range of around 1.40 million tonnes – 1.60 million tonnes during CY17 to CY21 as per CareEdge Research.

Going forward, growth in the end user industries is expected to fuel the increase of zinc oxide which has properties like high chemical stability, high electrochemical coupling coefficient, broad range of radiation absorption and high photo stability.

3.3.2 Factors driving growth

Growth in automobile and rubber industry

The market of automobile industry is expected to rise in coming years worldwide on account of increasing disposable income of global population. Expected growth in automobile industry is likely to increase the demand for tyres and thus rubber. The demand for radial tyres is also expected to boost with the increasing demand for passenger cars and two-wheeler segments. The industry is moving towards radialization even in truck and bus segments.

In addition to this, to tap the opportunity in export markets, the automobile companies set up their plants in regions or countries that offer automobile companies certain benefits that helps them to develop strong manufacturing base in these nations and support their exports. For example, international automobile companies like Hyundai Motor, Volkswagen, Kia Motors, Ford have their plants in India that aid automobile exports of these companies from India.

Rubber industry is one of the largest user industries of zinc oxide. This chemical is used for vulcanization of rubber to achieve improved elasticity, resilience, strength, hardness and weather resistance. Vulcanized rubber is used for manufacturing of tyre. Around 50%-60% of zinc oxide produced globally is used for making tyre. Non-tyre application of rubber in the automobile industry includes air bags that provides safety at time of collision, rubber mats that keeps the vehicle clean and other rubber products like rubber seal and rubber hoses. Thus, demand for zinc oxide is attributable to growth in demand from rubber and various end user industries catering to automobile industry.

In addition to this, rubber finds its application in various other products like footwear, conveyor belts etc. The durability, resistance to slip properties of rubber will also support the demand for rubber industry. Moreover, growth in global healthcare industry will also aid the momentum in rubber used in medical industry that involves latex gloves, tubing, blood pressure cuffs, rubber medical masks, rubber bladders, rubber rollers, rubber cords, diaphragms etc.

- **Ceramics**

Zinc oxide is highly versatile chemical, it is used in various industries and ceramics industry is one of them. It uses zinc oxide to build low thermal expansion and create a glaze. The properties of zinc oxide like high heat capacity, thermal conductivity and high temperature stability are desirable since it reduces the melting temperature, energy and equipment requirement. The global production of ceramics stands at 16,093

million sqm. for CY20. The overall world production increased by 1.7% in CY20 compared to CY19 while consumption in CY20 grew by 2.6% compare to CY19. Asia accounts for 74% of the world production and 71% of the world consumption of ceramics followed by European Union production at 7.6% and consumption at 6.5%.

Zinc oxide is also used for its property that aids varnishes and glazes used in ceramics. The ceramic wall and floor tile glaze, as well as low temperature ceramic glaze, are used increasingly frequently in construction. The ceramics industry is also expanding at a breakneck pace, as a shift in product focus, with glazed vitrified tiles (GVT) and polished glazed vitrified tiles (PGVT) gaining market share.

- **Personal care/ cosmetic products**

In addition to automobiles industry, the consumption of cosmetic and skincare products in developed and developing economies backed by increase in disposable income is also expected to drive market growth. Zinc oxide is used in cosmetic and skin care products as zinc as a potent ingredient is used to treat several skin conditions like inflammation, sun damage, acne, etc. Zinc oxide is a primary element of sunscreen since it blocks UV (Ultra Violet) rays, and does not get absorbed in the skin unlike other chemicals.

Skin care products are gaining popularity due to rising awareness of the effects of UV rays and sun exposure. Skincare products offering sun protection help prevent sunburn and early signs of aging, and shield from high-risk diseases such as skin cancer. They are likely to drive the growth in sales of skincare and cosmetic products going forward. The market size of global skin care market in CY21 stood at USD 112 billion with a growth rate of 7.4% for CY21.

- **Paints and coatings with zinc oxide**

Zinc oxide in paints helps in UV blocking, provide stain-blocking support, corrosion inhibition since it acts as a barrier, water resistance and color retention. It also neutralizes harmful acids, toughens films, and improves durability properties.

Zinc oxide in paints is used as a pigment as well as a coating. It is used in paints for the white pigmentation since it is opaquer than lithopone (mixture of barium sulphate and zinc sulphide). Zinc oxide has replaced white pigment used by painters and as coating it is used to prevent anticorrosive coatings of the metals. The coating of zinc oxide retains its flexibility and adherence for many years and hence is used coil coatings, industrial finishes, and automobile refinish, protective and marine coatings.

There has been growing demand for paints and coating for various purposes. In CY19, the global demand for paints and coatings was at USD 165 billion. The paint and coatings sector include various segments like architectural coatings, automobile OEM coatings, wood finishes, powder coatings, coil coatings, packaging finishes, general industrial finishes, automobile refinish paint, protective coatings and marine coatings. Zinc rich paints are highly anti-corrosive since it acts as a physical barrier. The industry demand is expected to grow by 4% in the medium term.

The market size and growth rate by different segments for paints and coatings sector is given below.

Table 5: Market size of paints and coatings sector by business

Sr. No.	Business	USD Million*	CAGR (CY19-CY24)
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1.	Architectural Coatings	67,550	4.2%
2.	General Industrial Finishes	17,700	4.6%
3.	Protective Coatings	16,042	4.4%
4.	Food Finishes	12,223	5.0%
5.	Automobile OEM Coatings	11,279	3.1%
6.	Powder Coatings	10,598	4.7%
7.	Automobile Refinish Coatings	9,242	3.0%
8.	Other Transportation Coatings	6,406	4.4%
9.	Coil Coatings	5,042	3.4%
10.	Marine Coatings	4,323	2.8%
11.	Packing Finishes	4,090	3.0%

*Figures are for year CY2019

Source: Nippon Paint Holdings Report, CareEdge Research

Other growth drivers

- **Pharmaceuticals**

Zinc oxide is used in pharmaceuticals since it is one of the critical chemicals available for skin care products and cosmetics. It is applied in creams and lotions for skin problems as well as medication for skin issues. It is also used as a skin protection against UV A and B rays, pollution and irritation. This is because zinc oxide contains astringent, soothing and protective properties. In addition, this, zinc oxide finds application in zinc soap, ointment, dental inlays, food powders among others.

- **Agrochemicals**

Agrochemicals are chemicals produced to be used in agriculture like pesticides, insecticides, synthetic fertilizers, and other chemical growth agents. It plays an important role in modern industrialized and intensive farming since it makes possible growth of crops on previously uncultivable lands.

Zinc oxide is used in agriculture for plant protection products, fertilizers, soil improvement, water purification and antimicrobial activities since it is cost effective and environmentally friendly. It contains properties like antimicrobial, antifungal, catalytic that makes it a potential for application in various other fields. Zinc oxide acts as a source of zinc micronutrient without any toxicity risk and they also boost yield and growth of food crops.

- **Nutraceuticals**

Nutraceuticals are food items that possess medical properties along with nutritional value. There has been rapid increase in the demand and consumption of nutraceuticals due to their increasing popularity. The segment has seen an explosive growth in Covid-19 pandemic era. Rising health concerns, aging population and rising income are the major driving forces for this segment for developing economies.

Zinc oxide is used for food fortification i.e. it is deliberately added nutrient to increase the nutritional value. Zinc oxide is used as a supplement to help with zinc deficiency. Results like rapid enhancement of body growth, appetite and hair growth are seen as a result of zinc oxide supplements.

The global market size of nutraceuticals for the CY20 is around USD 200 billion and is expected to grow at a rate of around 4% during the years 2019-2024.

- **Feed**

Animal feed refers to the food and products grown/manufactured for the consumption of poultry, swine, aquatic animals, etc. Zinc oxide is used as a trace element (chemical whose concentration is very low) in livestock. Zinc is an essential trace element since it plays an active role for the function of more than 300 enzymes and hormones.

Trace elements like zinc are essential livestock nutrition since they have important effects on animal growth. Deficiency of zinc causes poor growth, loss of appetite and bad feed conversion rate*.

*feed conversion rate- the weight of feed intake divided by weight gained by the animal.

- Batteries**

Batteries industry is emerging as a critical sector in the transition of a more sustainable future. The battery and cell market is expected to grow since the market is shifting to renewable technologies and which would accelerate growth of electric vehicles.

Zinc-carbon dry cells, zinc-silver oxide batteries, nickel oxide-cadmium batteries and secondary batteries use zinc oxide. Zinc oxide is also used as an electrode material, cathodic material and as a fuel element in fuel cells. It also acts as a photo catalyst in solar energy cells.

Zinc oxide battery helps to play a major role in semiconductor ceramic elements for operation at elevated temperatures or high voltages.

- Specialty Chemicals**

Zinc oxide is used in manufacturing of various other chemicals such as zinc stearate, zinc diacrylate, zinc borate, etc. These chemicals are further used in several applications such as plastics, rubbers, flame retardant materials, etc. Zinc oxide is used to produce various zinc-based chemicals in different industries. Examples are given below:

Table 6: Usage of zinc oxide in different zinc-based chemicals in various industries

Sr. No.	Industry	Chemical	Use
1.	Agricultural	Zinc sulphate	Encourages plant growth
		Zinc nitrate	Corrects zinc deficiencies
		Zinc EDTA	Chelating agent
2.	Construction	Zinc borate	Smoke suppressant, flame retardant
		Zinc octoate & neodecanoate	Paint driers, PVC stabilizers
		Zinc phosphate	Corrosion resistance
4.	Rubber	ZMBT, ZDMC, ZDEC, ZDBC	Accelerators
		Zinc stearate	Mold release agent
		Zinc diacrylate	Golf ball centers
5.	Miscellaneous	Zinc bromide	Oil well drilling fluids
		Zinc citrate	Dental care, human nutrition
		Zinc chloride	Batteries, metallurgical fluxes
		Zinc gluconate	Zinc lozenges

		Zinc resinate	Printing inks
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Source: Zochem Inc., CareEdge Research

- **Additives**

It is used as an additive in various materials and products like cosmetics, food supplements, plastics, lubricants, sealants, ferrities, adhesives, fire retardants and first aid tapes.

- **Concrete**

Zinc oxide in concrete is able to improve the flexural strength and hence zinc oxide is used. The zinc oxide nanoparticles also improve the pore structure of the self-compacted concrete and shifts the distributed pores to harmless and less-harmful pores, hence improving the mechanical strength. The ZnO nanoparticles acts as a filler to enhance the density of concrete, which reduces the porosity of concrete. This application is currently under development in emerging economies and once large-scale acceptance and deployment of it is achieved, this would support zinc oxide demand. With an expected increase in infrastructure activities like building of highways and roads globally, the scope for zinc oxide application in concrete is significant.

- **Research and development in zinc oxide nanoparticles**

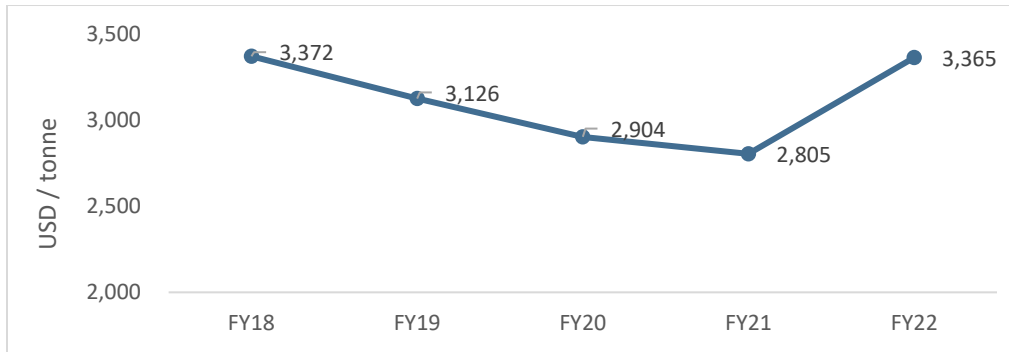
Zinc oxide is one of the most popular metal oxides due to its bio-compatibility, economic and low toxicity. In the field of bio-medicine it has emerging potential and other medical fields like anti-cancer and anti-bacterial fields.

The research and development of zinc oxide nanoparticles have increased the potential of biomedicine, specifically in anti-cancer and anti-bacterial fields. Nanoparticles of zinc oxide generate excess reactive oxygen species, release zinc ions and encourages cell apoptosis (programmed cell death). Zinc also possesses the ability to maintain structural ability of insulin and hence zinc oxide nanoparticles can also be used for antidiabetic treatment and anticancer treatment.

Recently, more industries are exploring the use of zinc oxide. Electronic industry has various uses like semiconductors, laser diodes, LEDs, Li-on battery, spintronics, etc.

3.3.3 Price Trends

Zinc oxide price tend to move in line with that of zinc prices which is the primary raw material for zinc oxide chemical. A deficit in zinc market has caused the zinc prices to average high in FY18 which thus is believed to have resulted in high zinc oxide prices during the year at USD 3,372 per tonne.

Chart 16: Global zinc oxide price trend (USD/ tonne)

Source: CareEdge Research

The price of zinc oxide is linked to the prices of zinc metal which is traded on the London Metal Exchange. This is because, the key raw material i.e. zinc dross and zinc metal prices are also a derivative of the zinc prices on the London Metal Exchange. Therefore, the producers generally do not have a price risk as the same can be passed to the end user industries except for cases where the producer has inventories back to back locked in prices with customers.

Further, the large zinc oxide producers who cater to major institutional and quality conscious buyers can command a better price on account of specific grades of zinc oxide produced by them which meet the requirements of customers. The specific grade zinc oxide tends to have a high price compared to that of average grade of zinc oxide.

3.3.4 Key global players in zinc oxide industry

- **EverZinc Group SA**

EverZinc is a global provider of specialty zinc materials that include fine zinc powders, zinc oxides and ultra-fine zinc oxide. The manufacturing operations of EverZinc is located in Belgium, Canada, China, Netherlands, Norway, and Malaysia. The zinc oxide capacity of EverZinc is 75,000 tons per year and the company is a leader in the European market. The headquarters of the company is located in Liege, Belgium. EverZinc was acquired by OpenGate Capital in 2016. EverZinc is one of the biggest recycler of residues from the galvanizing industry and hence majority of the zinc oxide is produced through direct process.

- **US.Zinc Inc.**

US.Zinc Inc. is a worldwide manufacturer, recycler and supplier of zinc oxide, zinc dust, zinc metal, zinc fines and Prime Western grade zinc metal. It was founded in the year 1949 with its headquarters situated in Greater Houston Area, Southern US. Manufacturing facilities are located at US and China at 5 different locations. US.Zinc manufactures zinc oxide from high grade and special high grade zinc metals as well as from zinc secondaries. Aterian Investment Partners had acquired US Zinc in 2018.

Aterian Investment Partners combined two of the largest global producers of zinc chemical products, US.ZINC and EverZinc, to form the pre-eminent global zinc chemistry business on 1st June 2022. The new

company will operate under the name EverZinc with headquarters located at Houston, Texas. The combined company is expected to source majority of the raw material from third party by products, hence reducing the need for virgin zinc. The company aims to support high value application markets through their products such as personal care, alkaline, storage and rechargeable batteries, pharmaceuticals, chemicals, textiles, agriculture, feed, paints and coatings, and rubber. The combined company will have 14 facilities located at various locations in North America, Europe and Asia.

- **Zochem Inc.**

Zochem Inc. was founded in the year 1933, has its headquarters located in Brampton, Ontario. The manufacturing and warehousing facilities are located in Brampton and Dickson, both use French process method exclusively for producing zinc oxide. Zochem produces variety of zinc oxide powders and pallets with purities of 99.9% and beyond. In 2017, Zinc Oxide LLC acquired Zochem, a subsidiary of American Zinc Recycling LLC. The new company operates the combined North American capabilities. The grades of zinc oxide produced by Zochem are used in rubber, tyre, chemical, pharmaceuticals, cosmetic, oil additives, ceramics, electronics, glass, plastics, paint and coatings and fertilizer market.

- **Hakusui Tech Co. Ltd.**

Hakusui Tech is an inorganic chemical producing company since 1947. The products of the company includes zinc oxide, zinc dust, zirconium silicate and other electro-conductive zinc oxide. The end users industry of the products manufactured by the company are primarily rubber, ceramics and paint manufacturing. Hakusui Chemicals (Thailand) is a wholly owned subsidiary of Hakusui tech Japan. The subsidiary manufactures zinc oxide in Thailand and supplies to surrounding countries in Asia.

- **Thai-Lysath Co. Ltd.**

The Thai-Lysath Co. Ltd. is the first company manufacturing zinc oxide in Thailand since 1972. The company is currently under the Univentures Public Company Limited. The company has a production capacity of 21,000 tons per year as of 2016. The company has developed zinc oxide powder in both powder and granular form. The company produces 4 grades of zinc oxide namely white seal, feed grade, red seal and RS-R (rubber industry) for various application industries like animal feed, ceramic, anti-rust paint, rubber, cosmetics, pharmaceuticals, medicine, etc.

3.4 Indian Zinc Oxide Industry

In India, around 60% of the zinc oxide is used in manufacturing of rubber, out of which tyre manufacturing makes a major part as per CareEdge Research. Rest of the rubber consumers are footwear, gloves, sports items, surgical items, etc. Apart from rubber, zinc oxide is also used in other specialty chemicals, petroleum additives and other allied products (the demand for which is prevalent in the western part of India since it is a large chemical production zone).

The domestic production is largely consumed in India with limited exports and imports. The top countries where India exports zinc oxide are countries in the SAARC region and in South-East Asia. The imports compared to the exports are very low since, imported zinc oxide attracts a custom duty of 7.5% per kg.

The raw material required for production of zinc oxide is zinc metal or zinc dross. The price of zinc scrap is low compared to the zinc metal prices, which are mainly dependent on the Zinc LME. The zinc metal prices are a direct reflection of the prices of LME zinc and hence the operating margins are protected in terms of the LME prices. This is because of the strong pass through pricing structure of the industry.

3.4.1 Industry structure

The Indian zinc oxide industry includes organized players that are limited in number but constitute a major portion of the market, due to the high barriers of the entry into the industry like stringent vendor approval process by tyre manufacturers, raw-material tie ups, technological expertise and large working capital requirements. The Indian zinc oxide industry is constituted by key organized players like JG Chemicals Pvt Ltd; Rubamin Pvt. Ltd., Transpek-Silox Ltd. that account for about 50% of the Indian zinc oxide market while rest of the market consists of various small zinc oxide producers. As a result, the industry is likely to see consolidation over the medium to long term.

High entry barriers

- **Stringent vendor approval process by Tyre manufacturers**

Tyre manufacturers are under strict scrutiny from the automobile OEM's for product quality. Hence in the last 15 years they have changed their sourcing strategy from having low cost suppliers to focus on scalability, reliability of supplies, infrastructure, systems and product quality and systems. Large tyre manufacturing companies want to deal with suppliers who have an existing track record. For any change in suppliers, tyre manufacturers have a lengthy and expensive process of testing the product and its impact on the tyre quality. Given the life of tyres, the end-to-end testing of a change in product in the market, takes over 5 years in itself. Hence there is resistance to change or add any new suppliers and approvals take significant time over 5 years. Even with existing suppliers, tyre manufacturers insist on taking supplies from the same production facility. Large tyre manufacturing companies want to deal with zinc oxide manufactures who scale up their operations so they can expand rather than dealing with many small/new vendors since the approvals and testing process for zinc oxide done by tyre manufacturing companies is a long and costly process.

