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India Steel 2023
Amrit Kaal journey: Facilitating the Indian growth story
Emerging themes for the Indian steel industry

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Table of contents

Executive summary

The last decade was significant for the Indian steel industry, as India pipped Japan to become the world's second-largest producer of crude steel.[1] India also witnessed significant capacity consolidation under the Insolvency & Bankruptcy Code (IBC) and through the acquisition of steel assets by leading players. Industry consolidation is expected to improve efficiencies and capacity utilisation and enhance domestic pricing power for the players, thus putting India firmly back on the path to potentially reach 300 Million Tonnes (MT) of crude steel capacity by 2030[2] and 500 MT by 2047. With scope for greater economies of scale and penetration in value-added special steel products, the next 25 years seem promising for the Indian steel industry.

The outlook for the global economy in 2023 is cautious.[3] This is primarily due to ongoing geo-political conflicts, tightening of global financing and liquidity conditions, moderating industrial production, volatile currency movements, and increasing trade tensions along with inward-looking policy protectionism across developed and emerging economies. Commodities, particularly steel, are expected to be significantly affected by such a global economic and investment outlook.

Increasing focus on sustainability, emission reduction, and zero waste will continue to drive the global steel industry towards a circular steel economy[4] and environment-friendly 'green' steel-making process. The key objective of a circular steel economy is to produce steel with a long-life expectancy that can be used, reused, and recycled infinitely, thereby reducing the demand for raw materials due to their durability. The global steel industry is actively pursuing innovative technologies that can substantially affect the industry's environmental performance and its raw materials demand. In addition, regulations about sustainability in advanced countries and geographies, such as the EU are posing challenges for steel exports from developing nations, such as India.

Leading global steel producers are also investing in manufacturing and digital technologies to move towards closed-loop steel platforms and create new value. Digitalisation is expected to disrupt steel value chains and the value creation paradigms for steel producers going forward. Automation, analytics, digital supply chain, and digital commerce will enable steel producers to manage risks and volatility, ensure sustainability, and drive profitability across the value chain.

Steel is critical for economic growth in a developing country, such as India with per capita consumption of steel, an important index for socio-economic development, still considerably lower than in developed economies. With an output multiplier of 1.4 on the Gross Domestic Product (GDP) and an employment multiplier of 6.8, the Indian steel industry contributes ~2 percent to the country's GDP and employs over 6,00,000 people.[5]

For the fast-growing Indian economy with many favourable tailwinds, it would not be difficult to achieve the ambition of creating 300 MT steel capacity by 2030 and 500 MT by 2047, provided it ensures that some of the key enablers are appropriately addressed during the upcoming Amrit Kaal period.

Demand creation

Domestic steel demand is expected to grow over the next decade due to a range of initiatives taken up by the present government, indicating a cue to capacity growth from the existing levels of 160 MT[6]. While several initiatives, such as affordable housing, expansion of railway networks, development of domestic shipbuilding industry, increased investments in the power sector etc. are going a long way in demand creation, there is a need for a greater focus on newer avenues for demand creation such as increasing private participation in defence sector enabling the growth in the automobile sector etc. Structural issues related to financial stress, margin pressures, and exposure of steel producers to service debts have led to insolvency and slower capacity growth. Significant capacity consolidation is underway and steel producers are expected to adopt a more cautious approach towards greenfield investments over the next 1-2 years. Increased dominance of integrated steel units is likely to have demand and price pressures for secondary steel producers.

Raw material availability

A relatively slow process of iron ore mine allocation along with intermittent mining bans across a few states have affected the domestic steel sector. It is expected that 2030 will be an important year for the iron ore mining sector and will have a significant effect on steel production, due to the expiry of captive leases under the Mines and Minerals (Development & Regulation) Act 2015. The government and industry need to take proactive steps to ensure a seamless transition for these significant milestones. Issues related to logistics from the mining areas also need to be addressed to mitigate the lag in the evacuation of iron ore. High import dependency on coking coal/coke is another ongoing concern for the Indian steel industry, due to constraints related to coking coal availability and production in India. Timely steps will have to be taken to make optimal quantity available for the sector and to improve production with new mining technologies.

Logistics infrastructure

An aspiration of achieving a steel production capacity of 500MT by 2047 would demand a logistics infrastructure to move ~2,000 MT (including raw materials and finished goods) by then. This will be a key challenge given that India is currently ranked 44 on the Logistics Performance Index (LPI) by the World Bank.[7] India will have to address the current issues around rake availability, track congestion, road infrastructure, etc., and evaluate innovative solutions, such as slurry pipelines, inland waterways, efficient use of land near ports/railway lines for blending/storage to address the logistics challenge.

Capital requirement

The National Steel Policy (NSP) 2017, estimates a capital investment of ~INR 10 lakh crore to achieve a steel capacity of 300 MT by 2030.[8] Sustained measures will be required to address this challenge to increase liquidity and reduce the cost of capital.

R&D spend

India would need to significantly improve its R&D efforts to enhance the quality of its products, improve environmental efficiency, and identify cost optimisation initiatives, such as reduced use of coal, use of hydrogen as a reactor instead of carbon, better heat recovery systems, appropriate usage of slag, innovative measures to reduce carbon emissions.