Zinc oxide manufacturers which complete this challenging approval process with multinational tyre companies tends to get included in global supplier base.

- **Raw material tie-ups**

Zinc oxide in India is produced from zinc metal and zinc scrap, but majorly zinc scrap is used since it is cheaper.

The overall availability of zinc scrap is far less than requirement and hence it is imported. Most of the zinc scrap that comes from Western countries is through old and established trading houses which operates on long term relationships and refrains to deal with new entrants due to a wide range of complexities associated with dealing in scrap.

One of the key elements for any trading house is to ensure volume stability. Most of these traders have contracts with small and large galvanizers located in different countries. These traders lift the material from these galvanizers and sell it to end users. Therefore, it is very important for them to ensure a) regular business, b) payment safety and cordial customer – supplier relationship. The availability of zinc scrap is a challenge and the biggest constraint for new entrant in the sector is to build a global supply network.

These traders prefer selling scrap to large buyers instead of small buyers since the scrap business operates mostly on advance payment basis. This not only ensures back to back contracts for large quantities but also assures regular payments.

Due to the difficult sourcing pattern for this product, new players are reluctant to enter zinc oxide business. Several zinc oxide facilities have faced supply side constraints due to which they have been forced to shut / curtail production.

- **Technical expertise**

Most of the zinc oxide produced in India is from zinc dross. Zinc dross is scrap and there is no uniform grade of zinc scrap. Every galvanizer generates zinc scrap which is different in terms of quality and therefore the productivity and quality of zinc oxide which can be derived from it will vary. The complex chemistry involved in making zinc oxide with various types of zinc dross is a very difficult process. Understanding this process along with usage of technology to match it with customer specifications is one of the key challenges in the industry. This is because each buyer has a separate specification and there are no standard specifications accepted across any end user applications.

- **Large working capital requirements**

The traders who sell zinc dross, the raw material for zinc oxide production, prefers advance payments from zinc oxide manufacturers. Also, sales made by zinc oxide manufacturers to customers is mostly on credit. These credit terms vary depending on customer, industry and the bargaining power of the suppliers. Hence, the working capital requirement is high in zinc oxide industry and thus it acts as a major deterrent for entry of new players.

As the zinc oxide industry has high entry barriers, only those players who have the capability to deal with such challenges (as mentioned above) can survive, while players who do not have the capability to deal with this kind of challenges may witness shutdown of their operations in the future.

3.4.2 Indian Zinc Oxide Market Size

The zinc oxide production in India (in terms of volumes) has been around 100 thousand tonnes – 115 thousand tonnes in the past 5 years (FY18 to FY22). During this period, the Indian zinc oxide market size is estimated at around Rs 18,000 million to around Rs 20,000 million. As per CareEdge Research estimates, the zinc oxide market in India is estimated to be increase by around 10%-12% CAGR from FY22 to FY27.

3.4.3 Consumption pattern of zinc oxide in India

Zinc oxide consumption is primarily divided into three broad categories:

Tyres and rubber industry: This segment account for the largest share of zinc oxide consumption in India. The share of this segment however has reduced in India over the years from an approximate two-third of zinc oxide consumption to more than half of zinc oxide consumption in India following the trend in zinc oxide consumption globally. Internationally, this segment has a lower share of around one third in overall zinc oxide consumption as zinc oxide has high penetration in other segments as well like ceramics and glass, paints, pharma, cosmetics, agrochemicals, feed, specialty chemicals, nutraceuticals, batteries etc. as compared to Indian zinc oxide market.

This, in turn, provides an opportunity for the Indian zinc oxide market to augment the industry's penetration in sectors other than tyres and rubber.

Ceramics and glass industry: The contribution of this segment in zinc oxide consumption in India is around one fifth of overall consumption compared to that of approximate one third global consumption of zinc oxide by ceramics and glass industry. The share of this segment in zinc oxide consumption in India however is expected to augment with usage of zinc oxide in ceramics industry in India in translucent glazes for brick glaze and coarse pottery, as well as transparent coarse glazes for process tableware.

Others: Others segment includes industries like paints, pharma, cosmetics, agrochemicals, feed, specialty chemicals, nutraceuticals, batteries etc. The share of others account for about one fifth of total zinc oxide consumption in India while it has a higher share of around one third in global zinc oxide consumption.

Increase in preference for premium paints, high usage of sun care products, zinc deficiency in Indian soil are some of the factors that will drive the demand from these segments and will expand the contribution of others in India's zinc oxide consumption going ahead like that of global consumption pattern.

3.4.4 Factors driving growth

- **Automobile and rubber industry**

The Indian tyres industry size is estimated around Rs 75,000 crores in FY23. With 41 tyre companies and 62 tyre manufacturing plants, this sector produces the largest variety of tyres in the world. The tyre industry has not been much impacted due to the Omicron wave due to its dependence on replacement demand. Vehicles require tyre replacement due to wear and tear which would positively influence the sales of tyres. With the surging demand for replacement tyres, the market is witnessing a healthy growth in this segment. Exports are expected to grow for the tyre industry. Steady demand from major export destinations such as

the USA, the UK, and the European nations including Germany, France and Italy supported exports in FY21 and is likely to continue growing forward. India's tyre industry is expected to grow favourably with a CAGR of 8%-10% over the next 4 years by FY27.

The expected growth in project completions by automobile and tyre industries in the upcoming years with an improvement in demand and consumer sentiments is also likely to increase the consumption of zinc oxide. In addition to this, the momentum in EV segment have also led to evolvement of tyres that handles instant torque and higher inertia, carries heavier load provides proper grip and resistance. Going forward, the automobile industry in India is expected to grow at a CAGR of 6%-8% over the next 4 years by FY27.

- **Ceramics**

With the overall real estate market in India witnessing a strong growth, ceramics industry also stands to benefit and observe a robust growth in the coming years.

In India, the real estate industry is one of the major sectors in terms of its direct, indirect and induced effects on the economy. It is the second largest employment generator after agriculture. Broadly, the real estate industry can be classified into residential and commercial real estate. The commercial real estate segment can be further segmented into office, retail and hospitality.

The residential real estate accounts for nearly 80% of the total real estate market in India as it is more end-user driven. The commercial segment depends on employment opportunities in the country, particularly for the office space. Since the demand for office space translates into better employment opportunities and possible relocations, higher investments in commercial real estate translate into increased demand for residences in these localities. Resultantly, the demand for residential real estate is propped up by the demand for commercial real estate.

The share of consumption of ceramic tiles in India is 56%, share of PGVT (polished glazed vitrified tiles) is approximately 33% & GVT (glazed vitrified tiles) has the least share of 11% in the overall tile market. However, over the last few years, the GVT & PGVT segment have shown steady growth. Moreover, the organized segment entities have introduced new sizes and designs in the GVT & PGVT segment (that has application of zinc oxide), in line with global trends, reducing dependency on imports while also providing clients with a wide range of options to meet their specific needs.

In India, the ceramic tile market has been steadily growing over the previous few years. However, the sector was severely impacted by the Covid-19 epidemic. As a result of the labor scarcity, timely project completion has become one of the primary issues for ceramic tile manufacturers during the pandemic. However, once the lockdown was lifted, the business began to see a resurgence in demand, and it is predicted to grow post Covid-19 and is expected to increase at a CAGR of about 6%-8% in the long term.

- **Personal care/ cosmetic products**

The cosmetic and personal care industry is one of the fastest growing consumer sectors in India. The beauty and personal care product market in India is currently valued at USD 26.8 billion and is expected to reach USD 37.2 billion in 2025. The reasons for the same being growing awareness, easier access, and changing lifestyle for the same. 50-60% of India's production is exported to western and middle-eastern markets.

The personal care and cosmetic segment is further divided into body care, face care, hair care and colour cosmetic. Out of the face care category, the sunscreen category is currently is a nascent category in the country and it is expected to grow at high rates. This is because of changing external environment, pollution, and damage caused by UV rays have been more visible and people suffering from skin ailment conditions have increased. The current market size of sun care is expected to be around USD 49 million and growth rate is expected to be approximately 25% moving ahead.

- **Pharma**

Zinc oxide pharmaceutical grade is one of the top chemicals used in the pharmaceutical industry as it is pure up to 99.8% making it completely harmless. It doesn't contain heavy metals like cadmium, lead and mercury. Zinc oxide is used as an API (Active Pharmaceutical Ingredient) for the pharmaceutical industry as it has no allergic reactions, side effects or harmful effects making it a safe choice to be used at a part of drugs required in treatment of skin problems. Zinc oxide is also used in skin products as it protects the skin from harmful ultraviolet rays; in burn ointments it aids healing. Another usage of zinc oxide is in the production of cosmetic and personal care products like bandages, bath soaps, nail products and makeup.

The Indian pharmaceutical industry (IPI) is ranked 3rd globally in terms of volume and 14th in terms of value. The industry size is estimated at about USD 46 billion in FY21 with domestic and export segment each holding a share of around 50% in industry's revenues.

The factors that have been aiding the domestic pharma market includes growth in presence of chronic diseases, increasing per capita income, improvement in access to healthcare facilities and penetration of health insurance. Going forward, the Indian pharma market (including exports) is estimated to rise by around 10%.

- **Agrochemicals**

Agrochemicals are used in agriculture to support the growth and safety of plants. They are produced to protect crops from pests and are used for auguring the yields of crops. Agrochemicals are made to prevent crops from insects, diseases and weeds. These pests when not controlled affects the volume and quality of food crops.

Zinc oxide is widely used in agro chemicals industry due to its fertilizing property which adds this micronutrient to soil in India which lacks such micronutrients. Zinc oxide helps in better yield and growth of food crops. The photocatalytic property of zinc oxide makes it an excellent antibacterial agent. As per the Fertilizers Association of India (FAI) of all the micro-nutrient deficiencies in the country, zinc deficiency is highest at 36.5% at all-India level compared to that of iron (12.8%), copper (4.2%), manganese (7.1%) and boron (23.4%).

To address zinc deficiency, the Government of India provides additional subsidy on usage of fortified fertilizers (fortified with boron and zinc) in order to increase their usage. As per Schedule I of Fertilizer Control Order (FCO) 1985, zinc forms part of micronutrients which includes zinc sulphate heptahydrate, chelated zinc as Zn-EDTA, zinc sulphate mono-hydrate, zinc sulphate monohydrate (granular). Also, it is included under fortified fertilizers which consists zincated urea, zincated phosphate (suspension) – for seed treatment, NPK complex fortified with zinc, DAP fortified with zinc and in 100% water soluble complex fertilizers that includes NPK Zn.

The Indian agrochemicals market has grown at a CAGR of 3.3% from Rs 439 billion in 2017-18 to Rs 499 billion in 2020-21. The Indian agrochemicals market is estimated to have continued with the growth momentum even in 2021-22 primarily on account of higher exports (that account for a major share in India's agrochemicals market) which reported growth of 21.6% during the year. In the long term, the Indian agrochemicals industry is likely to increase at a CAGR of 5%-6%.

- **Nutraceuticals**

Nutraceuticals as a term is coined from the confluence of nutrients and pharmaceuticals and could be defined as food or parts of food that is intended to provide incremental health or medical benefits. It is estimated that within nutraceuticals segment, functional food & beverages accounts for more than 60% of share. Food fortification is an important part of nutrition and wellness industry. While consumers were increasingly becoming conscious of improving their lifestyle and focusing on healthier choices, Covid-19 accentuated the need for easily accessible dietary solutions to improve one's immunity. It is estimated that immunity became the primary concern for health for consumers in 2020.

The market value of nutraceuticals sector in the year 2020 was USD 4 billion making India 2% of the global nutraceuticals market. The expected growth rate for 2019-2024 is around 7%. The Indian nutraceuticals market is sub divided into herbal supplements, functional foods and vitamins and minerals. India also exported 47% of its herbal export productions and 13% of its dietary supplements produce in 2018.

- **Feed**

Animal feed includes various raw, processed and semi processed products that are used to feed livestock. These products are carefully formulated with the help of nutritional additives, vitamins and minerals to maintain the health of animals and improve the quality of eggs, meat and milk. The market for compound feed is growing due to increasing demand for dairy products, inclination towards animal-based food and international demand for animal feed. Zinc oxide is used in animal feed so as to improve the intake of zinc by these animals.

In the year 2020, demand for overall animal feed was valued at USD 8.3 billion with a growth rate of 4.3% over previous year. India ranks 1st in cattle and buffalo population and is the largest producer of milk and buffalo meat, 2nd largest producer of goat meat and 3rd largest producer of poultry.

The animal feed market in India has potential of USD 6 billion by 2025 while the compound cattle feed had a market potential of USD 400-650 million growing at a CAGR of 16% over the next 5 years. This demand is driven by low organic feed market, penetration and increasing formal offtake.

- **Paints**

The Indian paint market consists of two segments, decorative and industrial paint segment. The paint segment is estimated to be around Rs 500 billion for the FY20. Decorative paint is mainly used in real estate for interior and exterior wall paints, wood finishes, enamels, undercoats, etc. and forms 75% of the paint market while industrial paint segment refers to paint that go into protective coatings of automobile, marine, packaging, powder, and other general industrial coating. The industrial paint segment consists of 25% of

the whole paint segment. Zinc oxide when applied in paints helps increase the life of paints and also protects the paints from UV rays. A positive trend in usage of zinc oxide in paints and coatings is expected due to the increasing preference of premium paints. The preference is due to demand for premium paints that do not wear off easily since zinc oxide increases paint life and durability.

Other growth drivers for the paints industry are its growing affordability, rise in demand from tier 2 and 3 towns, conversion of mud and clay houses to brick and mortar, affordable housing initiatives from government, rising disposable income, median age of population, urbanisation, rising demand from rural markets, etc. The paints market in India is estimated to rise in the range of around 7%-10% going ahead.

- **Batteries**

India is currently at the nascent stage of creating domestic cell manufacturing ecosystem and negligible presence in the global market for manufacturing of advanced cell technologies. But there is enormous potential for large scale battery manufacturing units. The manufacturing within India could allow domestically produced batteries to cater to demand of EVs, grid storage applications, consumer electronics, and other uses. It is estimated that in accelerated case, the annual demand for batteries by 2030 will be around 106GWh to 260 GWh. In terms of market size, the annual market for stationery and mobile batteries could surpass Rs 1.12 trillion by 2030. Zinc oxide battery helps in operations at elevated temperatures or high voltages.

- **Specialty Chemicals**

Specialty chemicals industry is a sub division of the Indian chemicals industry and forms part of the total chemicals and petrochemicals market in India. The specialty chemicals industry is rising domestically because of the demand from the end user industries like food processing, personal care and home care. Specialty chemicals are also used in oil and gas exploration, mining and refining.

The specialty chemicals sector is growing rapidly in India due to underlying end-market growth and increased usage intensity and new product standard and specifications. The intensity of usage of such chemicals is still at early stage compare and there is scope for growth. Specialty chemicals used in various end user industries like rubber, electroplating, concrete, coatings etc. all require zinc in their formulation. Hence the sector is expected to drive the zinc oxide industry too.

The export of specialty chemicals is expected to rise from India owing to the recovery demand after Covid-19, and shift of global supply from China. It will also be supported by weakened competitive from China due to US-China trade war and China plus one strategy. India is becoming attractive for specialty chemicals due to labor cost advantages, pool of technically qualified manpower, government's thrust to 'Make in India'. Zinc oxide is used to make several chemicals across a wide range of end user industries.

- **Government Initiatives**

India is also a prominent automobile exporter and has strong growth potential in becoming the leading world auto exporter in the future. Moreover, various government initiatives have benefited the auto players which will help in not only growing the Indian vehicle market but also in making India a world leader in

two-wheeler & four-wheeler segment. These initiatives, in turn, will also aid the consumption of zinc oxide in the long term.

PLI Scheme for EV

The Government has taken various initiatives to support EV adoption in India. In the Union Budget 2023-24, the government has allocated Rs. 35,000 crores in order to achieve the energy transition, energy security and net zero objectives, which will help the EV industry. India is planning to achieve 100% e-mobility by 2030 in smart cities and this opens up a huge market for EVs. PLI schemes has also been announced to assist the development of technology adoption that are currently low in India, and it can be used in collaboration with schemes for advanced chemistry cells (ACC).

PLI Scheme for Electronics Manufacturing

In order to position India as a global hub for Electronics System Design and Manufacturing (ESDM) and push further the vision of the National Policy on Electronics (NPE) 2019, three schemes namely the PLI for Large Scale Electronic Manufacturing (Rs 40,951 crore), Scheme for Promotion of Manufacturing of Electronic Components and Semiconductors (SPECES) (Rs 3,285 crore) and Modified Electronics Manufacturing Clusters Scheme (EMC 2.0) (Rs 3,762 crore) were notified in April 2020. A fourth scheme, namely the Production Linked Incentive Scheme (PLI) for IT Hardware was notified in March 2021 (Rs 7,300 crore). For enhancing India's manufacturing capabilities and exports, Production-Linked Incentive 2.0 for IT Hardware was introduced in May 2023. This scheme aims to broaden the manufacturing ecosystem by encouraging localization of components and sub-assemblies which will allow development of supply chain in India. Additionally, semiconductor design, IC manufacturing and packaging are also included as incentivized components. The approved budgetary outlay for the scheme is Rs 17,000 crore.

These schemes and increase in EV and electronics market in India are likely to augment the market for zinc oxide which helps in heat dissipation.

Outlook for some major user industries of zinc oxide in India

User industries	Outlook CAGR FY23-FY27E
Automobiles	6%-8%
Tyre	8%-10%
Ceramics	6%-8%
Paints	7%-10%
Pharma	10-11%

Source: CareEdge Research

Note: E indicates estimates

3.4.5 Sustainability and ESG to play a key role

Chemical companies, like other sectors are under pressure from investors as well as consumers to improve their Environmental, Governance and Social (ESG) practices across value chain and chemical industries are particularly held accountable for their raw material sourcing and recyclability of the products produced.

Zinc oxide produced from zinc dross, ash and scrap affects the industry in several major ways. It primarily reduces the consumption of raw material inputs (zinc metal) to manufacturing by returning recycled zinc

to the value chain. It also generates market for products like zinc scrap. Recovery of zinc from secondary market results in lesser energy consumption, low carbon footprint, low capital cost, less environmental hazards and high metal contents.

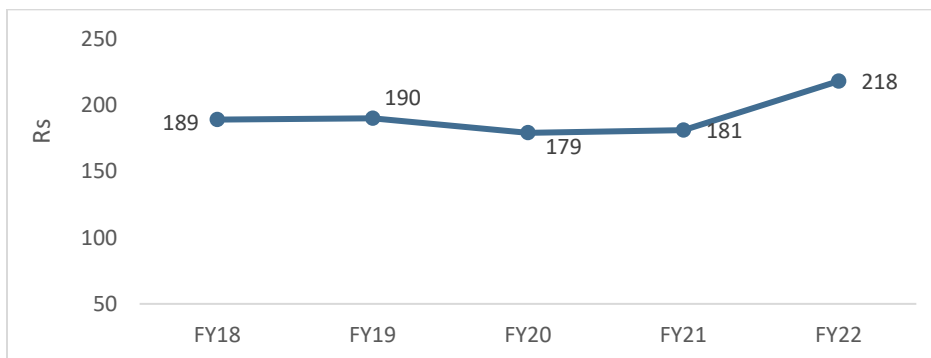
The more relevant risk to these companies arises from environmental exposure such as exposure to waste, pollution, and toxicity along with risks related to water use, scarcity, efficiency, decontamination and climate impact. This risk is heightened by the global trend moving towards more stringent regulations.

Recycling zinc scrap for manufacturing zinc oxide helps improve the ESG compliance and rating of the company. Companies having good ESG rating improve their relation with stakeholders, get access to lower-cost capital and it helps in making strategic decision in more effective way. ESG offers a competitive advantage as ESG metrics are also important to consumers, employees, lenders and regulators.

3.4.6 Price Trend

In FY22, the price of zinc oxide increased due to increase raw material price i.e. zinc. Since zinc oxide industry is linked to the zinc LME prices, any movement of the raw material prices is a pass through and gets reflected on the selling price. The industry is fairly well protected in terms of movement in prices of the primary metal index, i.e. LME.

Chart 17: Price trend for zinc oxide in India (Rs/kg)



Source: CareEdge Research

3.4.7 Key Players in India

- **JG Chemicals Pvt. Ltd.**

JG Chemicals Pvt. Ltd. was incorporated in 2001 and is a part of the BDJ Group of Kolkata, India. The company is currently India's largest, in terms of production as well as revenues, for zinc oxide manufacturing. The market share of the company is around 30% as on March 2022. The company is also

amongst top 10 globally for zinc oxide manufacturing. The company is based in Kolkata, West Bengal. JG Chemicals, along with its subsidiary – BDJ Oxides Pvt. Ltd. produce zinc oxide.

The company is engaged in the manufacturing of zinc oxide and has three manufacturing facilities with a capacity of around 46,000 metric tonne per annum (MTPA) for zinc oxide and another around 10,000 MTPA (is under development) for other zinc chemicals (including zinc sulphate). The company has set up an in-house R&D team to develop tailor-made products for various customers. The company strives to reduce carbon footprint by recycling zinc dross and producing zinc oxide through it.

JG Chemicals Group is the only zinc oxide producer in India with IATF certification and it also follows ISO standards. This is preferred by tyre manufacturers supplying to original equipment manufacturers. BOPL has a dedicated production line to produce zinc oxide IP/BP/USP/Eu. Phr³ and zinc oxide Gold Seal grade. BOPL is one of the few players in the industry to have certifications related to pharma industry. BOPL has licenses to cater to the pharmaceutical and other specialty chemicals industry. JG Chemicals is producing over 80 grades of zinc oxide across all its plants to cater to its wide variety of customers.

The company is also a leading supplier to zinc oxide end user industries like tyres, ceramics, paints, footwear, cosmetics etc. JG Chemicals Group is a supplier to 9 out of top 10 global tyre manufacturers and to all of the top 11 Indian tyre manufacturers. Similarly, JG Chemicals Group is also a supplier to top paints manufacturers, footwear players and cosmetics players in India.

- **Rubamin Pvt. Ltd.**

Rubamin Pvt. Ltd. is into chemicals, metal intermediaries, exploration and engineering services, industrial gases production and mineral exploration business. The headquarters of the company is located in Vadodara, Gujarat and has authorized zinc recycling facilities. The company was incorporated in 1987. The production capacity for French process zinc oxide is 22,000 TPA. The company also has other capacities for zinc derivatives. The manufacturing facilities are located in Halol and Nandesari, Vadodara in Gujarat.

- **Silox India Pvt. Ltd.** (erstwhile Transpek-Silox Industry Pvt. Ltd.)

Silox India Pvt. Ltd. is a joint venture set up by the Silox Group of Belgium and Transpek Industry Limited (Shroff Group) of India in the year 2001. The company was incorporated in 1996 and has its corporate office in Gujarat. The company is engaged into manufacturing of chemical derivatives of zinc and sulphur, and caters to diverse end use industries such as textile, paints & coatings, rubber, pharma, polymer, ceramic, paper and personal care. The company has an integrated zinc chain with forward as well as backward integration. The key products of the company include high quality Zinc Dust & Zinc Oxide as well as Zinc Derivates such as Zinc Phosphate, Zinc Carbonate, Zinc Active and Zinc Oxide HSA.

The company is one of the largest manufacturers of Zinc Oxide in India through Continuous Wet Process as the route of manufacturing, producing more than 12,000 TPA of zinc oxide. In this process, high-purity Zinc ingots are converted into a complex Zinc Salt which is then calcined to make Zinc Oxide that is very

³ IP/BP/USP/Eu. Phr refers to Indian Pharmacopoeia, British Pharmacopoeia, United States Pharmacopoeia and European Pharmacopoeia, respectively.

low on impurity profile, and hence high on environment friendliness. The company also holds IP certificate for sales of Zinc Oxide in Pharmaceuticals as well as Cosmetics industries. The company is also a leading manufacturer of 'Active' grade Zinc Oxide which is used for rubber applications.

- **Punia Zinox Pvt. Ltd.**

Punia Zinox Pvt. Ltd. is a part of the Punia Group of Industries engaged into manufacturing of zinc oxide. The group has started its production in Haryana, India in the year 1985. The group together has a production capacity of 12,000 MT per annum. The group also has 3 manufacturing facilities located in Haryana and Gujarat. The major application segments of the Punia group are rubber, phosphate, fire retardants, paint, ceramics, sulphur absorbent, cigarette filters, lubricants, pharmaceuticals, cosmetics, concrete, fungicides, foods, and plastics.

- **Upper India Group of Companies**

Upper India is engaged in the production of zinc oxide grade which is extensively used in manufacturing of rubber products. The company is also involved in distribution and export of zinc oxide in various grades for catering the distinct industry needs like cosmetics, glass & ceramics, agriculture, and other chemicals.

Upper India established its first unit in the year 1959 in Haryana and has two zinc oxide manufacturing units located at Yamunanagar in Haryana and Chhatral in Gujarat.

4. Tyres and Rubber Industry

4.1 Global Overview of Rubber Industry

The rubber and rubber products industry is a diverse industry. Rubber products market includes the sale of rubber products such as tyres, rubber sealants, rubber hoses and other rubber products by the organizations for domestic as well as industrial applications. There are numerous applications of rubber in various industrial sectors like adhesives, belting, padding, automobile sector for belts, moldings, hoses, construction for roofing, sealants and other sectors.

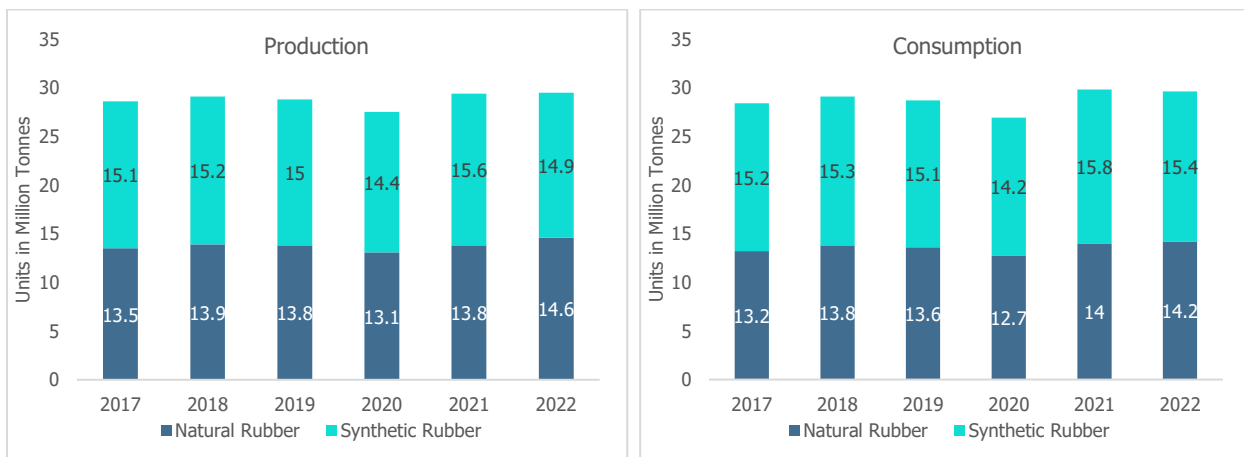
There are two types of rubber: Natural Rubber and Synthetic Rubber. Natural rubber is obtained from the latex of the sap trees which is also a vulcanized rubber that is used to manufacture various rubber products. It has high resistance to tensile and tear. Synthetic rubber is the primary raw material used for the manufacturing of rubber products. Its properties include good elasticity, better heat and aging resistance, better abrasion resistance. Synthetic rubber is often used in surgical gloves and drapes, radial tyres, rubber bands, shoe soles. The demand for synthetic rubber has increased due to the growing demand for non-tyre products, increasing automobile production.

4.1.1 Global Production and Consumption of Rubber

The global production of rubber (natural and synthetic) grew marginally by 0.7% y-o-y in CY22 while the consumption of rubber declined by 0.7% y-o-y in CY22. The ongoing geopolitical tensions due to Russia-Ukraine war has impacted the global supply chain of rubber. In addition, trade restrictions across key rubber markets is further impacting the global demand.

The global production of natural rubber grew by 5.8% y-o-y to 14.6 million tonnes in CY22. The global consumption of natural rubber also grew by 1.4% y-o-y to 14.2 million tonnes in CY22. Thailand, Indonesia and Vietnam have been the top 3 producers of natural rubber and produced 5.2 million tonnes, 2.7 million tonnes and 1.3 million tonnes of natural rubber, respectively, in CY22.

Chart 18: Global Production and Consumption of Natural Rubber and Synthetic Rubber



Source: Malaysian Rubber Council, CareEdge Research

The global production of synthetic rubber declined by 4.5% y-o-y to 14.9 million tonnes in CY22. The global consumption of synthetic rubber declined by 2.5% y-o-y to 15.4 million tonnes. China, USA and Russia have been the top 3 producers of synthetic rubber and produced 3.7 million tonnes, 1.9 million tonnes and 1.6 million tonnes of synthetic rubber, respectively, in CY22.

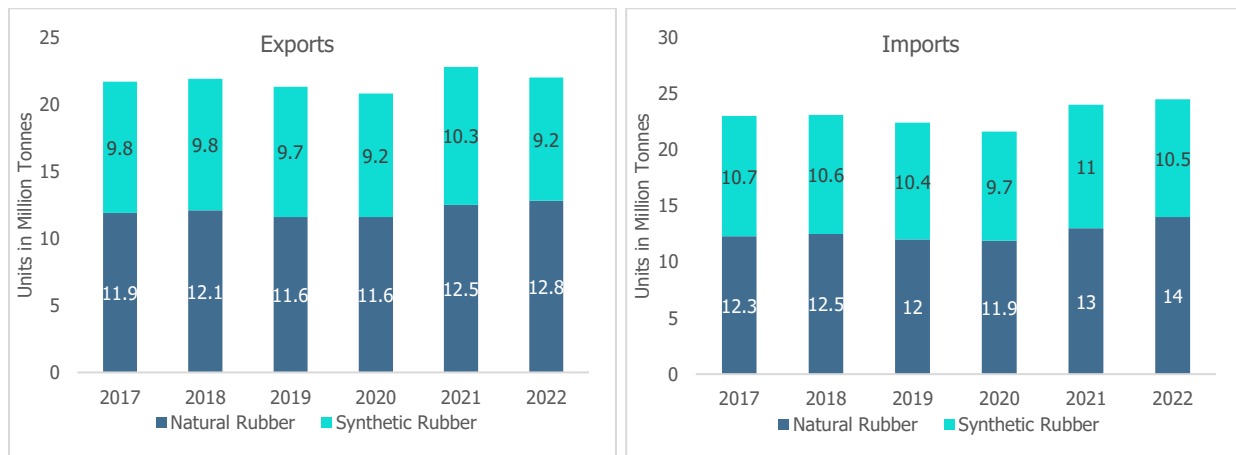
As per National Rubber Policy 2019, the per capita consumption of rubber in India stood at 1.2 kg which is below the global average consumption of 3.6 kg. This signifies an ample scope of opportunity for an increase in rubber consumption by India. For China, the per capita consumption is as high as 6.5 kg.

4.2.2 Global Exports and Imports of Rubber

The global exports of natural rubber grew by 2.4% to 12.8 million tonnes in CY22 while global exports for synthetic rubber declined by 11% to 9.2 million tonnes in CY22. Thailand, Indonesia and Vietnam were the top 3 exporters of natural rubber with exports of 4.4 million tonnes (85% of production), 2 million tonnes (82% of production) and 2.1 million tonnes, respectively, in CY22. South Korea, Russia and USA were the top 3 exporters of synthetic rubber with exports of 1.5 million tonnes, 0.7 million tonnes, 0.9 million tonnes respectively in CY22.

The global imports of natural rubber units grew by 7.7% to 14 million tonnes in CY22 while global imports for synthetic rubber declined by 4.5% to 10.5 million tonnes during the year. The top 3 importers of natural rubber were China, Malaysia and Vietnam with imports of 5.6 million tonnes, 11.1 million tonnes and 1.1 million tonnes, respectively, in CY22. The top 3 importers of synthetic rubber were China, USA and Vietnam with imports of 1.4 million tonnes, 0.7 million tonnes and 0.6 million tonnes, respectively in CY22.

Chart 19: Global Exports and Imports of Natural Rubber and Synthetic Rubber



Source: Malaysian Rubber Council, CareEdge Research

4.2.3 Key applications and growth drivers of rubber industry

The key applications of rubber industry and growth drivers are mentioned below: -

- **Increasing demand in automobile and tyres industry**

- **Tyres usage: -**

Rubber industry is directly related to automobile industry. Tyres are the main components used in the automobile industry where there is maximum rubber usage. The increased production in automobile industry supported by high disposable income and rise in demand for electric vehicles will drive the growth of rubber industry. Also, an increase in tyre replacement demand, which is around 55% of the total tyre demand, will increase tyre consumption, further leading to growth in demand of rubber industry.

- **Non-Tyre usage: -**

Rubber is used for variety of purpose in all the categories of vehicles like transmission systems, foams, tyres, sealants, adhesives and coatings, wipers, blades, moulded parts, flat seals, hoses, engine seals, body and spare parts.

- **Other sectors: -**

- **Textile & Footwear industry: -**

A wide range of rubber products are used in the textile industry. Some of the products include rubber coating, rubber footwear, rubber rollers, rubber suits, rubber moulded products. With the increasing demand in footwear industry due to the durability, resistance to slip properties of rubber, the demand for rubber products increase with the growth in the footwear industry.

- **Medical and healthcare industry: -**

Rubber is used for medical supplies and in various products and devices in the medical industry. Some products used in medical industry that involves rubber includes latex gloves, tubing, blood pressure cuffs, rubber medical masks, rubber bladders, rubber rollers, rubber cords, diaphragms etc.

- **Other industries: -**

Other industries where rubber usage is included are aerospace, chemical, construction, defence, mining, petroleum, defence, medical, power generation, printing and paper industries.

- **Increased radialization**

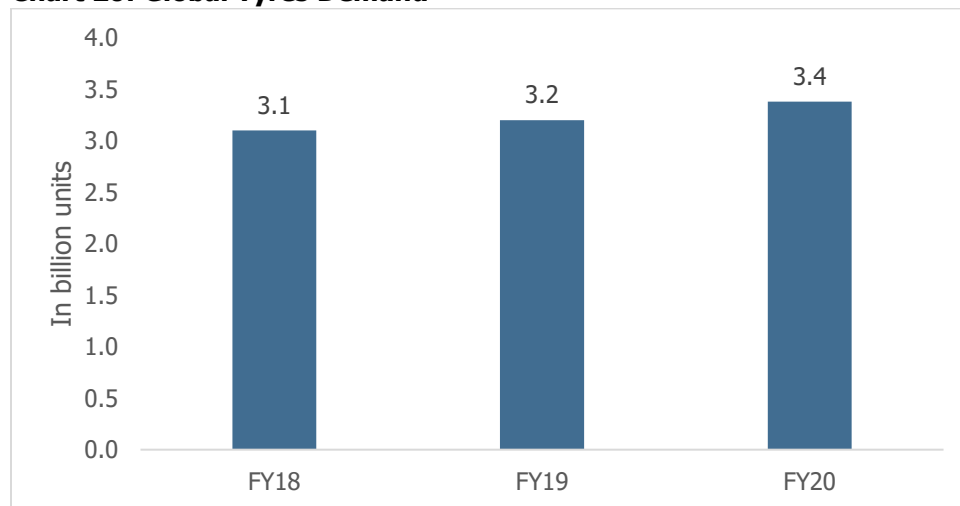
The demand for radial tyres is increasing globally as it consumes less fuel and delivers higher quality tyre life. Increased radialization of tyres that will be used in various categories of vehicles will further increase the demand for rubber.

4.2 Overview of Global Tyres Industry

4.2.1 Overview of Global Tyres Industry

The growth in the global tyres market is driven by expansion in global production and sales of vehicles. The Asia-Pacific region accounts for highest demand due to the technological advancements and key R&D investments by major market players. The global tyres market has been classified into radial and bias tyres. The radial tyres segment is growing faster on account of reduced fuel efficiency, lower ground damage, lower transverse slip.

Chart 20: Global Tyres Demand



Source: Company Annual Reports, CareEdge Research

The global tyres industry demand grew with a CAGR of 3% from FY18 to FY20. It was primarily driven by rising vehicle production along with increasing replacement demand. In FY21, the global tyres industry was affected by the mobility restrictions imposed by the government due to the geopolitical tensions around Russia-Ukraine and resurgence of Covid-19 cases in China. In FY22, the tyre industry growth was supported by demand for premium and high-performance tyres specifically in developed markets.

Table 7: List of top 10 tyres companies in the international market

S. No.	Company	S. No.	Company
1	Michelin	6	Pirelli & C. S.p.A.
2	Bridgestone Corporation	7	Hankook Tire & Technology
3	The Goodyear Tire & Rubber Company	8	Yokohama Tire Corporation
4	Continental AG	9	Zhongce Rubber Group Co; Ltd.
5	Sumitomo Rubber Industries Ltd.	10	Maxxis International

Source: CareEdge Research

4.2.2 Key applications and growth drivers for Global Tyres Industry

- **Growing automobile industry**

The increased production in the automobile industry supported by rising demand for electric vehicles along with increasing preference of personal mobility will drive the growth of global tyres industry. With continued development in infrastructure spending like improved road infrastructure, increased construction activities, rise in e-commerce and the increasing logistics demand will further help in the growth of automobile sector.

- **Increasing demand for agricultural equipment**

There are agricultural tyres used for various agricultural purposes. The farm tractor, forklift, grain carts run on rubber tyres and these are used for a wide variety of special services such as gardening, moving, terrain vehicles. The agricultural tyres are designed in such ways that helps in operating on different requirements.

- **Recovery in construction equipment segment**

Industrial rubber products are highly demanded in the construction industry. Excavators, cranes, fork lifts, concrete mixer machines, lift truck are used for various construction purposes that are all fitted with tyres and tracks made of rubber. With the increasing construction activities, the demand for such vehicles will increase, further increasing demand for tyre.