Quality improvement

India has brought about 90 percent of its products under Quality Control Orders[9](QCO) and it is expected that soon 100 percent of products would be covered under QCO. India should also ensure that it harmonise its quality standards with the key trading countries and administers the same quality standards on imported goods as well to enable a level playing field. Indian steel companies must also adopt digital and exponential technologies to achieve quality leadership amongst its global peers.

Sustainability and green steel

Steel industry is one of the leading producers of carbon dioxide across the globe. In India every tonne of steel produced, emits 2.55 tonne of CO2 against a global average of 1.85 tonne. Further, steel sector contributes to 12% of the CO2 emissions in the country. Therefore, it is time, steel producers adopt strategies to contribute to decarbonise the steel sector.

Out of the various technologies available, green hydrogen based DRI is the most effective alternative. The use of hydrogen in steelmaking can improve energy efficiency, reduce operating costs, and improve the quality of the steel produced.

Recognising its potential in decarbonizing the steel industry, the Government has launched National Green Hydrogen Mission to promote the development of hydrogen infrastructure, including production and transportation, creating export opportunities for green hydrogen, and to support research and development in hydrogen technologies.

Import substitution and export promotion:

India's steel exports accounted for about 3 percent of all steel exported in 2021[10], and with steel demand expected to grow by 1.5 times by 2050, this presents a great opportunity for Indian steel exports to leapfrog other countries in terms of market share. Considering the current growth figures (GDP growth rates over the past few years) the most attractive export destinations appear to be East Asia and Pacific (China, Hong Kong, Taiwan, Vietnam, Indonesia, Philippines, and Malaysia amongst others), the Middle East and North Africa (Saudi Arabia, the UAE, Egypt, Jordan, Algeria, Tunisia, Morocco, amongst others). Despite the presence of a short-term window of opportunity due to the Russia-Ukraine conflict and the US trade war with China, the growth of steel demand in traditional markets, such as the US and the EU is slowing down.

Indian steelmakers are pursuing aggressive capacity expansion plans in line with the vision of the National Steel Policy to achieve 300 MTPA crude steel capacity by 2030. The leading Integrated Steel Producers have planned to enhance their capacities by around 100 percent in this decade. Going forward, it is expected that India would achieve a capacity of 500 MTPA during the Amrit Kaal. This presents an opportunity to bring brand India Steel on the centre stage of global trade and become a leader in steel export.

Secondary steel producers are playing a key role in capacity creation; there is a need to create a favourable policy environment for them to ensure a strong performance in the coming years. Reduced input costs through duty reduction on power tariffs and coordinated efforts across ministries (coal, mining, railways, power, etc.) could be some of the measures that may go a long way in supporting this section.

Although there are issues regarding raw material availability and financial pressures for the domestic steel industry, it has managed to come out stronger towards the end of the last decade. Focussed efforts from both the government and industry players are required to achieve long-term growth objectives and strengthen domestic and export competitiveness.

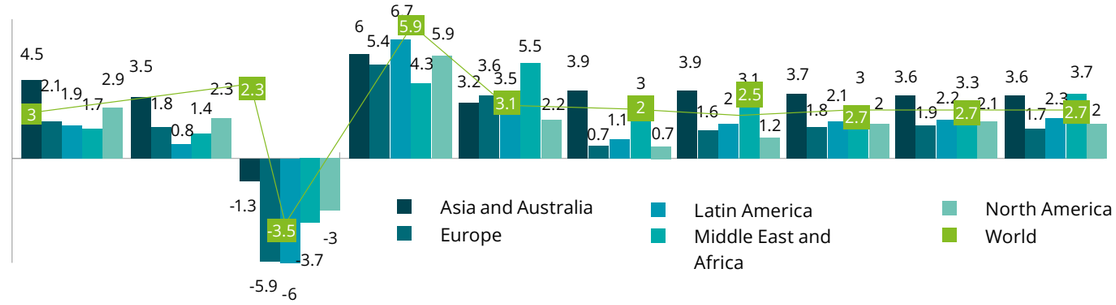
[1]World Steel Association
[2]National Steel Policy, 2017
[3]World Bank, International Monetary Fund
[4]POSCO Research Institute
[5]National Steel Policy, Ministry of Steel
[6]Ministry of Steel Annual Report
[7]Ministry of Steel, World Steel Association
[8]World Steel Association, JPC
[9]Ministry of Steel, World Steel Association
[10]World Steel Association, JPC

India Steel 2023 Amrit Kaal Journey: Facilitating the Indian Growth Story | Emerging Themes for Indian Steel Industry

Economic outlook

While the world was still on the path to recovery post-COVID-19, global geopolitical instability has prolonged the recovery period. The world GDP growth rate is expected to be slower in 2023, due to the headwinds arising from the Russia-Ukraine conflict's ripple effect, in addition to high inflation and interest rates. Global inflation is expected to subside only gradually, from an estimated 9.3 percent in 2022 to 6.7 percent in 2023 and 4.3 percent in 2024[11]. It is expected that major central banks might end their tightening cycles by mid-year as inflation slows, but rates will remain high in 2023–24. The Global GDP trends and forecasts is shown in Figure 1.