- **Aviation Industry Demand: -**

With the increasing air traffic mainly due to the rapid recovery in most international routes post the pandemic, there is an increasing demand for air travel. This in turn is leading to increase in demand for aviation tyres.

4.2.3 Outlook for Global Tyre Industry

The global tyres industry is highly competitive market and the demand is primarily driven by increasing vehicle production, rising demand for radial and premium tyres, and increasing replacement demand across various geographies. The automobile industry has gone through various structural changes over past few years which in turn affected the demand in the tyres industry. The replacement demand has significantly higher share as compared to OEM demand. Replacement demand for tyres is at record high in line with improving economic activities. However, transition towards electric vehicles is expected to support demand in the new tyre segment over the long term. The demand for radial tyres is also expected to pick-up with the increasing demand for passenger car and two-wheelers. The demand for bias tyres is also expected to gain momentum with the growing demand in the commercial vehicle segment.

The global tyre demand is also expected to grow with stringent OEM requirements and evolving regulatory changes in tyre technology to provide enhanced value to customers and suit requirement of new-age vehicles. Electric vehicle adoption is rapidly growing across the world and the industry is actively working towards innovative solutions to address the evolving needs and producing tyres that are more fuel efficient with lower rolling resistance, low noise, higher grip, and wear resistant.

Major global tyre companies are planning to shift their production facilities to countries like India, South-East Asia and China to accrue the benefit of low production costs. The global markets, especially Europe and USA have shown good demand traction post pandemic and these markets are looking for a China-plus-

one strategy to de-risk supply chains. Many auto companies are also expanding their production in India and this will result in healthy demand growth for tyres. In addition to this, automobile exports from India will also aid the demand for tyres. On an overall basis, developed and emerging economies will continue to recover but growth might be restricted due to higher inflationary pressure, supply chain disruption and the ongoing geo-political tensions.

4.3 Indian Overview on Rubber Industry

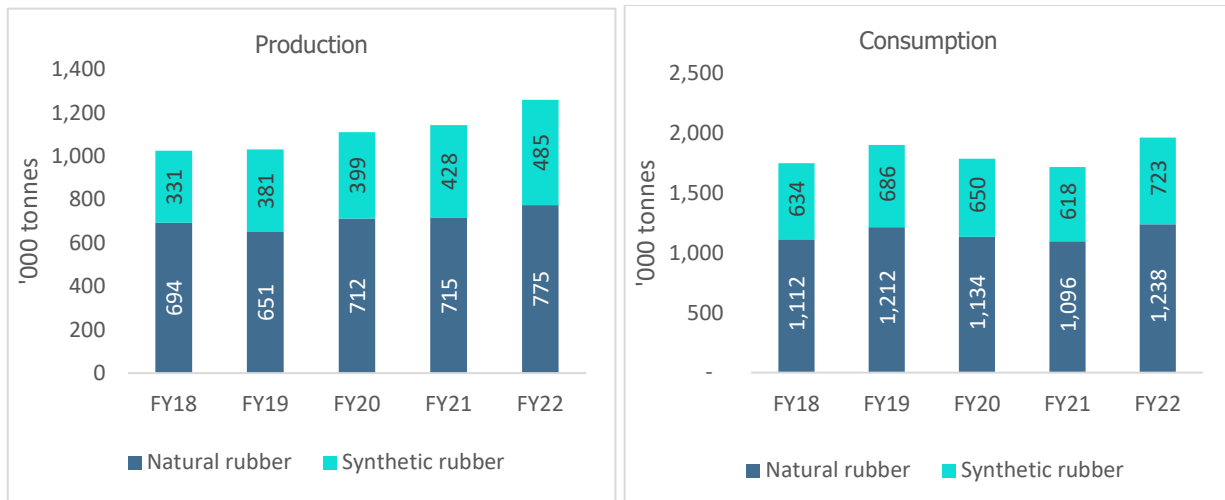
Indian rubber industry is characterized by the co-existence of a well-established rubber production sector and a fast-growing rubber product manufacturing and consuming sector. India is the 5th largest producer of natural rubber. The rubber industry value chain begins from natural rubber plantations and ends with a huge range of dry rubber and latex based products. The key factors which have contributed to the growth of Indian rubber industry are positive intervention of institutional agencies aiming at self-sufficiency and import substitution. The rubber consumption in India is mostly in automobile sector, civil and aviation sector, railways and agricultural transport, pharmaceuticals, steel plants and mines, aeronautic, and textile engineering industries. Its application can be in automobile tyre, bicycle tubes and tyres, belts and hoses, footwear, latex and other products. Traditional rubber-growing states comprising Kerala and Tamil Nadu account for 81% of production. Major non-traditional rubber growing regions are the North Eastern states of Tripura, Assam and Meghalaya, Odisha, Karnataka, Maharashtra and West Bengal. The growth of the rubber industry is enhanced by the boom in the automobile industry and rapid industrialization.

4.3.1 Production and Consumption of Rubber

India is currently the 5th largest producer of natural rubber in the world. The total production in India stood at 775,000 tonnes (0.78 million tonnes) in FY22. Ribbed smoked sheet rubber accounted for around 63% of natural rubber production in FY22 followed by solid block rubber (20%) and latex concentrates (14%) as per the Rubber Board of India.

India is the 2nd largest consumer of natural rubber globally with consumption of around 1.3 million tonnes in CY21. As per the Rubber Board of India, ribbed smoked sheet rubber, solid block rubber and latex concentrates accounted for 42%, 48% and 8%, respectively, in natural rubber consumption during FY22. Around 40% of the total natural rubber consumption in India is at present met from import of rubber. About 70% of natural rubber consumption in India is in the automobile tyres sector.

Chart 21: India Production and Consumption of Natural Rubber and Synthetic Rubber

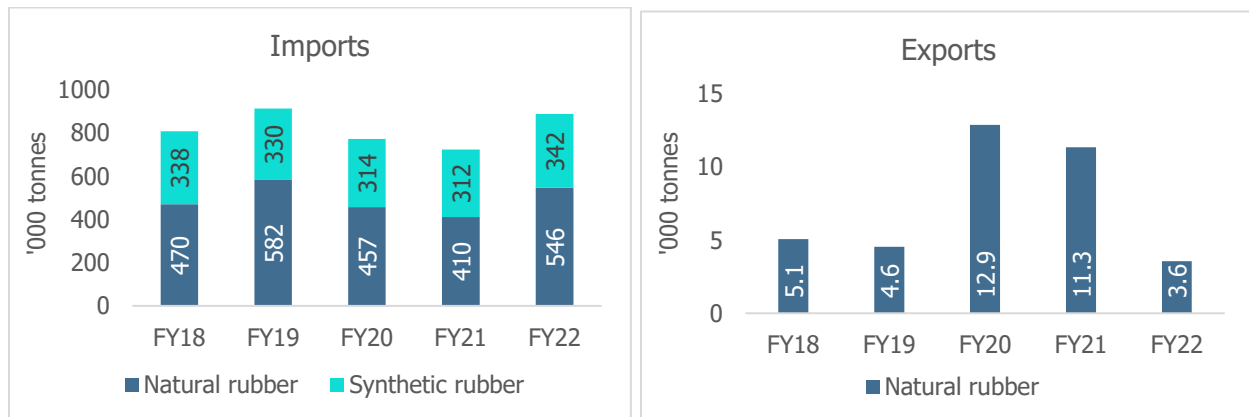


Source: Rubber Board of India, CareEdge Research

4.3.2 Exports and Imports of Rubber

India is dependent on imports of rubber to meet the requirement. The imports of natural rubber was 546 thousand tonnes and synthetic rubber was 342 thousand tonnes in FY22.

Chart 22: India Imports and Exports of Natural Rubber and Synthetic Rubber



Source: - Rubber Board of India, CareEdge Research

4.3.3 Key applications and growth drivers of rubber in India

- **Automobile Industry**

- **Tyre usage: -**

The rubber industry is directly related to automobile industry. Tyre industry in India accounts for around 70% of rubber consumption in India. The automobile industry depends on the

production and quality of rubbers. The increased production in the automobile industry supported by rising demand for electric vehicles will drive the growth of rubber industry.

- **Non-Tyre usage: -**

Other applications of rubber in vehicles includes matting, flooring, hoses, belts wiper blades. It is used in the vehicles like rubber bumper, rubber air bags, rubber seal in various categories of vehicle like passenger vehicles, commercial vehicles, two-wheelers, three-wheelers, tractors.

- **Other industries**

Rubber is also used in various other industrial applications like conveyor belts, floor and wall coverings, roll coverings, vibration control products, transmission belts, weather stripping products, sheet & film, elevators, conveyor belting, geo-membranes and fabricated rubber products. It is also used in medical industry like rubber gloves, rubber tubing, rubber injection parts. Other industries where rubber products are used includes aerospace, chemical, construction, defence, mining, petroleum, textile industries.

4.4 Overview of Tyre Industry in India

4.4.1 Overview of Indian Tyre Industry

The size of Indian tyres Industry is estimated around Rs 75,000 crores in FY23. With 41 tyre companies and 62 tyre manufacturing plants, this sector produces the largest variety of tyres in the world.

Table 8: India Tyres Industry

Turnover of Tyre Industry	Rs 75,000 crores in FY23
Tyre Production	169.1 (Million Units) in FY21
Number of Tyres Companies	41
Exports	3.6 (million units) in FY21
Industry Concentration	10 Large tyre companies account for over 95% of total tyre production.
Radialization level - current (as a % of total tyre production)	OEM – 78% Replacement -47%

Source: - Automotive Tyre Manufacturers Association (ATMA), Industry Sources, CareEdge Research

Indian tyre industry has witnessed intense competition between the domestic players and the Chinese tyre manufacturers. The level of competition by international player is significantly higher in the trucks and buses segment which is price sensitive. However, measures taken by the government like imposition of anti-dumping duty (implemented in September 2017) and anti-subsidy countervailing duty (implemented in July 2019) on tyre imports from China have helped Indian tyre manufacturers. Diverse product offerings and strong focus on the replacement market have enabled the companies to sustain the established market position.

Table 9:List of top 11 tyre companies in India

S. No.	Company	S. No.	Company
1	MRF Ltd.	7	TVS Srichakra Ltd.
2	Apollo Tyres Ltd.	8	Goodyear India Ltd.
3	CEAT Ltd.	9	Continental India Pvt. Ltd
4	JK Tyres & Industries Ltd.	10	Michelin India Pvt. Ltd.
5	Balkrishna Industries Ltd.	11	Yokohama India Pvt. Ltd.
6	Bridgestone India Pvt. Ltd		

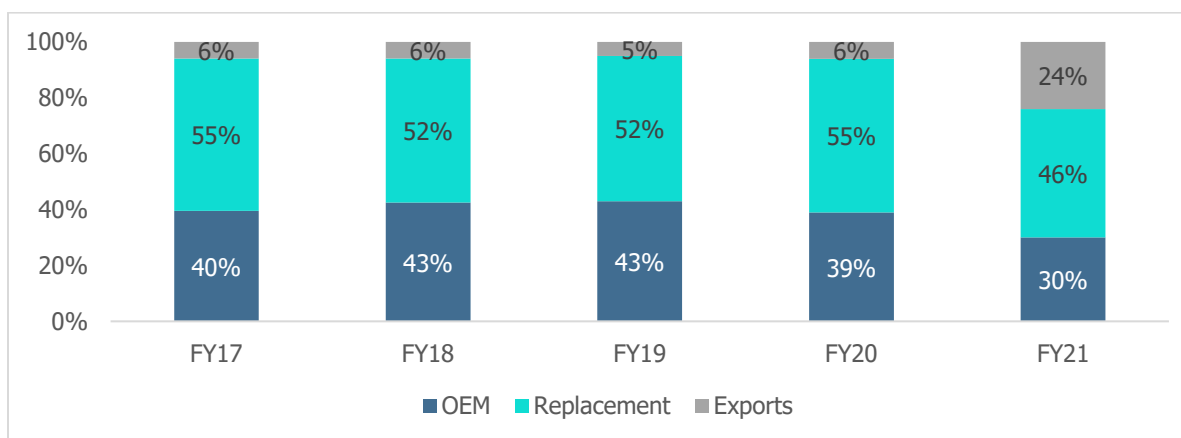
Source: CareEdge Research

Market Dynamics

Tyre demand originates from two end-user categories- Original Equipment Manufacturers (OEMs) and the replacement segment. Demand from the replacement segment dominates the Indian tyre market contributing about 55% of the total volume, while the OEMs account for the rest 45%. Consumption by OEMs is dependent on new automobile sales trend while the replacement segment is linked to usage patterns and replacement cycles. Replacement demand remains a major consumption source in India.

There was a rising trend observed in the industry up until FY19 on the back of high demand from the replacement segment, the trend reversed as the pandemic hit and there was a decline in the sales numbers. The contribution of OEMs to the tyre industry volumes has declined consistently. This segment formed 30% of the industry demand in FY21. The replacement segment constitutes around 46% of volumes. Exports continued to remain strong as India benefited from imposition of anti-dumping duties (ADD) by US on China and with increased acceptance of Indian tyres globally and healthy demand from top export destinations such as the US, the UK and the European nations. The top 5 exports markets for India in FY21 were US, Germany, France, Italy and UK. As per the ATMA report, India now exports over to 170 countries in the world.

Chart 23:Tyre end user segmentation share (%)



Source: CMIE, CareEdge Research

Types:

Radial Tyres:

To increase structural integrity, radial tyres are constructed with perpendicular polyester plies and crisscrossing steel belts underneath the tread. This construction provides a smooth ride and extends the life of the tyre. Radial tyres are generally used for long-haul towing, travel trailers, toy haulers, larger boats and livestock. In radial tyres the steel belts run at a 90-degree angle with the tread line. It allows the sidewall and the tread of the tyres to function independently. Thus, there is low sidewall flex and more contact with the ground. Though cross-ply tyres are still widely accepted in India due to its adaptability on poor road conditions, radial tyres are consistently gaining ground on the back of the inherent benefits. Over the last few years, India has seen an increased adaption of radial tyres technology. Though India has achieved almost 100% radialization in the PV tyres segment, the country still has a lot of growth potential in the CV and two-wheeler segments. On the backdrop of increase in R&D spending by the domestic tyre manufacturers for making cost-effective radial tyres, coupled with growing low-cost Chinese imports, the process of radialization of CV and two-wheeler segments is expected to happen at a faster pace. Zinc oxide produced through French process is generally preferred in radial tyres.

Bias Tyres:

A bias tyre's construction consists of internally crisscrossing nylon cord plies at a 30 to 45-degree angle to the tread centre line. This design gives the tyre a tough and rugged build and increases sidewall puncture resistance. Bias technology is generally used for construction, agriculture, marine and utility applications. In bias ply tyres the nylon belts run at 30 to 45-degree angle with the tread line. The multiple, over lapping rubber plies in these tyres connect the sidewall and tread. The stiff internal construction causes less contact with the ground and may result in overheating. Radial tyres generally cost 20-25% higher compared to bias tyres, as larger amount of steel is required due to which the cost of manufacturing also slightly increases.

4.4.2 Production

The tyres industry has high correlation with the automobile industry. Over the past few years, the production of tyre industry has been in line with the production and sales of the automobile industry. There has been decline in automobile industry performance since last 2-3 years due to Covid-19 pandemic, increased fuel and raw material price inflation, semi-conductor shortage, increased acquisition cost and geopolitical tensions.

Apart from the demand for tyres from the auto OEMs (Original Equipment Manufacturers), the industry's demand is also supported by stable replacement volumes which constitutes approximately half of the total demand for tyres.

Table 10: India Automobile Industry Production Trend (in units)

Category	FY17	FY18	FY19	FY20	FY21	FY22	FY23
Passenger Vehicles	3,801,670	4,020,267	4,028,471	3,424,564	3,062,280	3,650,698	45,78,639
Commercial Vehicles	810,253	895,448	1,112,405	756,725	624,939	805,527	10,35,626
Three Wheelers	783,721	1,022,181	1,268,833	1,132,982	614,613	7,58,669	8,55,696
Two Wheelers	19,933,739	23,154,838	24,499,777	21,032,927	18,349,941	1,78,21,111	1,94,59,009

Total	25,330,967	29,094,447	30,914,874	26,353,293	22,655,609	2,30,40,066	2,59,31,867
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Source: SIAM, CareEdge Research

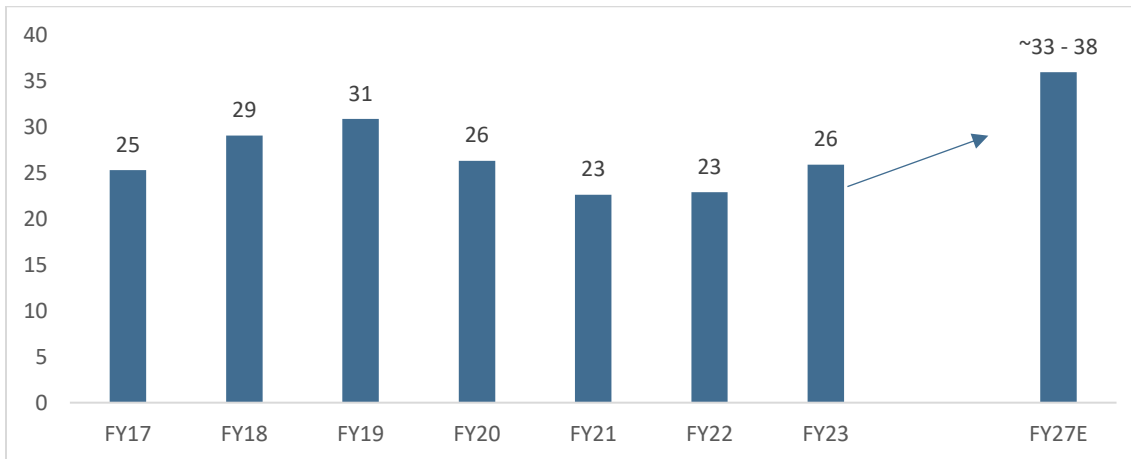
Note: Data excludes quadricycles production trend

The overall automobile production grew by 13% in FY23. With the improvement in domestic demand sentiment in passenger vehicle and commercial vehicle segments along with ease in availability of semi-conductors and improving supply chain issues, the production of automobile industry increased during the year. Further, the demand for EVs was driven by a push from the government policy framework, a significant increase in oil prices, the development of the EV charging infrastructure and overall ecosystem and the availability of the right product at the right price with increased customer acceptance.

Automobile industry outlook

The automobile industry nevertheless is expected to grow at a CAGR of 6%-8% over the next 4 years from FY23-FY27 with demand likely to be buoyant amidst the ongoing geopolitical challenges with FY24 expected to post a growth of 7%-9% during the year. Many automobile OEMs are expected to embrace new technologies in the electric mobility space which is expected to witness a slew of launches in various vehicle categories in the coming years.

Chart 24: Outlook for Indian automobile industry production (in million units)



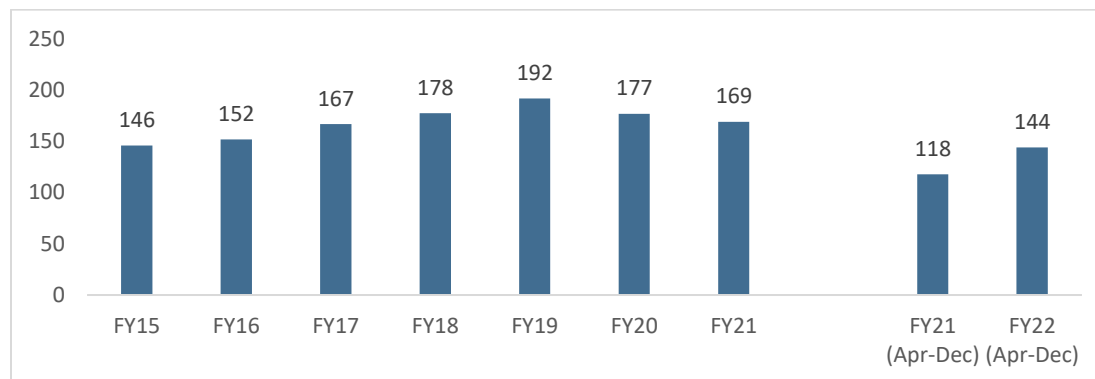
Source: CareEdge Research estimates and SIAM

The improvement in commercial vehicle segment production will be led by government’s continued focus on improving infrastructure and construction activities along with increase in e-commerce activities and pick up in increased fleet utilization levels. The two-wheeler and three-wheeler segment is also expected to show improvement led by increased budgetary allocation to rural and agriculture sectors, uptick in demand from rural as well as urban markets and Government’s subsidies towards electric two-wheeler and three-wheeler space. The production in passenger vehicle segment is likely to grow over the long term led by new launches made by the OEMs both in ICE and electric vehicle space and increase in demand from premium and SUV segment.

The Government’s push for enhancing productive capacity with local manufacturing along with investments into electric vehicle space (FAME-II scheme) will further help in strengthening overall aggregate production

and demand. The government announced PLI scheme for semi-conductors in December 2022 and has proposed to provide incentives of Rs 76,000 crores for the development of semiconductors and display manufacturing ecosystem over the next 6-10 years. This initiative will further help to strengthen the domestic semiconductor manufacturing capacity and support the automobile industry.

Chart 25: Production of tyres in India (in million units)



Source: ATMA and CMIE, CareEdge Research

During FY17 to FY21, tyre production in India increased by a marginal CAGR of 0.32% from 167 million units in FY17 to 169 million units in FY21. Tyre production, however, during the period FY15 to FY19 (the period before automobile industry slowdown in FY20 and Covid-19 pandemic affected year FY21) had increased by a CAGR of 7.1% from 146 million units in FY15 to 192 million units in FY19 and that of automobile production increased by a CAGR of 7.3% from 23 million units in FY15 to 31 million units in FY19. The momentum in CAGR indicates the potential these two industries have going forward. Had it not been for disruptions in two years FY20 and FY21, tyres and automobile industries would have witnessed an improvement in production in these two years. Nevertheless, with revival in economic activities in India, the production from these two industries is expected to see an uptrend and would cross the production levels of FY19 moving ahead.

Of the total tyres produced in India during the last five years in FY17 to FY21, 2W & 3W tyre segment accounted for 56% on an average in total production. This was followed by passenger cars and trucks and buses segment with an average share of 23% and 10% respectively during these years.

Table 11: Segment wise production (in million units)

Tyre Segment Wise Production (in million/numbers)	FY16	FY17	FY18	FY19	FY20	FY21
Truck & Bus Tyre Production	16.8	16.3	18	20.8	18	18.4
LCV Tyre Production	9.7	10.2	10.3	11.8	11.2	9.6
Passenger Car (including Jeep) Tyre Production	38.7	41.6	42.8	42.8	40.8	38.9
Farm/Tractor (including Front, Rear & Trailer) Tyre Production	5.7	6.1	6.6	7	5.8	6.8
2W & 3W Tyre Production	79.9	91.4	98.7	108	99.8	93.8
OTR Tyre Production	0.5	0.8	0.9	1.1	1	1.1

Other (ADV and Industrial) Tyre Production	0.7	0.5	0.4	0.4	0.4	0.5
Total	152	167	178	192	177	169

Source: ATMA, CareEdge Research

In the overall sales of tyres in unit terms, the commercial segment contributes about 21% while the remaining comes from sales of personal vehicles which include passenger vehicles, two and three wheelers.

Commercial Vehicle Industry Cycle

The Indian Commercial Vehicle (CV) Industry is the lifeline of the economy. About two-thirds of goods and 87% of the passenger traffic in the country moves via road. The growth in Medium and Heavy Commercial Vehicle is considered to be a crucial indicator for pickup in investment activity while growth in Light Commercial Vehicle is considered as indicator of consumption demand.

The commercial vehicle cyclical pattern directly depends on the state of economy. Past trends show that the CV industry has a 4-5-year cycle, with the growth in demand moving closely with the growth in industrial activity. Thus, during periods of economic downturns, the industry experiences a huge decline in demand, which is a matter of high concern for an industry which is capital intensive by nature. In order to reduce this dependence on economic activity, manufacturers need to diversify into other economies. Technological tie ups with players having strong international presence can help manufacturers to expand globally and thereby reduce their correlation with domestic economic cycles.

The MHCV segment contributed to around 63% of total CV sales in India while the LCV segment contributed to around 37% share in FY23 as per SIAM sales data. The MHCV segment can be further classified into two segments, trucks and buses. The LCV segment can be classified into goods carrier and passenger carrier. The MHCV segment generally caters to the logistic companies for long distance transport and companies in infrastructure, metal and mining sectors. Therefore, the growth of this segment is considered to be a good indicator of industrial and infrastructure growth in the economy. The LCV segment is usually required for short haul transportation and last mile connectivity. The growth of this segment indicates growth in consumption demand.

The CV industry draws its demand from the economy and hence is prone to cyclicity. However, due to greater versatility of usage, the LCV demand is less cyclical than the M&HCV demand. The industry is capital intensive in nature but with CV manufacturers moving towards increased ancillarisation, the initial capital outlay for setting up a greenfield plant has decreased substantially. Instead manufacturers are now directing significant effort towards vendor development and rationalization. The industry is highly susceptible to technological changes.

With environmental norms becoming stricter and consumers demanding better technology vehicles, it has become imperative for the manufacturers to either have technology partners or a strong in-house R&D. The need of having a wide product range in each of the segments along with the short lifecycle of these vehicles makes it mandatory for the manufacturers to constantly innovate so as to sustain competition. These factors together increase the entry barriers to this industry making it an oligopolistic market.

As per SIAM sales data, the commercial vehicles segment posted sales volume growth of 34% y-o-y in FY23, the 2nd highest domestic sales, and is close to the previous peak of FY19. The industry has shown very good performance growth due to structural upcycle over the past few years. In FY23, the demand sentiments across the segments showed healthy growth led by infrastructure spending by the Central

Government, improved freight availability, and pre-buying ahead of the implementation of phase-II of the BS-VI emission norms. This growth was driven by robust demand for heavy trucks in light of the strong infrastructure push by the Government and increased activity in construction, and mining segments. Healthy demand from e-commerce, as well as agriculture and allied sectors, aided the sales of goods carriers in the LCV segment.

Commercial vehicle sales are likely to remain stable going forward in FY24 due to sustained demand from infrastructure construction, logistics as well as agricultural sectors, e-commerce, and state transport authorities (STAs). There might be some pull in growth rate going forward due to upcoming general elections slowing project execution below normal monsoon and the past 2 years of robust growth. Going forward, the push towards public transportation in urban areas along with the focus on clean technology, and special mobility zones with zero fossil-fuel policy will lead to increased adoption of EV passenger carriers and buses in CV space.

With the government's continuing thrust on infrastructure development, the overall CV demand is expected to grow in FY24 led by increase in infrastructure construction activities. The government has announced a 33% increase in capital expenditure to Rs.10 trillion for infrastructure development in the Union Budget 2023-24, which is almost 3.3% of India's GDP. The Union Budget 2023-24 also allocated Rs.750 billion towards 100 critical transport infrastructure projects for last-mile connectivity for ports, coal, steel, fertilizer and food grains sectors. Under the National Infrastructure Pipeline (NIP), infrastructure projects worth Rs.40 trillion are currently under implementation. In addition to that, the outlay towards the flagship housing scheme, the Pradhan Mantri Awas Yojna (PMAY) has been enhanced by 66% y-o-y to Rs.790 billion in the Union Budget 2023-24. Under the PMAY-Gramin, the government has set a target to complete 29.5 million houses by 2024. Under the PMAY-Urban, the target of 11.2 million homes by 2024 has been set. This is likely to speed up the completion of houses to be constructed under the scheme during the year. Project completions in the real estate sector are expected to touch an all-time high in the year 2023-24. These will lead to traction in construction activities during the year 2023-24. This will support the demand for trucks, including tippers and haulage.

Overseas demand for commercial vehicles is likely to remain sluggish going forward led by the current geopolitical and sluggish demand in key export markets. However, OEMs are trying to compensate by exporting to other countries. Further, commercial vehicle prices are expected to rise since the OEMs are investing in upgrading the vehicles to meet stricter emission norms (BS-VI Phase 2) from April 2023. It will further increase the cost of acquisition for customers. Going forward, high inflation and interest rates, foreign exchange fluctuations, and fears of a recession in the global markets might dampen the sentiments thereby impacting sales in the medium term.

Chart 26: Sales (including exports) of Commercial Vehicle Industry



Source: SIAM, CareEdge Research

4.4.3 Imports & Exports

India’s total exports grew with a CAGR of 18% over FY18-FY23 with India’s imports declined at a CAGR of 39.6% over the same period.

- Tyre Exports**

While tyre industry witnessed decline in FY21 amidst the pandemic, exports continued to remain strong with increased acceptance of Indian tyres globally and healthy demand from top export destinations such as the US, the UK and the European nations. Further, the exports surged in FY22 on account of strong global demand during the year. However, there was decline in tyre exports due to the ongoing geopolitical tensions that led to some trade restricts across key tyre markets.

Table 12: Segment-wise exports of Tyres & Tubes

Tyre Exports (in '000 units)	Trucks Buses & PV	Farm & Tractor	2 - Wheeler
2017-18	3,349	1,941	3,439
2018-19	3,575	2,095	3,427
2019-20	3,627	2,187	3,481
2020-21	3,392	2,405	4,360
2021-22	6,217	7,188	6,984
2022-23	5,413	7,461	5,765
CAGR over 5 years (%)	10.9	37.4	13.9

Source: ATMA and CMIE, CareEdge Research

- Tyre Imports**

The imports have been declining continuously since FY19. Restrictions imposed by the Government of India on imports and anti-dumping duties (ADD) on China has led to the decline in imports.

Table 13: Segment-wise imports of Tyres & Tubes

Tyre Imports (000' Units)	Trucks & Buses	PV	Two Wheeler
2017-18	1,153	5,974	2,785
2018-19	845	5,831	3,182
2019-20	591	5,982	1,932
2020-21	168	1,386	363
2021-22	124	1,962	247
2022-23	68	911	332
CAGR over 5 years	-46.7	-37.1	-43.2

Source: CMIE, CareEdge Research

4.4.4 Investment Trends and Capex Additions

The automobile industry is witnessing new capacity additions across all the major segments, namely electric vehicles, commercial vehicles, passenger vehicles and two and three wheelers. The planned spending is aimed primarily at adding manufacturing capacity, debottlenecking of factories, upgrading technology and research and development.

The top 5 domestic tyre manufacturers have incurred capital expenditure of around Rs 30,000 crores over last 4-5 years. As a result, the capacity utilization currently has reduced. Despite the same, the tyre industry is expected to incur a capital expenditure of more than Rs 20,000 crores over next 4-5 years. The planned spending is aimed primarily at adding manufacturing capacity, debottlenecking of factories, upgrading technology, and research and development.

India's tyre industry's turnover is estimated at Rs 75,000 crores in FY23. In the last three years, the tyre industry in India has completed cumulative investment of more than Rs 35,000 crore in new capacity creation and debottlenecking. As per Automotive Tyre Manufacturers Association (ATMA), the investments span across all the key tyre segments with major focus on truck & bus and passenger car radial manufacturing. The new capacity will help the industry achieve a turnover of Rs 1 lakh crore in the next three years. The new capacities will go on stream over the next couple of years to meet the growing demand, particularly since demand is expected to be strong in view of the uptick in economic activities and the big push expected in infrastructure growth. Different segments of the domestic auto industry have already reached or are reaching pre-pandemic levels in size and scale which has helped tyre demand.

Premiumisation of the passenger car market (in the Utility Vehicle Segment) is creating an exponential rise in demand for high profile tyres. The recent move by the government regarding non-renewal of registration of 15-year-old government vehicles owned by the Centre and the state governments, local government bodies, state transport undertakings and PSUs, more fuel efficient and technologically advanced vehicles phasing out old vehicles will create demand benefitting a host of associated sectors including tyres.

Capex Additions in automobile and tyres industry

The subdued project completions in the last two years in the automobile industry were primarily due to impacted by Covid-19 and slowdown in demand from the automobile original equipment manufacturers (OEMs). However, with the improvement in demand and consumer sentiments, the automobile OEMs are

ready to make investments for new capacity expansion, new products, electric vehicle segment and developments in new technologies. The automobile industry capex are as follows: -

- Maruti Suzuki Private Limited has committed the capex of Rs 8,000 crores for FY24-25 for new models. Suzuki Motors Gujarat has also made the total investment of Rs 10,000 crores on electric vehicle and its battery.
- TVS Motors expects to incur capex of Rs 12,000 crores in FY24 that will be used for investments in electric vehicle and other new products and emerging technologies.
- Hero Motocorp Limited committed capex of up to Rs 1,000-1,500 crores for next 2-3 years in premium motorcycles and electric two-wheeler space.
- Ashok Leyland is planning to incur capex in the range of Rs 600-750 crores in FY24 to expand its LCV portfolio and new product development.
- Mahindra & Mahindra is expected to invest Rs 15,900 crores for enhancing production capacity both in passenger vehicle segments as well as tractors segment from FY22-FY24. An additional capex of Rs. 1,600 crores will be incurred for ICE vehicles for the anticipated regulatory changes and capacity expansion and Rs. 1,125 crores for the electric vehicle segment.
- Tata Motors Limited is expected to spend Rs 38,000 crores towards capex with investments to be made in passenger vehicle, commercial vehicle, electric vehicle segment in its standalone business along with JLR business in FY24
- Hyundai Motor India Ltd. plans to invest Rs 4,000 crore in electric vehicles space in India by 2028.

The tyre manufacturers like Apollo Tyres Limited, Ceat Limited, MRF Tyres, JK Tyres Limited and Balkrishna Industries Limited will be adding tyre manufacturing capacities during the year through their respective projects:

- Apollo Tyres has committed a capex of Rs. 1,100 crores for current fiscal year FY24.
- MRF Tyres is planning to invest Rs 1,000 crores as capex which will be used for the expansion of manufacturing facility and creation of new specialty assembly line near Hyderabad.
- JK Tyres Limited has estimated capex of Rs 790 crores for FY24 which includes Rs 560 crores towards passenger radial tyre segment and Rs. 230 crores on truck radial tyre segment.
- Balkrishna Industries Limited has planned capex of Rs 1,100 crores for capacity expansion in FY24.

The growth in capex in automobile and tyre industry will drive the demand for zinc oxide in the domestic market.

4.4.5 Trends in Tyre Industry

The latest trends in the tyres industry are: -

1. Radialization:

Improved road infrastructure, coupled with government's curbs against overloading of trucks along the major freight corridors, is paving way for a structural shift in the country's tyres industry. The traditional cross-ply tyres for trucks and buses is losing its sheen and is being replaced by radial tyres. Radial tyres are designed and manufactured to offer increased durability to provide powerful grip and stiffness. They are extra thick that safeguards from shocks and damages and it also supports the vehicle to consume lesser fuel.

2. Emergence of Tubeless Tyres:

Tubeless tyres are the substitute to the old-style pneumatic tyres due to the augmented dependability and safety they propose. It is comparatively safer to drive vehicle on an advanced speed in the event of puncture at a high speed. Similarly, they have lengthier life span as equated to the air-filled equivalents. Extended working life expectancy, low-slung maintenance and stress-free repair is expected to power the demand for these tyres.

3. Smart Tyres:

Smart tyres are equipped with sensors that measures various parameters like any corrosion, frictions, temperature, air pressure. The leading tyre OEMs have started manufacturing IoT enabled tyres that have increased demand for such tyres both in domestic as well as international markets.

4. Electric Vehicle Tyres

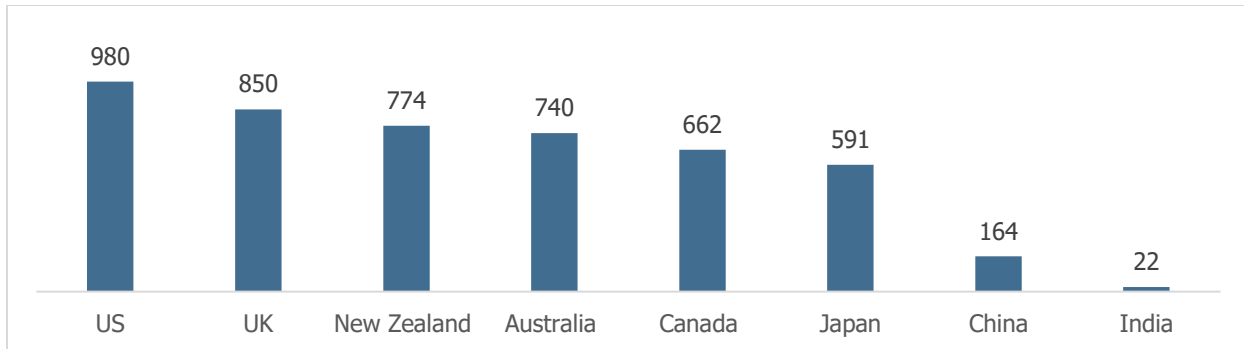
The technology behind tyres use on electric vehicles (EVs) is evolving and enhancements over the coming years should be expected as the vehicles evolve. EV tyres have a stronger sidewall to handle the weight of the battery and the car components.

4.4.6 Growth drivers of Tyre Industry

The growth drivers for tyres industry are mentioned below:

1. Low car penetration & Rising family income:

The growing domestic income is to make motor vehicles more affordable for local consumers. The emergence of a young and aspirational middle class in India is also likely to drive passenger vehicle industry, which in turn is likely to fuel growth for the tyres industry. Demand is linked to economic growth and rise in income levels. Further, it is inversely related to the interest rates and fuel prices as 85% of the total vehicles are bought on credit. Per capita penetration at around nineteen cars per thousand people is among the lowest in the world.

Chart 27: Motorization Rate: Cars per 1000 inhabitant

Source: Niti Aayog 2021, CareEdge Research

2. Revival in Rural Demand:

Hike in Minimum Support Price (MSP) for agricultural produce in (which year) last year (especially for Kharif crops), farm loan waivers and improvement in farm yield are expected to drive two-wheeler, CV and tractor volume which should generate demand for tyres.

3. New launches:

As several OEMs are scheduled to launch new models in the FY23, decent volume growth is foreseen, as historically new models drive volume growth for the industry.