Figure 1: Global GDP: Trends and Forecasts

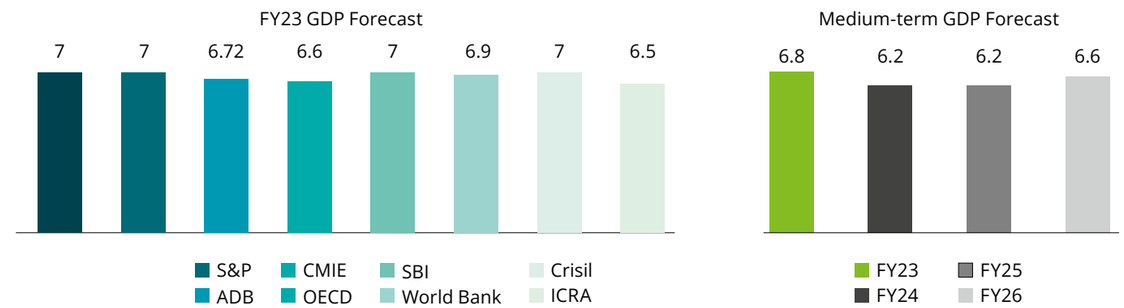


Source: Economic Intelligence Unit, The Economist

However, developing economies will observe comparatively higher growth rates. The emerging market and developing economies across all regions are expected to grow by ~4.2 percent in 2024. Moreover, India will continue to be the bright spot in the world economy, accounting for ~15 percent of global growth in 2023[12].

Despite strong global headwinds and tighter domestic monetary policy, India is still expected to grow between 6.5 percent and 7.0 percent[13] as shown in Figure 2. This reflects India's underlying economic resilience and ability to recoup, renew, and re-energise the growth drivers of the economy.

Figure 2: Indian GDP forecast



Source: GDP forecasts by S&P, ADB, CMIE, OECD, SBI, World Bank, Crisil, ICRA, Deloitte Analysis

[11]https://www.imf.org/en/Publications/WEO/Issues/2023/01/31/world-economic-outlook-update-january-2023
[12]https://www.businesstoday.in/latest/world/story/imf-chief-says-india-remains-a-bright-spot-to-contribute-15-of-global-growth-in-2023-371433-2023-02-25
[13]https://argusenglish.in/article/economic-survey-showcases-indias-economic-resilience

Steel industry overview

Steel is one of the world's most essential materials. It is fundamental to every aspect of our lives, including construction, transportation, machinery, appliances, and packaging. It is produced in various forms, such as bars, plates, sheets, pipes, wires and can be shaped and formed through various techniques including forging, casting, and rolling. Recycling steel is also widely practiced, making it a sustainable and environment-friendly material.

The steel industry plays a vital role in the global economy, with a significant effect on employment, trade, infrastructure development, and the growth of other industries. However, it also faces a range of challenges including environmental concerns, fluctuating demand and raw material prices, and intense competition.

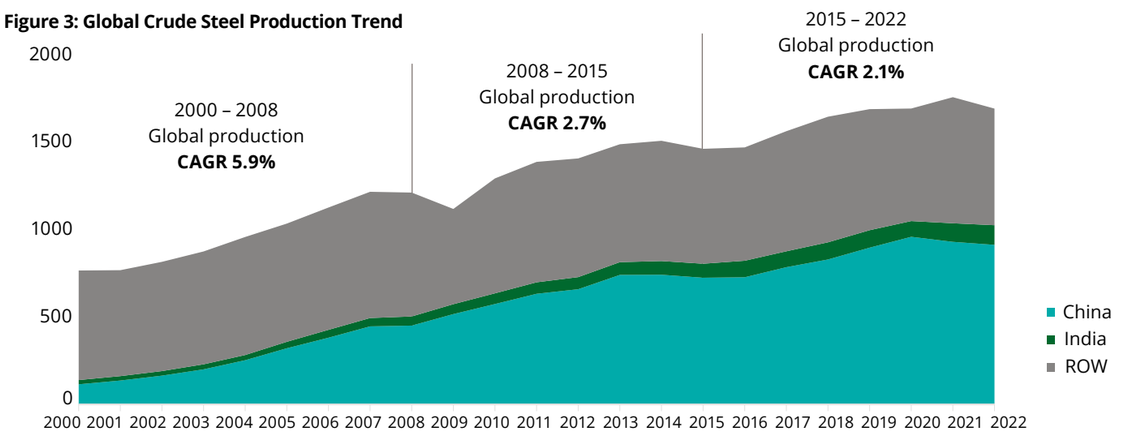
Global steel industry

Global steel production has increased from 850 MT in 2000 to 1,878.5 MT in 2022[14], due to an increase in demand (majorly because of rapid industrialisation). Steel production grew at an accelerated rate of ~6 percent from 2000 to 2008. The growth was fueled by China, Japan, the US, Russia, and Germany. During the same period, China and India's steel production grew at a CAGR of 18.7 percent and 10 percent, respectively.

In 2006, India became the fifth-largest steel-producing country[15]. The years 2008–2015 saw a steady growth in global steel production led by China, Japan, and India. During this period, steel production in China and India grew at a CAGR of 7 percent and 6.3 percent, respectively.

India surpassed the USA in 2015 to emerge as the third-largest steel producer after China and Japan[16]. The next seven years saw decent growth in steel production amidst the impact of COVID-19 and the subsequent shortage of raw materials. However, India overtook Japan to become the second-largest producer of steel in 2018[17]. Today, the global steel industry remains a critical part of the global economy, with China being the world's largest producer of steel, followed by India, Japan, the US, and Russia.[18] The Global crude steel production trend of China, India and Rest of the World is shown in Figure 3.

Figure 3: Global Crude Steel Production Trend



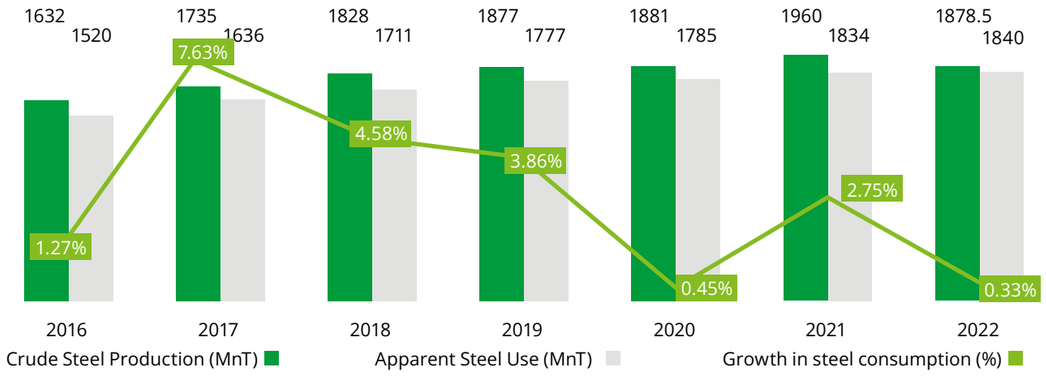
Source: World Steel in figures 2022, WSA

[14]https://worldsteel.org/media-centre/press-releases/2023/december-2022-crude-steel-production-and-2022-global-totals/#:~:text=to%2Ddate%20aggregate,2022%20global%20crude%20steel%20production%20totals,4.2%25%20decrease%20compared%20to%202021.
[15]https://www.oneindia.com/2007/08/07/india-now-worlds-5th-largest-crude-steel-producer-1186483183.html?story=2
[16]https://economictimes.indiatimes.com/industry/indl-goods/svs/steel/india-emerges-as-third-largest-steel-producer-in-the-world/articleshow/50718627.cms?from=mdr
[17]https://www.indiatoday.in/india/story/india-overtakes-japan-to-become-the-second-largest-producer-of-crude-steel-1205089-2018-04-05
[18]World Steel Association

Demand supply trend

Global crude steel production increased from 1,632 MT in 2016 to 1,960 MT in 2021, growing at a CAGR of 3.73 percent. China dominated the production, followed by India and Japan respectively contributing 53 percent, 6 percent, and 5 percent of the total steel production. India, the world's second-largest steel producing country, increased the output by 17.8 percent in 2021 to 118.1 MT, while production from Japan increased by 14.9 percent to 96.3 MT for the year[19].

Figure 4: Global Crude Steel Production vs Apparent Steel Use



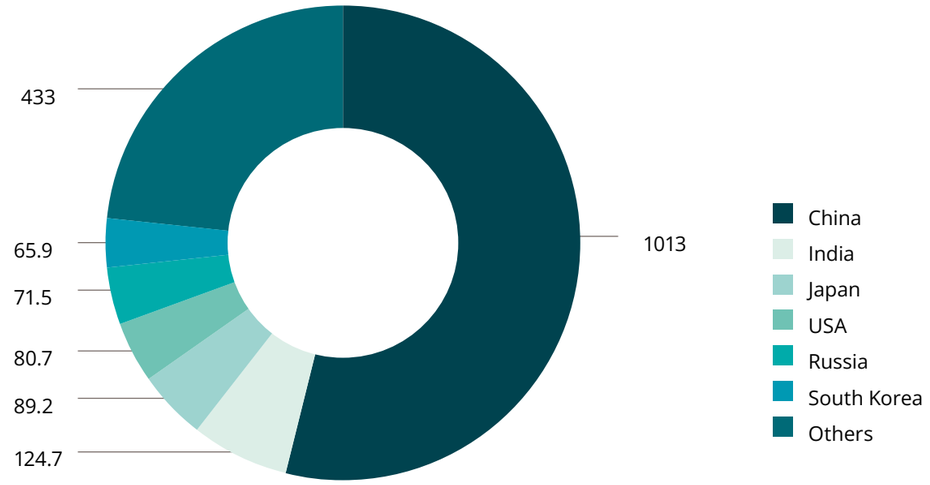
Source: World Steel Association

The world's crude steel output (as shown in Figure 4), saw its first decline in seven years in 2022, as production dropped by 4.2 percent to 1,878.5 MT[20]. China's crude steel production declined by 2.1 percent to 1.01 BT, largely due to a subdued economy amidst its zero-COVID policy and uncertainties over its real estate market. Japan recorded a 7.4 percent decline in production to 89.2 MT as auto production slowed on account of chip shortage.[21] Global crude steel output in countries other than China fell by ~2 percent in 2022, expected due to a 15 percent drop in CIS (Commonwealth of Independent States) production following Russia's invasion of Ukraine[Economist Intelligence Unit]. There was a fall of 9 percent in the EU due to the economic impact of the war resulting in rising energy and power prices.[23] However, India was the only country that saw an increase of 5.5 percent in steel output amongst the five major steel-producing countries, producing 124.72 MT of crude steel in 2022. The major steel producing countries are shown below in Figure 5.