4. Improved Road Connectivity:

A significant growth has been witnessed in the construction of roads and highways over the past few years. With the government's focus on roads and infrastructure development, it is envisaged most villages will be connected to the highways in the next 2-3 years. Introduction of smart cities and highways is expected to increase the volumes of CVs and PVs, which account for the maximum tyre consumption.

5. Increasing demand in luxury car segment:

The demand for luxury vehicle segment, especially the SUV luxury cars have increased over the past few years. The demand for pre-owned luxury cars is also increasing as the owners want more upgraded and latest models while they sell off their vehicle in few years. With the increasing number of service providers in the market, the high penetration is helping the industry to grow. The increasing demand for luxury car segment is further helping improve tyre production. The tyre manufacturers in India are planning to expand and make businesses with the luxury car manufacturers. The demand for run flat tyres which are used in the luxury cars segment will improve with growth in demand from this segment.

6. Aviation tyre industry

With the increasing air passenger traffic all across the world, there is an improvement in demand for aircraft orders which is the key driving growth factor for aircraft tyres. There is also an increase in demand for military as well as commercial aircrafts which has further bolstered the growth in the industry. The replacement cycle of aviation tyres is also shorter and it requires frequent tyre replacement which is the key factor for growth in aviation tyre market.

The Covid-19 pandemic had severely impacted the airlines industry that restricted travel. With relaxations of domestic as well as international travels along with resurgence in recommencement of travel and tourism industry, there will be further growth in the aviation tyre demand.

4.4.7 Key Government Initiatives

- **Duty on Chinese TBR tyre imports**

The Government of India (GoI) on June 24, 2019 had imposed Countervailing duty (CVD) on import of new Chinese Truck and Bus radial (TBR, including tubeless), for a period of five years effective from June 24, 2019. CVD in the range of 9.1% - 17.6% is levied on imported TBR tyres originating from China and exported through any country (including China), and TBR tyres exported from China irrespective of the place of origin. In September 2017, GoI had re-imposed Anti-dumping duty (ADD) on import of Chinese TBR tyres for five years, ranging between USD245.4 and USD452.3 per ton (or) 9-15%.

Tyre imports, which represent ~7% of the domestic tyre industry (in value terms), has witnessed a 10% growth in the last three years (CAGR ending FY18) as against the industry's revenue growth of 2%. Specifically, influx of TBR tyres was high during this period, with TBRs accounting for 43% of total tyre imports (in values) in FY18.

TBR imports surged from Rs 7.1 billion in FY13 to Rs 14.2 billion in FY17 and accounted for a major share of TBR consumption in India. Country-wise, China cornered a lion's share, with ~89% of TBR tyres originating from China in FY18. Following the imposition of ADD on Chinese tyres by the US in FY15 and the removal of ADD on Chinese tyres imports to India in FY15, Chinese TBR tyres imports to India had witnessed a sharp growth.

The move has come as a sentiment booster for the industry that has been bearing the brunt of the slowdown in the auto sector and disruption caused by Covid-19 pandemic. Emboldened by the development, the tyre industry in India is looking at better than expected domestic production and increased exports from the country.

- **National Auto Policy 2018**

In February 2018, The Department of Heavy Industry (DHI), Ministry of Heavy Industries & Public Enterprises (MoHI&PE) released the draft National Auto Policy (NAP).

Vision: "To provide a long-term, stable and consistent policy regime and to have a clear roadmap for the automobile industry, making India a globally competitive auto R&D and manufacturing hub and achieving the targeted objectives of green mobility"

Mission: The National Auto Policy is envisaged to achieve the following missions:

- To propel India as an automobile industry amongst the top 3 nations in the world in engineering, manufacturing and export of automobile vehicles and components.
- To scale-up exports to 35-40% of the overall output and become one of the major automobile export hubs in the world.
- To enable the automobile sector to become one of the largest employment creation engines.
- To enable the automobile sector in India to become a global hub for research & development.
- To drive the automobile sector in India to adopt safe, clean and sustainable technologies.

Objectives: The objectives of the National Auto Policy are:

- Increase contribution to GDP To support the growth of the automobile industry in India and become one of the major contributors to the country's GDP and comprise a considerable proportion of the manufacturing sector GDP by 2026
- Increase exports To scale-up exports to 30-40% of the overall output over the next decade and improve the brand recognition, competitiveness and technological advancement of the Indian automobile industry across the world.

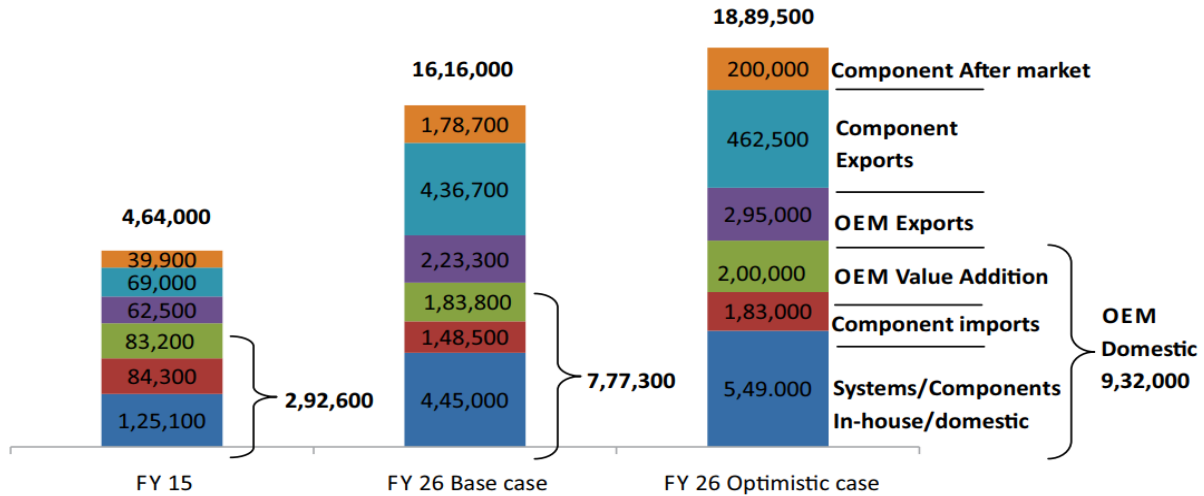
The policy would boost the auto sector which would in turn also lead to a rise in demand for the tyres industry.

- **The Automotive Mission Plan 2016-26**

The Automotive Mission Plan 2016-26 (AMP 2026) is the collective vision of Government of India (Government) and the Indian Automobile Industry on where the Vehicles, Auto components, and Tractor industries should reach over the next ten years in terms of size, contribution to India's development, global footprint, technological maturity, competitiveness, and institutional structure and capabilities.

AMP 2026 envisages that the Indian Automobile Industry will grow 3.5-4 times its value from its current output of around Rs 4,640 billion to about Rs 16,160 – 18,885 billion by 2026, based on a base of case with average GDP growth rate of 5.8% and an optimistic case with an average GDP of 7.5% during the period. The following chart provides current and projected composition of the industry over the next decade.

Chart 28: Automotive Mission Plan Projections



Note: All values in the above chart are in ₹ crore and at current year (2015) prices.

All numbers in the above chart are in Rs crores

Source: Niti Aayog; CareEdge Research

Current policy framework/regulations pertaining to Electric Vehicles industry in the passenger vehicles segment

Automobile industry globally is at the cusp of a major transformation. Growing concerns for environment and energy security clubbed with rapid advancements in technologies for powertrain electrification, increasing digitalization, evolution of future technologies and innovative newer business models and ever-increasing consumer expectations are transforming the automobile business. One of the key facets of such a change is the rapid development in the field of electric mobility which might transform the automobile industry like never before. This would in turn also benefit the tyres and the auto component industry.

- New Star Rating Rules**

The government is expected to bring new 5-star rating for the tyres industry. The ratings are expected to be given on the basis of its fuel efficient, ensured safety and prevent skidding of the vehicle. The oil consumption is expected to be reduced by 10%. With the introduction of the star labelling, customers will be able to select tyres best suited for driving usage, along with fuel efficiency and safety standards such as rolling resistance, wet grip, and rolling sound emission. Currently, BIS rules apply for the quality of tyres.

Electric Vehicles Policies Electric vehicles are driving much of the innovation in the tyre industry. The government approved the FAME-II scheme with a fund requirement of Rs 10,000 crores (Rs 100 billion) for FY20-22. The demand for tyres will increase as the electric vehicles will be introduced into the public transport under this plan. The rising share of EV sales has the potential to present new opportunities for the tyre industry in India. In addition, multiple production-linked incentive schemes intend to create a local manufacturing ecosystem. This is sought to be achieved by incentivizing fresh investments into developing indigenous supply chains for key technologies and products.

4.4.8 Tyre Industry Outlook

The demand momentum from India market is expected to remain healthy in the OEM segment, although demand in replacement and export segment is expected to remain subdued in the near term. The increasing consumer preference towards premium car segment, which is primarily led by growth in SUV segment along with the increasing trend in personal mobility is also expected to drive car sales in future and thus tyre consumption. The replacement demand is also expected to show high potential growth going forward.

In FY24, the tyres industry is likely to record an increase of around 9%-11% backed by the replacement demand and an expected 7%-9% growth in automobiles industry. Going forward, the tyres industry is likely to grow favourably with a CAGR of 8%-10% over the next 4 years by FY27. This is expected to grow by increasing demand in the automobile industry which is estimated to increase at a CAGR of 6%-8% over the next 5 years.

Further, government policy and interventions towards import restrictions will further help the domestic tyres industry to grow over the long term. Further, the automobile sales in this fiscal are expected to be supported by new launches, and continued support by the Government to the agriculture sector and infrastructure spending. However, high inflation and rising interest rates, possibility of El Nino in FY24 and geopolitical factors might impact the overall sentiment, thereby impacting the sales of automobiles in the medium term. This would further impact the tyre industry as well.

Government policy and interventions towards import restrictions would further help the domestic tyre industry to grow over the long term. The government has imposed anti-dumping duty on the import of bus and truck tyres from China which was extended till December 2022. This move had been positive and a significant dumping margin could hurt the domestic industry with the cessation of duty. It is expected that anti-dumping duties on new tyres from China will not be extended for another three years, as recommended by India's Directorate General of Trade Remedies. Government initiatives, such as implementing a scrappage policy, rising demand for Electric Vehicles (EVs), and increased personal vehicles due to improved middle-class disposal income, are expected to support the company's domestic segment. However, the challenging demand environment and recessionary pressure in international markets like Indonesia, Europe, the US, North America and sub-continent is likely to dent demand in the exports market.

The Ministry of Road Transport and Highways (MoRTH) has also issued a notification that new tyres for passenger cars, trucks and buses will have to meet the defined standards for rolling resistance, wet grip and rolling sound emissions from October 2022. All existing tyre designs will have to comply with wet grip and rolling resistance standards from April 2023 and less rolling noise standard from next June 2023.

The domestic tyre industry has invested over Rs 35,000 crore in new capacity creation and debottlenecking over the last three years. The investments have been undertaken across key tyre segments, with the major beneficiary being the manufacture of Truck & Bus Radials (TBR) and Passenger Car Radials (PCR). The new capacity will help the industry register a turnover of Rs 1 lakh crore in the next three years, from estimated turnover of Rs 75,000 crore in FY23. Phasing out of old vehicles and non-renewal of registration of 15-year-old government vehicles will create a demand for new vehicles benefiting a host of associated sectors, including tyre and kick off a cycle of economic growth. Demand is expected to grow stronger in view of an uptick in economic activities and the big push envisaged for infrastructure growth. Although the external environment continues to be challenging there are several tailwinds to tyre sector's growth domestically.

4.4.9 Thailand tyre market

Thailand has a very critical role in the global natural rubber market (primary raw material used in manufacturing of tyre) as it is the largest player in the industry. Of the total 13.8 million tonnes of natural rubber produced globally in CY21, a significant share of 34.8% was contributed by Thailand. Similarly, in terms of natural rubber exports, the share of Thailand was substantially high at 32.8% during the year.

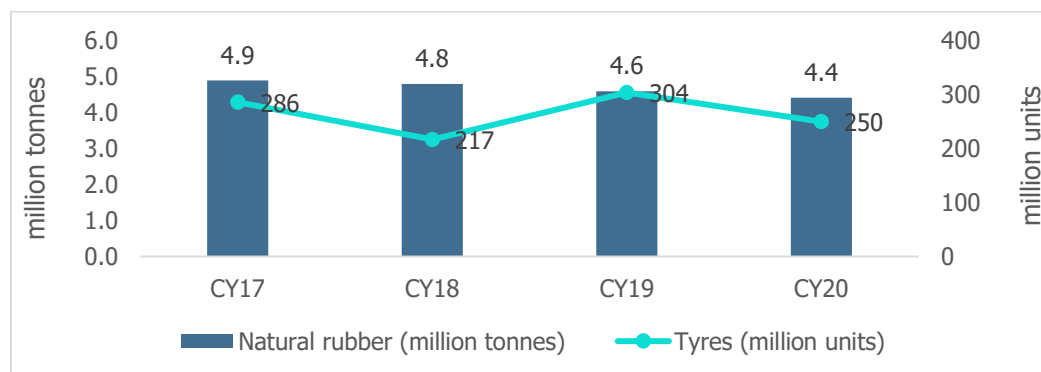
Table 14: Share of Thailand in natural rubber production and exports CY21 (million tonnes)

	World	Thailand	% share of Thailand globally
Production	13.8	4.8	34.8%
Exports	12.5	4.1	32.8%

Source: Malaysian Rubber Council, CareEdge Research

It is to be noted that of the total natural rubber produced by Thailand, a massive share of 85% of natural rubber is exported. Rubber produced in Thailand is used towards tyres, gloves, elastics etc. With high contribution in rubber market, Thailand is also a tyre export hub of Asia with almost every category of tyre produced.

Chart 29: Trend in natural rubber and tyres production in Thailand



Source: Thailand Board of Investment and CareEdge Research based on industry sources

During the CY20, tyres production in Thailand declined by 17.8% y-o-y to 250 million units and that of automobiles (including 2 wheelers) production fell by 23.2% to around 3 million units mainly due to Covid-19 situation and lockdown in the country. However, with easing of restrictions, the scenario in the country is improving on the back of better economic activities. In CY21, Thailand’s automobile production improved by a healthy 15.8% to 3.5 million units.

The uptick in Thailand’s automobile production going forward is expected to be supported by various initiatives taken by the Government of Thailand. One of the initiatives is the introduction of EV stimulation package in February 2022 by the Ministry of Finance which is detailed below.

Battery Electric Passenger Car
Import Duty Reduction: Up to 40% during 2022-2023
Excise Tax Reduction: From 8% to 2% during 2022-2025
Battery Electric Pick-up
Excise Tax Reduction: Reduced to 0% during 2022-2025
Battery Electric Motorcycle
Excise Tax: 1%

In addition to duty and tax advantages, the Government of Thailand will also provide cash subsidies based on certain conditions and criteria for each of the 3 segments mentioned above. These initiatives, in turn, will provide an advantage to tyres industry in Thailand.

Thailand has emerged an attractive market for tyre manufacturers globally as it is the largest rubber exporter in the world. In addition to this, Thailand has witnessed expansion in tyre capacities by international manufacturers. Global tyre companies are moving their production to countries like Thailand due to US/EU trade war with China and reduction of imports into those countries from China. Moreover, Thailand has favourable regulatory regime which is supportive to the tyre manufacturers. All these factors will facilitate a medium to long term CAGR of around 4%-6% for Thailand's tyres industry. Similarly, Thailand's rubber production is also expected to increase at a CAGR of around 5% supported by expansion in plantation sizes and demand in exports and domestic market.

Growth drivers for Thailand Tyres market

To support the natural advantage that Thailand has in terms of natural rubber production, the Government of Thailand has taken some initiatives which has driven new capex and demand from various countries.

Thailand Board of Investment

The Thailand Board of Investment offers an attractive and competitive package of tax incentives. It imposes no foreign equity restrictions on manufacturing activities or on some service. It also provides assistance in the provision of visas and work permits to facilitate entry and subsequent operation for a foreign-owned business and waives restrictions on land ownership by foreign entities.

Eastern Economic Corridor (EEC)

The Eastern Economic Corridor (EEC) development lies at the heart of Thailand 4.0 scheme and is an area-based development initiative, aiming to revitalize the well-known Eastern Seaboard. The project initially focused on the 3 Eastern provinces, namely Rayong, Chonburi, and Chachoengsao.

Thailand 4.0 is an economic model that aims to unlock the country from several economic challenges resulting from past economic development models which place emphasis on agriculture (Thailand 1.0), light industry (Thailand 2.0), and advanced industry (Thailand 3.0). These challenges include "a middle-income trap", "an inequality trap", and "an imbalanced trap".

The EEC's 12 targeted S-curve industries are: cars; smart electronics; affluent, medical and wellness tourism; agriculture and biotechnology; food; robotics for industry; logistics and aviation; biofuels and biochemicals; digital; medical services; defence; and education development.

WHA Eastern Seaboard Industrial Estate 4 (ESIE 4)

WHA Eastern Seaboard Industrial Estate 4 (ESIE 4) has a strategic location with infrastructure placed around 150 km from Bangkok, and 60 km from deep-sea port in Laem Chabang. The port enables import of machinery and aids tyre exports to the key markets like China and other APAC (Asia Pacific) countries.

The Thailand Government has been giving priority to area-based development policy to proliferate prosperity in the country by taking maximum benefit of the location that connects various Asian subregions. This, in turn, is expected to increase investments in Thailand from foreign countries.

Apart from this, Thailand's strategic location have aided investments in the country's tyre market from different regions – For instance, Continental invested in Thailand's Rayong province for new passenger and light truck tires production facility in the Asia and Pacific region.

Global tyres manufacturers in Thailand

China

Chinese tyres companies invested in Thailand due to anti-dumping duties imposed on imports of China produced tyres by a number of countries and increased competition in Chinese domestic market. As per China Rubber Industry Association, South-East Asia is the most preferred destination for Chinese tyre makers due to ample availability of natural rubber, comparative labour costs, and proximity to China. Subsequently, China's largest tire producer, Hagzhou Zhongce Rubber, built a facility in Thailand. Other major tyre producers from the country, such as Linglong Tire, Sentaida and Double Coin have also established manufacturing presence in Thailand to take benefit of the robust automobile market of the country.

Other Key International players

In addition to Chinese players, other key international companies like Bridgestone, Michelin, Sumitomo, Yokohama, Goodyear etc. have their facilities in Thailand. Moreover, China plus one strategy adopted by international players will also aid momentum of tyre facilities in Thailand and thus the country's tyre production.