However, the global consumption trend of steel has witnessed an increasing trend in 2022, unlike the production trend. Global consumption of steel was estimated at 1,840 MT in 2022 against the total production volume of 1,878.5 MT[24]. The strong growth in construction activity and rising automotive output saw a rise in crude steel consumption in 2022. China dominates global crude steel consumption with a 50 percent market share in 2022. The major driving industry is the construction sector, which accounts for China's 55 percent finished steel consumption. The EU is the world's second-largest consumer of steel, accounting for 8 percent of global consumption in 2022. As energy prices surged after Russia invaded Ukraine, Europe's economy faced a sharp slowdown in the second half of 2022, declining the EU's steel consumption by 7 percent year-on-year[25].

[19]https://worldsteel.org/steel-topics/statistics/world-steel-in-figures-2022/#world-crude-steel-production-1950-to-2021
[20]https://worldsteel.org/media-centre/press-releases/2023/december-2022-crude-steel-production-and-2022-global-totals/#:~:text=to%2Ddate%20aggregate,2022%20global%20crude%20steel%20production%20totals,4.2%25%20decrease%20compared%20to%202021.
[21]https://asia.nikkei.com/Business/Materials/World-crude-steel-output-sees-first-decline-in-seven-years-in-2022
[22]Economist Intelligence Unit
[23]http://www.eiu.com/industry/commodities/article/1782645761/steel/2023-01-01s
[24]https://worldsteel.org/steel-topics/statistics/world-steel-in-figures-2022/#world-crude-steel-production-1950-to-2021
[25]https://www.eiu.com/industry/commodities/article/1012842684/steel/2023-04-01

Figure 5: Major Steel Producing Countries in 2022



Source: SteelMint

Table 1: Major Companies in Steel Production

Rank	Company	Crude Steel production (MT)	Headquarters	Revenue (USD Million)
1	China Baowu Group	119.95	Shanghai	1,50,730
2	Arcelor Mittal	79.26	Luxembourg	83,759
3	Ansteel Group	55.65	Anshan	59,447
4	Nippon Steel Corporation	49.46	Tokyo	60,612
5	Shagang Group	44.23	Jiangsu	47,072

Source: World Steel Association, Fortune Global 500

The top five players shown in Table 1 accounted for ~18 percent of the global crude steel market in 2021. The global production capacity of crude steel was about 1,960 MT in 2021. China Baowu Group accounted for the largest production capacity with a production of 119.95 MT in 2021. The production by the company occupied 6.1 percent of the global production shares. ArcelorMittal was the second-largest company accounting for 4 percent of the global share and producing 79.26 MT of crude steel. Globally, other leading crude steel producers were Ansteel Group, Nippon Steel Corporation, Shagang Group, and others. These accounted for 2.8 percent, 2.5 percent, and 2.3 percent, respectively[26].

[26]https://worldsteel.org/steel-topics/statistics/world-steel-in-figures-2022/#top-steel-producing-companies-2021

Price trend

Steel prices surged during the post-COVID-19 recovery as the supply of raw materials has struggled to keep up with the demand. Steel prices and long product prices have boomed since December 2020 as supply was insufficient to cover end-use demand and supply chain restocking.

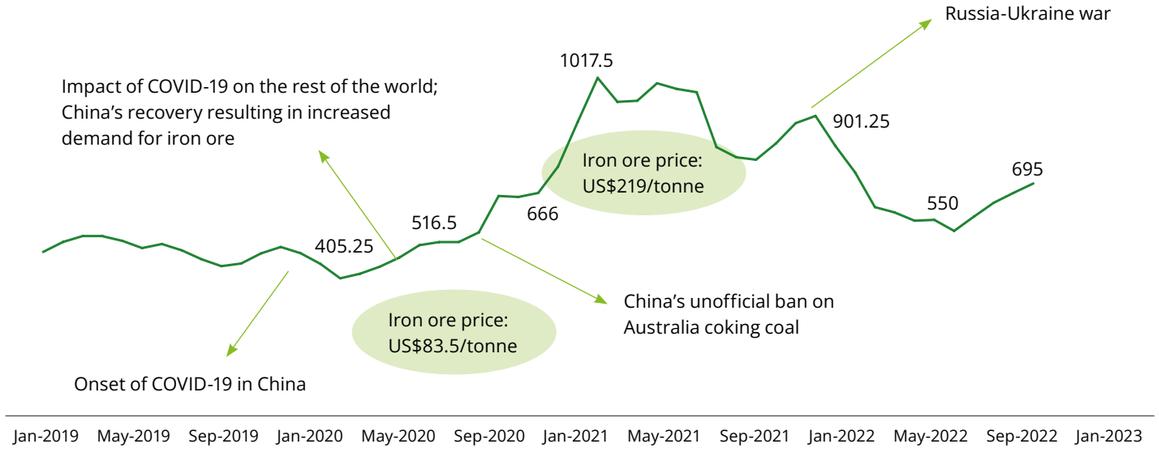
Production of long products outside China was severely hit by the COVID-19 crisis and the recovery was gradual but was outplaced by the improvement in apparent demand.[27] Iron ore prices have increased by over 260 percent from US$ 83.5 per tonne in May 2020 to US$ 219 per tonne in June 2021[28], as an effect of post-COVID-19 recovery, disturbing the demand-supply balance.

As COVID-19 cases rose across China in January 2020, most factories were forced to shut and production almost came to a complete halt. During this time, many governments saw construction as key to keeping the economy operating, increasing the demand for basic building materials while supply was substantially affected. In addition to iron ore, coal prices also increased, due to China's unofficial ban on Australian coal in October 2020[29], which eventually got lifted in January 2023.