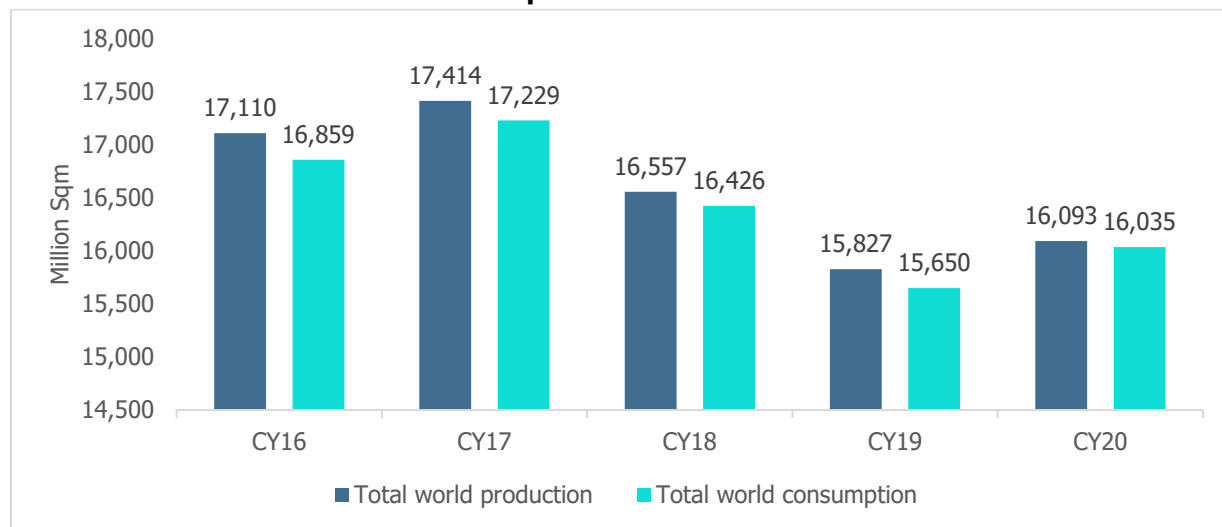
5. Ceramics Industry

Ceramic tiles are versatile items with a wide range of uses in different locations and industries. There are various elements that are propelling the global market forward. The most visible trend is the increase in construction activity, which is fueled by the growing demand for houses. Rapid urbanization and rising disposable incomes play a crucial role in market dynamics in developing economies, such as those in the Middle East and Asia-Pacific regions.

5.1 Global Production & Consumption

The global tile production fell in CY18 due to slowdown of many national economies and this trend was carried ahead in CY19, however this trend reversed in CY20, providing an initial partial recovery despite the epidemic. The overall world production increased by 1.7% in CY20 compared to CY19.

Chart 30: Global Production & Consumption Trend



Source: Ceramic World Review, CareEdge Research

In CY20, the world consumption for ceramics grew by 2.6% compared to the previous year. CY20, marked as a year witnessing an upward trend after consecutive drop in CY18 & CY19. However, when compared to the trend of past seven years the consumption levels still remain low.

Table 15: Region wise production & consumption

Region	Production (Million Square meter)	Share in world production	Consumption (Million Square meter)	Share in world consumption
Asia	11,905	74.0%	11,470	71.5%
European Union	1,218	7.6%	1,035	6.5%
Central-South America	1,088	6.8%	1,249	7.8%
Africa	918	5.7%	1,124	7.0%
Other Europe	638	4.0%	563	3.5%
North America	321	2.0%	541	3.4%
Oceania	5	0.0%	53	0.3%
Total	16,093	100.0%	16,035	100.0%

Source: Ceramic World Review, CareEdge Research

Region wise overall production trend in CY20:

Asia: Asia's production increased by 2.8% to 11.9 billion square meter in CY20, accounting for 74% of worldwide output; this outcome was mostly due to higher volumes produced in China, India, and Iran, which offset lower quantities produced in Vietnam and Indonesia.

Europe: The European continent produced a total of 1,856 million square meter in CY20 (11.6% of global production). Production in the European Union declined by 6.6% (from 1,304 million square meter to 1,218 million square meter). Production in non-EU Europe rebounded (CY20- 638 million square meter; 11.9% growth). This growth in production was due to a strong upswing in Turkey.

American continent: In the American continent, production declined to 1,409 million square meter. The losses in North America was only 2.7% de-growth (321 million square meter), whereas production in Central and South America, the region hardest hit by the extended 2020 lockdowns, plummeted to 1,088 million square meter (7.6% de-growth).

African continent: Africa continued to grow, with production estimated to reach 918 million square meter in CY20 (6.1% growth). Apart from Egypt, which maintained its leadership position on the continent despite a drop-in production to 285 million square meter, and Algeria, which stood at 185 million square meter, sub-Saharan African countries (Ghana, Tanzania, Ethiopia, Kenya, Sudan, Uganda, Senegal, Zambia, Zimbabwe, and Angola) continued to grow with production levels of between 10 and 50 million square meter (largely due to Chinese investments), while Nigeria's production was 114 million square meter.

Region wise overall consumption trend in CY20:

Asia: The demand for ceramics in the Asian region grew by 2.8% in CY20 compared to CY19, reaching 11.4 billion square meter. The overall share of the Asian demand to world consumption in CY20 was 71.5%.

Europe: Ceramics consumption increased in overall Europe i.e. Europe Union & non-EU markets during CY20. In CY20, the European Union countries, consumption increased to 1,035 million square meter with a growth of 1.4% whereas, in non-EU markets the consumption grew by 11.3%, reaching 563 million square meter.

American continent: The American markets witnessed stable demand for ceramics during CY20. In Central & South America the consumptions de-grew by 1%, reaching 1,249 million square meter and North America witnessed a de-growth of 0.4% with consumption reaching to 541 million square meter.

African continent: The African markets saw a growth of 1.4%, with ceramics consumption reaching 1,124 million square meter. The overall share of the African market in the world consumption for ceramics stood at 7% in CY20.

5.1.1 Demand drivers

1. Urbanization:

One of the main reasons for the increase in demand for ceramic tiles is the growing population. Global population movement from rural to urban areas has accelerated the rate of increase further. According to the United Nations' Population Division, the overall world population is predicted to reach 9.5 billion by CY50, with urban population accounting for at least 66.4% of the total. Improved hygiene and sanitation are required for an improvement in living standards.

APAC has seen significant growth in the ceramic tile industry in recent years, with growing economies such as India and China leading the way. By CY50, Asian cities will account for 52.3% of the world urban population, resulting in the greatest workforce ever. The population transition from rural to urban areas has accelerated the rate of urban population increase in the Asia-Pacific region. According to the United Nations Population Division, APAC's overall population is expected to reach 5.1 billion by CY50, with cities accounting for at least 68% of the region's total population. By CY50, the APAC urban population, along with global population growth, could bring another 2.5 billion people to urban areas, with Asia and Africa accounting for about 90% of this rise. To accommodate the growing population, cities will need to build more housing and other commercial facilities which will further accelerate the demand for ceramics industry.

2. Surge in application of ceramics in construction industry:

The increase in the number of ceramics applications in the construction industry is a major factor driving the global ceramics market. Ceramic materials are widely employed in the manufacture of bricks, tiles, and other sanitary ware, all of which are used in building. In the majority of countries, commercial and residential construction is on the rise. More construction is being done in both developed and emerging countries as a result of the rapid development in urbanization, which has raised demand for ceramics and ceramic-related products. With new home construction and replacement and renovation construction, the residential segment, which accounts for a larger share of the market, is recording more transactions.

Although, the construction sector is suffering various obstacles as a result of the ongoing Covid-19 epidemic, including a lack of investment, failure to complete projects on time, raw material shortages, a lack of competent labor, high operating expenses, and so on. However, it is progressively returning to growth. In future, the growth tendency of construction sector is expected to continue, allowing ceramic tiles to develop into a more niche market.

3. Increase application of ceramics in various sectors:

Advanced 3D printing and nanotechnology both utilizes ceramics. Because of their better electric and magnetic properties, advanced ceramics, especially superconductive ceramics, have a wide range of applications in the electronics industry.

Another aspect driving ceramics market growth is the expanding medical industry. Ceramics are widely utilized in dental and bone implants, hip and joint replacement, and femoral heads, among other applications. Furthermore, technical developments and government investment in advanced ceramics research and development are boosting market growth.

Several significant players are currently investing in extending their business operations to acquire a competitive edge in the ceramics industry. However, market expansion is constrained by shifting raw material prices.

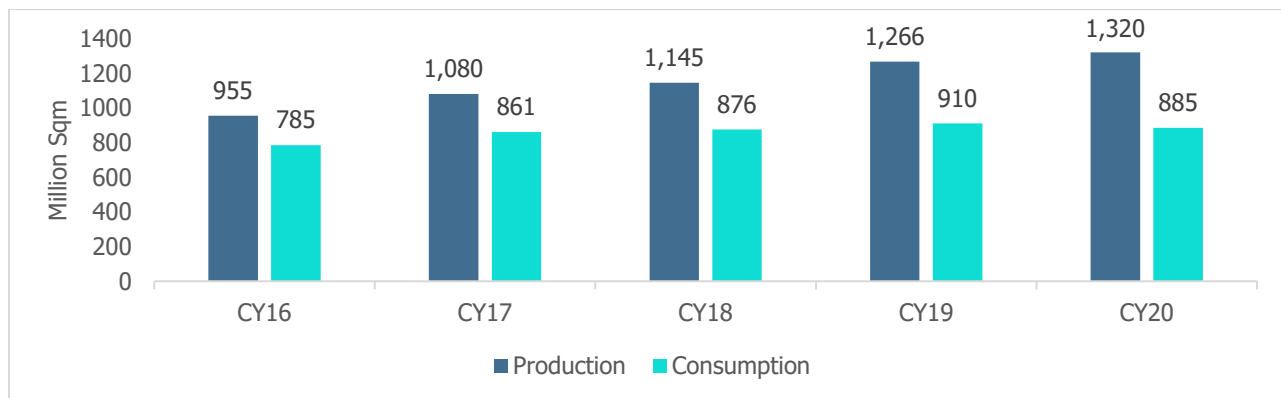
5.2 Indian Overview of Ceramics Industry

India is one of the world's most rapidly expanding ceramic markets. The Indian ceramics market is segmented on the basis of products, application, construction and end-use. India is the world's second-largest manufacturer of ceramic tiles, accounting for 8% (1,320 million square meter) of global production. The rising real estate sector, combined with government policies fueling robust growth in the housing sector, are some of the primary reasons boosting ceramic demand in India. Furthermore, increased disposable income in India, as well as a desire to beautify living and working environments, are driving the demand for ceramic tiles in the country.

5.2.1 Indian Ceramics Market

India not only retained its position as the world's second largest tile manufacturer in CY20, with volumes increasing by 4.3% to 1,320 million square meter, but it also surpassed Spain as the world's second largest exporter.

Chart 31: Indian Production & Consumption trend



Source: Ceramic World Review, CareEdge Research

While the pandemic reduced domestic consumption by 2.7% to 885 million square meter, the country's exports increased by 21% from 360 to 437 million square meter. With export volumes nearly doubling in just four years, India now, in CY20 accounts for 15.8% of global exports and more than a third of the country's entire production. Exports totaled 1,350 million euros, equating to an average selling price of 3.1 euros per square meter, one of the lowest among all major exporting countries. The overall exports from India has grown at a CAGR of 24% over the period CY16 to CY20 and the consumptions in India grew at 3.04% during the same period. Although the growth in consumption was slow during the period, but the growth in Indian exports is expected to support the growth in Indian ceramics production over the coming years.

Indian Export Trends:

- With a 20.8% share of overall exports and a 24.8% increase in sales from 73 to 91 million square meter, Saudi Arabia remained India's top export market. This result is especially noteworthy in view of tariffs placed on Indian tiles imported into GCC countries ⁴ in CY20, which were projected to result in a drop-in shipment.
- Major market for Indian exports also witnessed a growth in CY20 such as:
 - Indian exports to Iraq accounted for 23 million square meter in CY20 with 26% growth in exports compared to CY19.
 - Indonesia is another key export market for India. Indian exports to Indonesia began from CY18 and within three years it has become the third key exporting market for Indian ceramics. In CY20, Indian exports to Indonesia reached 22 million square meters with a growth of 22% compared to CY19.
 - Exports of Indian ceramic tiles increased from 9.2 million square meter in CY19 to 18.6 million square meter in CY20 in the United States and, in the United Arab Emirates the exports grew by 2.8% in CY20, reaching 20.6 million square meters.
 - South Africa also witnessed a significant increase of 145% in CY20 compared to CY19 in Indian exports, with export volumes reaching 12.6 million square meters. On the other hand, exports to Russian market saw the highest growth of 400% in CY20 with export volumes of 5.6 million square meter.
- Overall in CY20, share of Indian exports in the Asian market was 62%, with export volumes of 270 million square meter ; share of Africa was 14% and 60 million square meter export volumes; North America accounted for 9% of Indian exports and 39 million square meter in volumes; European continent (including EU & non-EU) had a share of 11.6% and 50.3 million square meter export volumes; and South America accounted the least share of 3.5% in the exports with 15 million square meter volumes.

⁴ GCC Countries: The Gulf Cooperation Council (GCC) is a political and economic union of Arab states bordering the Gulf. It was established in 1981 and its 6 members are the United Arab Emirates, Saudi Arabia, Qatar, Oman, Kuwait and Bahrain.

5.2.2 Demand Drivers

- Government initiatives accelerating demand for ceramics

1. Pradhan Mantri Awas Yojana (PMAY):

- The Pradhan Mantri Awas Yojana (Urban) was launched on June 25, 2015, with the goal of providing pucca houses to all eligible recipients by 2022. It is geared toward metropolitan areas, whereas PMAY-G is geared toward rural ones.
- The program is divided into four sections: "In-Situ" Slum Redevelopment (ISSR), Credit Linked Subsidy Scheme (CLSS), Affordable Housing in Partnership (AHP), and Beneficiary-led individual house construction/improvements (BLC).
- The PMAY-U sanctioned 1.21 crore houses under the scheme till 9th May 2022. Out of these 58.8 lakh houses have been completed. The remaining 62.18 lakh houses are expected to drive the demand for the ceramics industry. Ceramic tile volumes are likely to rise as the government increases infrastructure spending, home building picks up, and macroeconomic conditions improve.

2. Swachh Bharat Abhiyan (SBA):

- People are becoming more conscious of the importance of sanitation and cleanliness, and some businesses have begun to benefit from this shift in mindset. Under the Swachh Bharat Abhiyan (SBA) initiative, the government had announced in 2015, the construction of 800 million toilets over a period of five years, with 160 million construction of toilets every year. This initiative accelerated the demand for sanitary fittings which in turn increased the demand for ceramics.
- The SBA initiative mainly benefitted the small unorganized players because of their low price point of the offerings. The large organized players did not have much scope in the initiative. Many small scales businesses witnessed growth in sales. The majority of the order flowed to unorganized players of Khanghad and Morbi (Gujarat towns) as the prices of their offerings were one third times lower than the organized players. However, these small players were massively focused of meeting the demand created by this initiative which resulted in vacuum in supply for the existing demand where, the top players filled the gaps.
- Overall, the initiative created an immense demand for sanitaryware fittings and the ceramics industry benefitted as a whole.

- Rising construction activities have fueled demand for ceramics industry:

With the revival of the real estate industry, tiles, sanitaryware and overall ceramics industry stand to benefit. The need for sanitary wares in construction projects has increased due to rapid infrastructure development, the growing trend of smart houses, and increasing urbanization. Consumer demand for new retail malls, schools, restaurants, offices, and single-family homes has caused the construction industry to increase in size over the years. Additionally, rising consumer disposable income,

government policies and tactics supporting the construction industry, increased public investment in construction projects, and fast industrialization have all boosted the construction industry globally. As a result, demand for ceramic components such as toilets, washbasins, and urinals has increased in both residential and commercial settings, including hotels, hospitals, factories, public transportation stations, and educational institutions. As a result, rising construction activity will accelerate the use of sanitary goods and move the worldwide ceramic sanitary ware market forward.

- **Transformation from unorganized to organized sector:**

The ceramic sector is likewise seeing exponential expansion, as it shifts gears amid a constant transfer from unorganized to organized hands, as well as a shift in product focus, with glazed vitrified tiles (GVT) and polished glazed vitrified tiles (PGVT) gaining market share. Other significant elements that are consistently providing much-needed assistance to the industry include expanding global penetration of huge slabs, deployment of best-in-class technology, and innovation to make products fit for global markets.

Changes like GST, RERA, and the e-way bill have cleared the path for the business to transition from unorganized to organized hands. Furthermore, in CY20 India accounts for 8% of global ceramic production. Following the imposition of an anti-dumping tax (ADD) by the US on Chinese tiles earlier in CY20, exports to major markets such as the US and the UK are likely to expand rapidly. As the ceramics growth story continues to lead India to the top of the globe, the Indian ceramic industry is likely to enjoy a steady influx of domestic and foreign investments in the coming years.

5.2.3 Trends in the Indian Ceramics Industry

1. Nanotechnology:

Ceramics is one of the domains where nanoscience and nanotechnology have made significant development, resulting in a wide range of sophisticated materials with distinct features and capabilities. Ceramic nanoparticles are largely made up of metals, carbides, phosphates, and carbonates, such as calcium, titanium, and silicon.

Due to a number of advantageous features, including strong heat resistance and chemical inertness, they have a wide range of use. Most of the ceramic nanoparticle application is in the biological field. Ceramic nanoparticles are thought to be effective carriers for medicines, genes, proteins, imaging agents, and other biological agents.

2. 3D- Printing:

One of the current key trends in the ceramic tile market is the growing popularity of 3D-printed tiles. Traditional ceramics tiles are created from a mix of clay, sand, and other elements. 3D tile printing is a low-pollution approach that is rapidly gaining favour. Tile manufacturers can employ 3D printing to add attractive facets and design textures to their products.

Another factor that is expected to enhance the adoption of 3D printed ceramic tiles in the coming years is rising demand for them due to their stain and scratch resistance and ability to emulate the appearance of more expensive genuine stone and hardwood tiles.

3. Eco-friendly tile manufacturing:

Due to strict environmental restrictions, the rise in popularity of green building standards, and increased consumer awareness for sustainable products, ceramic tiles have been a part of green or sustainable chemistry in the recent decade. Because eco-friendly tiles are more durable and require less maintenance than standard tiles, they are widely utilized around the world.

Environmental issues are a subject of discussion around the world, and eco-friendly tiles help reduce environmental impact by using less energy in the manufacturing process. Furthermore, use of solar and wind power in manufacturing of eco-friendly tiles has reduced the negative environmental impact.

Going forward, environmental awareness and government-imposed environmental rules will drive eco-friendly tile market. Furthermore, the market is being fueled by an increase in the number of end-user industries due to the durability and low maintenance of eco-friendly tiles. The utilization of renewable energy to power the equipment used in the production of environmentally friendly tiles has resulted in a significant production of tiles with minimum environmental impact. This enormous production raises the chances of future market expansion.

4. Use of zinc oxide in ceramics industry:

Zinc oxide is a crucial component of ceramic chemical flux. Zinc oxide is commonly used in the ceramic industry in translucent glazes for brick glaze and coarse pottery, as well as transparent coarse glazes for process tableware. Ceramic wall and floor tile glaze, as well as low temperature ceramic glaze, are used increasingly frequently in construction.

The ceramics industry is also expanding at a breakneck pace, as a shift in product focus, with glazed vitrified tiles (GVT) and polished glazed vitrified tiles (PGVT) gaining market share. The share of consumption of ceramic tiles in India is 56%, share of PGVT consumption is approximately 33% & GVT has the least share of 11% in the overall tile market. However, over the last few years, the GVT & PGVT segment have shown steady growth. Moreover, the organized segment's entities have introduced new sizes and designs in the GVT & PGVT segment, in line with global trends, reducing dependency on imports while also providing clients with a wide range of options to meet their specific needs.