Steel prices were on a downward trend for most parts of CY22 on account of factors affecting the Chinese market. The slowdown in the infra and construction sectors in China due to stalled projects and liquidity crunch, leading to higher inventory levels was the primary reason for reduced demand.

The prices have started to recover in the ongoing CY and increased by 26 percent from November 2022 prices to reach US$ 695 per tonne in March 2023, on an upward trajectory[30]. The price trends of HRC, FOB Rizhao, China export, is shown in Figure 6.

Figure 6: HRC, FOB Rizhao, China export: 3–12 mm, SS400 (US$/tonne)



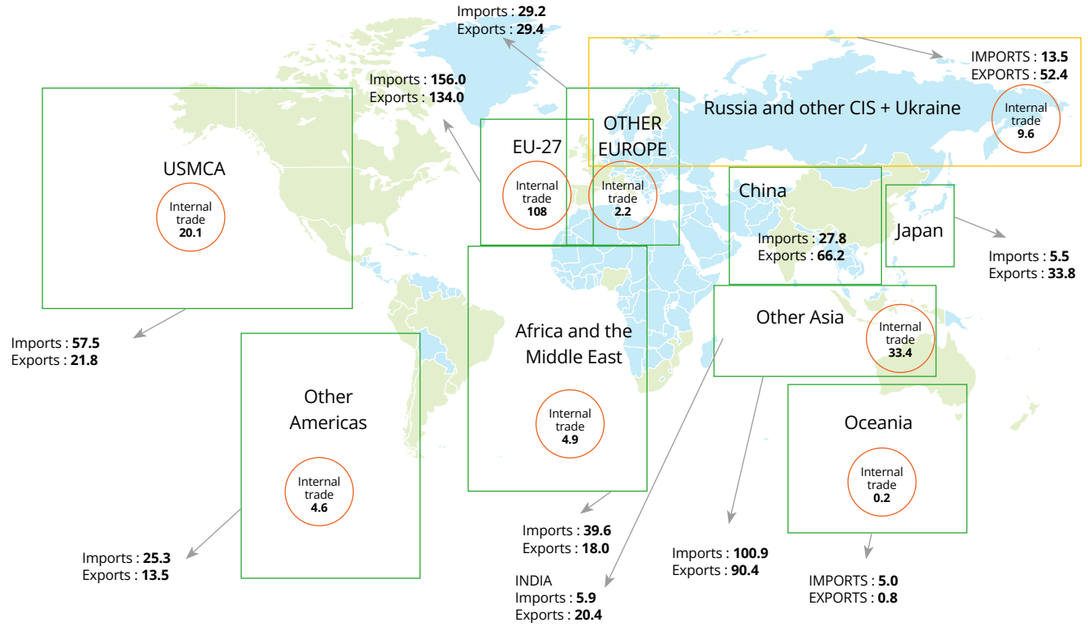
Source: Steel Mint

Global trade

Steel manufacturing is a critical industry worldwide and a heavily traded commodity. The global trade of steel has a significant effect on the global economy and the competitiveness of different countries.

[27]https://www.fastenerandfixing.com/insight/steel-prices-have-boomed-in-2021-but-it-won-t-last-forever/
[28]https://klse.i3investor.com/web/blog/detail/koonyewyinblog/2021-10-27-story-h1592918749-What_is_causing_the_steel_price_to_increase_so_rapidly_in_USA_Koon_Yew_
[29]https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/coal/022223-china-starts-buying-australian-coal-as-unofficial-ban-ends
[30]SteelMint

Figure 7: World Steel Trade Flow (MT) in CY21



Source: World Steel Association, World Steel in figures 2022

International trade in steel in 2021 accounted for ~460 MT[31], as shown in Figure 7. World trade flows have been consistent with production rates, and China is the largest exporting region (in terms of extra-regional exports). The largest exporters China and Japan export majorly to the largest importing region, i.e., other Asian countries (in terms of extra-regional imports), which includes South Korea, Vietnam, Thailand, and Indonesia.[32] Russia majorly exports steel to the European Nation, which is the second-largest importer of steel (in terms of extra-regional imports). The major exporting and importing countries are shown in Table 2.

The major products traded include hot rolled sheets and coils, which constitute 18.1 percent of the total export volume in 2021[33]. Ingots and semi-finished material and galvanised steel are the second and third most exported products constituting 14 percent and 10 percent of the total export volume.[34]

[31]https://worldsteel.org/steel-topics/statistics/world-steel-in-figures-2022/#world-trade-in-steel-by-area-2021
[32]World Steel in figures 2022
[33]https://worldsteel.org/steel-topics/statistics/world-steel-in-figures-2022/#world-steel-exports-by-product-2017-to-2021
[34]World Steel Association

Table 2: Major exporting and importing countries

Rank	Exporting Countries (2021)		Importing Countries (2021)	
	Country	Total Export (MT)	Country	Total Import (MT)
1	China	66.2	The EU	48.1
2	Japan	33.8	The USA	29.7
3	Russia	32.6	China	27.8
4	South Korea	26.8	Germany	23.3
5	The EU	26	Italy	20.8
6	Germany	23.9	Turkey	16.2
7	Turkey	22.1	Thailand	15.7
8	India	20.4	Mexico	15.1

Source: World Steel Association, data of CY-2021

Domestic steel industry

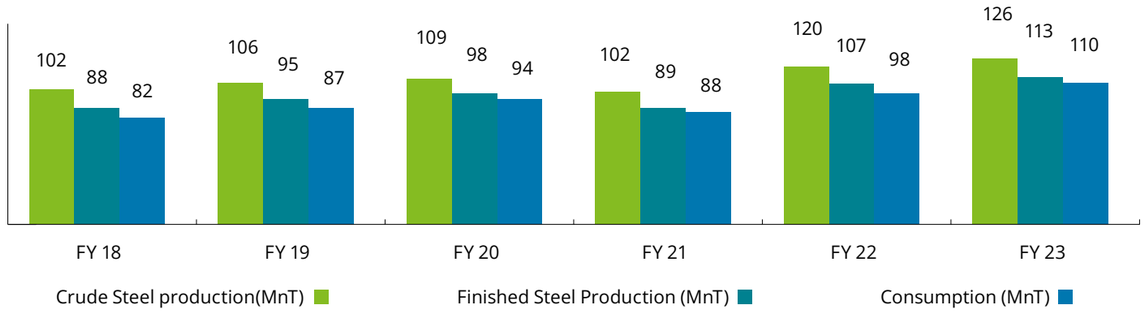
The first steel plant in India was established in 1907 by Tata Steel. However, the steel industry gained momentum post-Independence as the government implemented a series of policies to support its growth. The Hindustan Steel Limited (HSL) was established in 1954 and set up its first integrated steel plant at Rourkela in Odisha in 1959. The Bhilai Steel Plant in Chhattisgarh and Bokaro Steel Plant in Jharkhand were established during the 1960s.

In 1973, the government nationalised the steel industry, merging HSL with other steel companies to form the Steel Authority of India Limited (SAIL). The industry picked up with the establishment of new private sector companies, such as JSW Steel, Jindal Steel and Power Limited, Essar Steel. India became one of the top 10 steel producers in the world in 2005, and in 2018 the country went on to become the second-largest crude steel producer in the world.

Production

India is the second-largest producer of crude steel globally with 125.5 MT of crude steel production in FY 23, registering an increase of ~4.8 percent compared with 119.8 MT produced in FY 22. India's crude steel production grew at a CAGR of 7.2 percent from 2000 to 2022. Crude steel production fell by ~6.4 percent during FY 21 to 102.1 MT as most of the steel-producing regions witnessed a decline in crude steel output (due to production cuts amidst a more stringent lockdown in the country). However, the domestic steel industry witnessed a significant boost in production levels growing at ~17.4 percent to reach 119.8 MT in FY 22. India's crude steel production, finished steel production, and consumption is shown in Figure 8.

Figure 8: Domestic Steel production vs consumption



Source: Steel Mint

Finished steel production vs consumption

India's finished steel consumption grew at a CAGR of ~6 percent in the past five years to 110 MT in FY23. The buildings and construction industry is the primary demand driver that consumes ~62 percent of the total production, followed by the capital goods and automotive industry with shares of 15 percent and 9 percent, respectively[35]. The Indian government's initiatives and schemes, such as GatiShakti Master Plan, Make in India, Pradhan Mantri Awas Yojna - Housing for all, Urban infrastructure development scheme for small and medium towns, etc., have created prospects for significant consumption of steel.

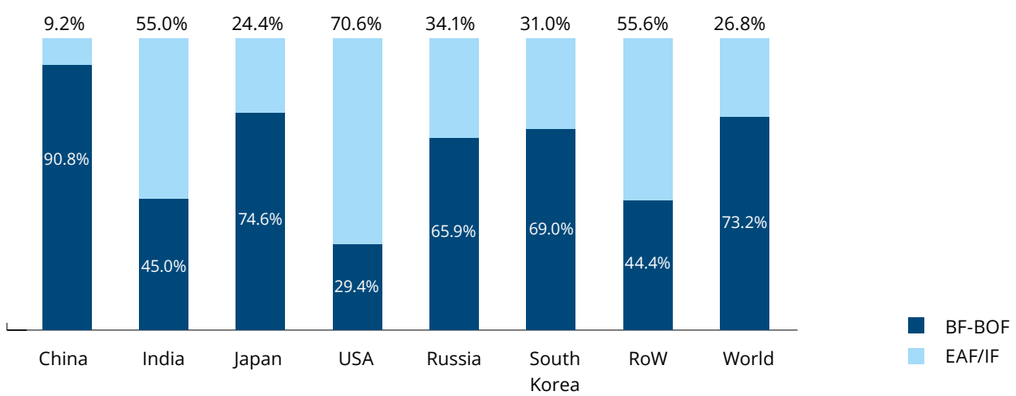
Process routes

There has been a gradual shift in steel production routes over the past few years from induction furnaces to Electric Arc furnaces (EAF) by steel producers, as shown in Table 3, primarily due to the inferior quality of products through the former route. The share of steel production through the Basic Oxygen Furnace (BOF) route is expected to increase in the future (mainly due to better product quality and the low availability of graphite electrodes).

At present, India produces 55 percent of its steel through the EAF/IF (Electric Arc Furnace/ Induction Furnace) route (as shown in Figure 9) . However, the NSP envisages reducing this share to 35–40 percent while the remaining 55–60 percent is envisaged to come from the Blast Furnace route. Globally, the share of the EAF/ IF route is considerably small at 26.8 percent while that of China is a mere 9 percent[36].