5.2.4 Indian Ceramics Industry Outlook

India is one of the world's most rapidly increasing ceramic tile markets. The rising real estate sector, together with government initiatives fueling robust growth in the housing sector, are some of the primary reasons boosting ceramic tile demand in India.

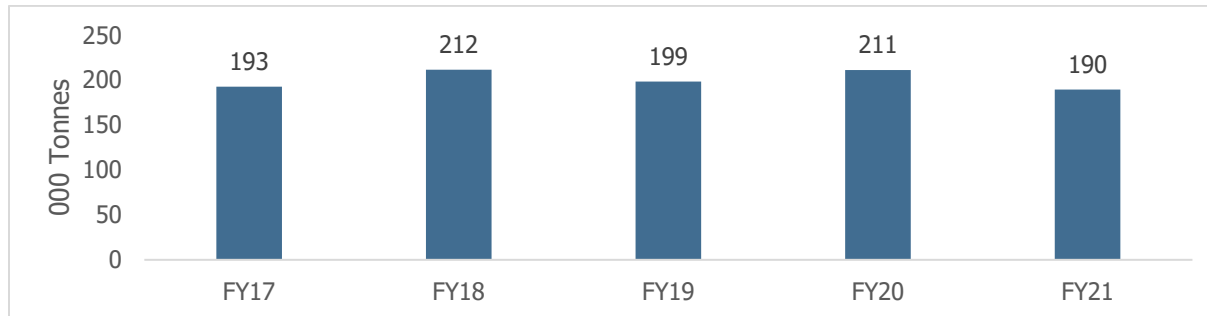
In India, the ceramic tile market has been steadily growing over the previous few years. However, the sector was severely impacted by the Covid-19 epidemic, as India's GDP plummeted in FY20 and the Indian economy declined in the April-June quarter of FY21. Migrant workers returned to their home countries in March 2020, following India's national lockdown in response to the Covid-19 outbreak. As a result of the labor scarcity, timely project completion has become one of the primary issues for ceramic tile manufacturers during the pandemic. However, once the lockdown was lifted, the business began to see a resurgence in demand, and it is predicted to grow post-Covid-19.

Going forward, increased disposable income in India, as well as a desire to beautify living and working environments, are anticipated to drive the demand for ceramic tiles in the country. Further, government programs such as the Pradhan Mantri Awas Yojana and the Swachh Bharat Abhiyan, among others, are also expected to boost the Indian real estate industry which will, in turn, boost the demand for ceramics industry. The Indian ceramics industry thus is expected to increase at a CAGR of 6%-8% in the long term.

6. Zinc Sulphate

Zinc sulphate is an inorganic compound which is used as a medication and as a nutritional supplement. It is majorly used in agricultural, fertilizers and pharmaceuticals industry.

Chart 32: Zinc Sulphate Consumption in India (000 Tonnes)



Source: Fertilizer Association of India, CareEdge Research

Consumption of zinc sulphate from FY17 to FY21 has been in the range of 190,000 tonnes to 215,000 tonnes. In the year 2020, Covid-19 contributed to rise in the consumption of zinc sulphate. Zinc is a strong immunity builder. Zinc sulphate supplements were taken to increase the amount of zinc in the human body.

The zinc sulphate market can be segmented based on product and application.

By products:

- Zinc Sulphate Heptahydrate – Contains 21% Zinc. Highly soluble in soil aiding to the demand of fertilizers and pesticides
- Zinc Sulphate Monohydrate – Contains 33% Zinc. Highly soluble in soil aiding to the demand of fertilizers and pesticides

By application:

- Agriculture
- Pharmaceutical

Agriculture: The major usage of zinc sulphate is in the agricultural industry. It is mainly used for meeting the deficiency of zinc micronutrients in the soil. Healthy soil rich in zinc helps in improving the quality of crop and productivity of soil. On domestic side, the demand for zinc sulphate is expected to increase significantly from the southern part of the country (as the soil in the southern India is deficient in Zinc), while the demand from northern India is likely to continue. In addition to this, zinc sulphate is used as a supplement in animal feed.

Pharmaceutical: Pharmaceutical industry aids the demand of Zinc Sulphate. Human body does not have zinc sulphate storing ability therefore regular intake of zinc sulphate is required. It is also used to treat

acne as it has wound healing and anti-inflammatory properties. It is used in number of over the counter products.

In addition to this Zinc Sulphate is also used to preserve wooden products from regular wear and tear. It is also used as a mordant in textile dyeing and paints industry. Due to zinc sulphate's anti-bacterial and anti-microbial properties, it is widely used in cosmetic products.

While there is huge demand potential for zinc sulphate in India, the sourcing of raw material for producing zinc sulphate, i.e. zinc ash, continues to be a major challenge.

Growth drivers of Zinc Sulphate

- **Deficiency of micro nutrients in soil**

Fertile soil is important for better quality crops as it can absorb the rainwater well, is easily cultivated and combat soil erosion. Fertility of soil depends on both soil quality and soil health. Soil health can be defined as the capacity of the soil to sustain the crop. A mix of macro and micro nutrients makes the soil fertile. Macro nutrients are used in large quantities by the plant whereas micro nutrients are required in small quantities. Nitrogen, phosphorus and potassium are some of the macro nutrients. Micronutrients on the other hand include boron, chlorine, copper, iron, manganese, molybdenum, and zinc. A balance between the macro and micro nutrients is important for proper plant growth. Few macronutrients or excess micronutrients hinders proper growth of the crop. Increased usage of zinc-based micro nutrients will potentially ensure better crop productivity and quality.

The soil quality in the southern states (primarily Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, and Telangana) has deficiency in zinc. To meet the zinc deficiency zinc sulphate is added in the soil thereby contributing to the rising demand of zinc sulphate in the country.

- **Agriculture:**

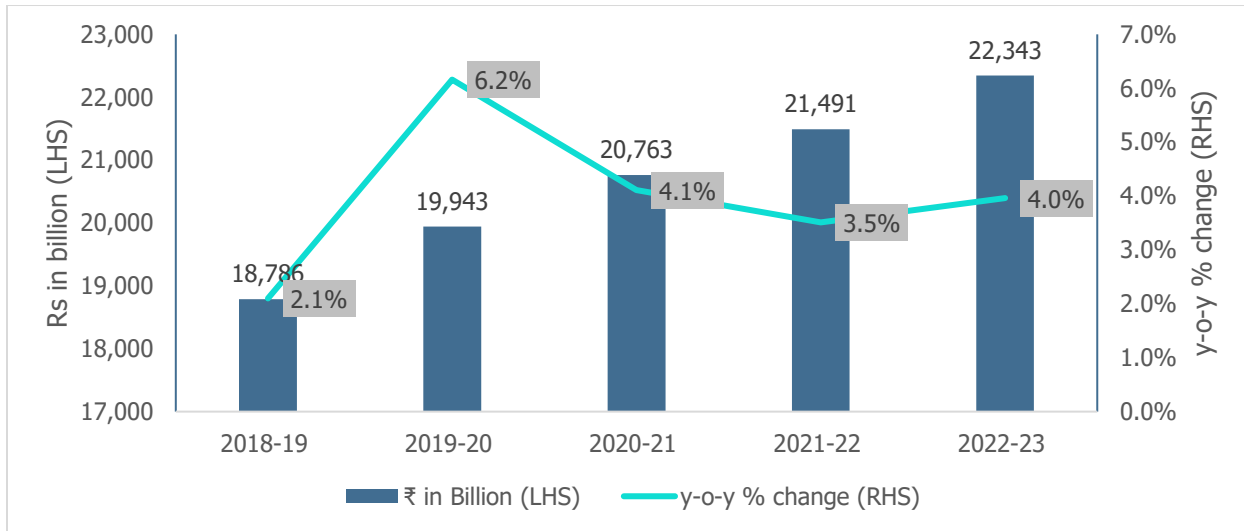
Agriculture is the primary source of livelihood for about 58% of India's population. As a result, the share of agriculture and allied sector to total Gross Value Added (GVA) has been significant and has increased over the years as shown here in the table.

Table 16: Percentage share of GVA (at current prices) of agriculture and allied sector to total economy

Year	% share
2018-19	17.6
2019-20	18.3
2020-21	20.3
2021-22	18.9
2022-23	18.4

Source: PIB release, CareEdge Research

The expansion in share of agriculture and allied sector's GVA is backed by an upward trend in the GVA of agriculture activities. During the five-year period 2018-19 to 2022-23, the GVA for agriculture increased at a CAGR of 4.4% from Rs 18,786 billion in 2018-19 to Rs 22,343 billion in 2022-23.

Chart 33: Trend in agriculture GVA at constant prices (Rs billion)

Source: CMIE, CareEdge Research

The growth in agriculture GVA has been supported by various measures on credit, market reforms and food processing. Moreover, in addition to several measures aimed at increasing productivity and improving marketing of agricultural produce, the government also carries out a large food management programme with a significant financial implication in terms of food subsidy. The growth in agriculture sector is expected to result in more demand of zinc sulphate-based agrochemicals, in India thus aiding its overall production and consumption.

- **Government support:**

The government provides aid to the rural economy through various budget announcements that aim at reviving rural areas and raising farmer's income. In addition to this, growth in credit facilities to farmers through institutional credit mechanisms and low interest rate farm loans are likely to motivate farmers towards usage of pesticides that helps increase the productivity and yields of crops. Besides, increase in minimum support price (MSP) of crops also may contribute to pesticides usage. Zinc sulphate is the major ingredient of pesticides used in agriculture sector.

- **Growth in food demand:**

With expected increase in population, the demand for food grain in India is likely to rise. These consumption requirements are to be met with decreasing arable land and small holdings of land. Thus, raising farm productivity becomes important and this can be done with optimal usage of products like zinc sulphate-based agrochemicals.

Indian soil has become deficient in both macro nutrients and micro nutrients. Increased usage of high yielding crop varieties and fertilizers has over the time made the soil devoid of healthy nutrients thereby reducing the productivity. Therefore, the need to overcome nutrient deficiency is of utmost importance. National Food Security Mission is an initiative of Ministry of Agriculture, Govt. of India, which aims at

creating awareness among farmers and promoting use of micronutrients in major pulse crops, rice, and wheat growing States of the country.

Table 17: State-wise distribution of micronutrient deficiencies in Indian States (%)

Name of State	Percent samples deficient				
	Zinc	Iron	Copper	Manganese	Boron
Andhra Pradesh	22.92	17.24	1.33	1.63	4.08
Arunachal Pradesh	4.63	1.44	1.40	3.01	39.15
Assam	28.11	0.00	2.80	0.01	32.75
Bihar	45.25	12.00	3.19	8.77	39.39
Chhattisgarh	25.59	7.06	3.22	14.77	20.59
Goa	55.29	12.21	3.09	16.91	12.94
Gujarat	36.56	25.87	0.38	0.46	18.72
Haryana	15.42	21.72	5.13	6.16	3.27
Himachal Pradesh	8.62	0.51	1.43	6.68	27.02
Jammu & Kashmir	10.91	0.41	0.34	4.60	43.03
Jharkhand	17.47	0.06	0.78	0.26	60.00
Karnataka	30.70	7.68	2.28	0.13	36.79
Kerala	18.34	1.23	0.45	3.58	31.21
Madhya Pradesh	57.05	8.34	0.47	2.25	4.30
Maharashtra	36.60	23.12	0.14	3.02	20.69
Manipur	11.50	2.13	2.46	2.06	37.17
Meghalaya	3.84	1.33	1.03	2.95	47.93
Mizoram	1.96	0.49	0.98	1.22	32.76
Nagaland	4.62	2.00	0.53	3.05	54.31
Odisha	32.12	6.42	7.11	2.12	51.88
Punjab	19.24	13.04	4.67	26.20	18.99
Rajasthan	56.61	34.38	9.15	28.28	2.99
Tamil Nadu	63.30	12.62	12.01	7.37	20.65
Telangana	26.77	16.65	1.36	3.54	16.49
Tripura	5.51	1.57	2.36	0.00	23.62
Uttar Pradesh	27.27	15.56	2.84	15.82	20.61
Uttarakhand	9.59	1.36	1.51	4.82	13.44
West Bengal	14.42	0.03	1.76	0.98	37.05
All India	36.50	12.80	4.20	7.10	23.40

Source: Fertilizers Association of India, CareEdge Research

As is evident from the above data, several states in India have a substantial degree of zinc deficiency with highest deficiency reported in the southern state of Tamil Nadu at 63.3%. All the other southern states like Karnataka, Telangana, Andhra Pradesh and Kerala too have zinc deficiency that ranges between 18%-31%. Thus, there is very strong demand for zinc sulphate by various fertilizer and micro-nutrient mixture companies in the southern states. In addition to this, other states like Madhya Pradesh, Rajasthan, Goa,

Bihar, Maharashtra, Gujarat, Odisha, Assam, Uttar Pradesh, Chhattisgarh, Punjab also contributes towards demand for zinc sulphate. Zinc deficiency in these states ranged between 19%-57%.

Of all the micro-nutrient deficiencies mentioned, zinc deficiency is highest at 36.5% at all-India level compared to that of iron (12.8%), copper (4.2%), manganese (7.1%) and boron (23.4%).

Zinc deficiency is a major problem in coarse textured soil. Zinc micronutrient is required in protein synthesis and good seed quality with uniform maturity. Therefore, to meet this micronutrient deficiency food fortification is done. Food fortification is an important part of nutrition and wellness industry. Consumers have become conscious of improving their lifestyle and focus on healthier choices. This trend of consumer being conscious regarding their personal overall wellbeing is expected to continue in the future and drive demand for wellness industry including food premixes.

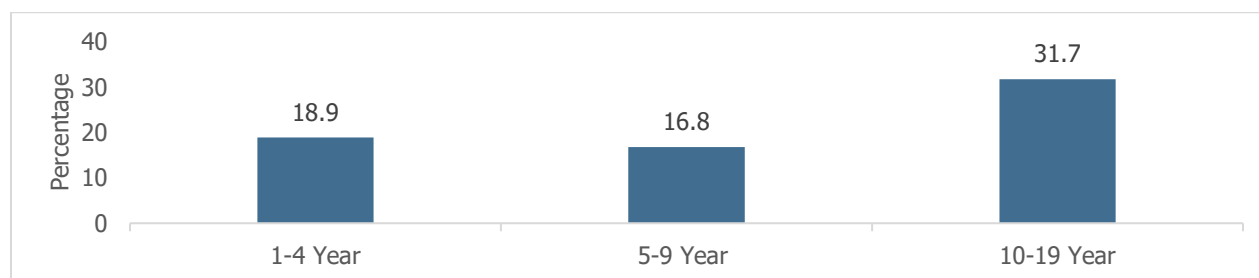
Micronutrient deficiency, also termed as hidden hunger is a cause for concern and is a serious health risk issue, hence it is important to have access to safe and nutritious food. It is commonly perceived that micronutrient deficiency occurs due to food insecurity however, many people from non-poor families and in food secure environment suffer from nutrient deficiencies due to lack of balanced diet and low bioavailability of nutrients.

The National Health Family Survey 2019-21 (NFHS-5) gives information on population, health and nutrition at India level and state/union territory level as well. Some of the key statistics are stated below:

- 67.1% of children in the age group of 6-59 months are anemic
- 57.2% of non-pregnant women are anemic (15-49 years age group)
- 52.2% of pregnant women are anemic (15-49 years age group)
- 25% of men in the age group of 15-49 years are anemic (15-49 years age group)
- 32.1% of children under 5 years of age are underweight
- 35.5% of children under 5 years of age are stunted
- 19.3% of children under 5 years of age are wasted
- Only 11.3% of children in the age group of 6-23 months receive an adequate diet

In addition, the prevalence of vitamins A, D and zinc deficiencies among 1 to 19-year-old children in India according to Comprehensive National Nutrition Survey (CNNS), 2016-18 is detailed below.

Chart 34: Percentage of adolescents with zinc deficiency in India



Note: For Zinc deficiency cut-offs, International Zinc Nutrition Consultative Group guidelines were used. Children aged 1–9 years were defined to have Zinc deficiency if serum zinc concentration was < 65 µg/dl. Adolescents aged 10-19 years old were defined to have Zinc deficiency if serum zinc concentration was < 70 µg/dl (morning

fasting) and < 66 µg/dl (morning non-fasting) in non-pregnant girls and < 74 µg/dl (morning fasting) and < 70 µg/dl (morning non-fasting) in boys.

Source: CNNS, 2016-18, CareEdge Research

Zinc deficiency

About 31.7% adolescents aged 10–19 years were suffering from zinc deficiency. 18.9% of children and 16.8% of the children in the age group of 1-4 years and 5-9 years were zinc deficient.

One of globally proven methods to address the problem of micronutrient deficiency is fortification of food. It means addition of micronutrients to food. It is intended to increase the content of the target micronutrients in the food and micronutrients are added to food during food processing and value addition.

Some of the key vitamins and minerals such as Iron, Iodine, Zinc, and Vitamins A & D are added to staple foods such as rice, wheat, oil, milk and salt and processed foods as well in order to improve their nutritional content.

Nurturing of zinc micronutrient with Fertilizer Control Order 1985

As per Schedule I of Fertilizer Control Order (FCO) 1985, zinc forms part of micronutrients which includes zinc sulphate heptahydrate, chelated zinc as Zn-EDTA, zinc sulphate mono-hydrate, zinc sulphate monohydrate (granular). Also, it is included under fortified fertilizers which consists zincated urea, zincated phosphate (suspension) – for seed treatment, NPK complex fertiliser fortified with zinc, DAP fortified with zinc and in 100% water soluble complex fertilizers that includes NPK Zn.

Zincated urea, while already included in the Fertilizer Control Order (FCO), is not being produced or marketed by the fertilizer industry due to a minor price disparity in India. ZnO suspension (39.5% Zn) is already included in the FCO. Inclusion of ZnO itself in the FCO is likely to improve the zinc fertilizer usage efficiency.

The main aim to use fortified fertilizers is increasing the crop nutrition. In addition to this, under the Nutrient Based Subsidy (NBS) policy, the government of India provides additional subsidy on usage of fortified fertilizers (fortified with boron and zinc) in order to increase their usage. The subsidy provided by the Government of India is Rs/MT 300 and 500 for boron and zinc, respectively.

Benefits of food fortification

Food Fortification is estimated to have a high benefit-to-cost ratio. According to the Copenhagen Consensus, it is estimated that every 1 Rupee expensed on fortification leads to 9 Rupees in benefits to the economy.⁵ It does require initial investments towards purchase of both the equipment and vitamin and mineral premix, however overall costs of fortification are extremely low. Even if all program costs are passed on to consumers, the rise in price is about 1-2% only.

Following are the various benefits of fortification of foods:

- Nutrients are usually added to widely consumed foods such as staples as this follows a broad-based approach and can aid in improvement of the health of population at large.

⁵ Food Fortification Resource Centre (FFRC), FSSAI

- It is a safe method in terms of improving health of people and the quantity of micronutrients is within the Recommended Daily Allowances (RDA) and is regulated as per prescribed standards for safe consumption.
- Cost effective method that does not require changes in food habits or eating patterns of people.
- It does not affect the taste, smell or texture of the food.

To promote food fortification the government of India on 8th April, 2022 announced fortification of rice (around Rs 2,700 Crore Per Annum), entire cost to be borne by the Government of India.

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