[35]IBEF
[36]https://steel.gov.in/sites/default/files/draft-national-steel-policy-2017.pdf

Figure 9: Route wise Production share (Global) 2021



Source: Mysteel Global, S&P Global, Argus Media

Table 3: Route wise Production Trend (India)

Year	BOF	EAF	IF
FY14	43%	23%	34%
FY15	42%	26%	32%
FY16	43%	27%	30%
FY17	43%	30%	27%
FY18	46%	26%	28%
FY19	45%	25%	30%
FY20	45%	28%	27%
FY21	45%	27%	28%

Source: MoS Annual Reports

Key producers in India and their expansion plans

Steel manufacturing companies in India are classified into integrated steel producers and secondary producers based on their presence in the value chain. Integrated players, such as JSPL, JSW Steel, Tata Steel, SAIL, Essar Steel, Rashtriya Ispat Nigam account for ~61 percent of the total finished steel production[37], as shown in Figure 10.

Before 2014, the performance of leading integrated steel producers was marked by rapid capacity expansions and growing profitability. However, the declining Chinese domestic demand and excess global steel capacity created an uncontrolled dumping of steel in India.

[37]SteelMint

Major Asian steel producers, i.e., China, South Korea, and Japan took advantage of the situation and started bringing domestically produced steel products to India at highly competitive prices. The situation was further aggravated by the sudden cancellation of allocated raw material mines thus halting ongoing mining activities. Such disruptions in the supply chain of raw materials and finished products affected the entire industry resulting in low utilisation, declining price realisation, lower margins, and disturbed business operations.

Many leading producers started facing the pressure of mounting debt burden due to blockage of investments in expansion and modernisation plans and later embarked upon either divesting their steelmaking facilities or initiating insolvency resolution process.

A few producers, such as Tata Steel, JSW, SAIL managed to withstand the situation and started recovering their operations. The Government of India also reformed policies and strategic trade measures. Imposition of anti-dumping duty and safeguard duty managed to curb the growing rate of imports and improve exports of steel products from the country. Amendment of the Mines and Minerals Development and Regulation (MMDR) Act and other mining regulations were meant to ensure effective and efficient allocation of mining blocks and fast track the operationalisation of auctioned blocks.

Moreover, interventions in the form of initiating the insolvency resolution of debt-laden businesses helped in the consolidation of the industry.

Moreover, the major ISPs have announced plans to increase their capacities, helping the nation realise their targeted capacity envisaged in the NSP. The capacity expansion plans are listed in Table 4.

Figure 10: Major Integrated Steel Plants in India and their production share (FY23)

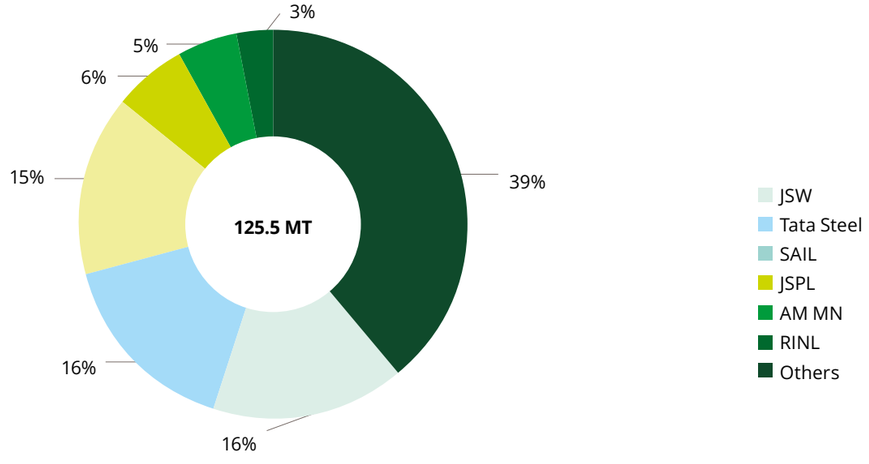


Table 4: Capacity expansion plan of the major ISPs

S No	Company	Existing Capacity in MT (FY22)	Expansion Plans in MT (FY30)
1	JSW	27	50
2	Tata Steel	20.6	40
3	SAIL	23.3	50
4	JSPL	9.6	50
5	AMNS	9	30
	Sub-total	**89.5**	**220**

Source: Secondary Research

Per capita steel consumption

Although India is the second-largest consumer of finished steel, its per capita consumption of 76 kgs is noticeably below the world average of 233 kgs. Some of the leading countries include South Korea (1,075.6 kgs), Taiwan (885.6 kgs), Czech Republic (775 kgs), China (666.5 kgs), Austria (516.9 kgs), Italy (439.4 kgs), and Germany (426.1 kgs)[38]. The per capita consumption of steel declined significantly across most economies in 2020, due to the COVID-19 crisis.

However, India's per capita consumption of steel is growing at the highest rate, after China, amongst other countries across the globe. Table 5 highlights the per capita steel consumption trend over the past four years when India's consumption grew at a CAGR of 3.5 percent against a global increase of 1.7 percent, which majorly got affected due to COVID-19.

Table 5: Region-wise per capita steel consumption trend (in kgs)

Region	2017	2018	2019	2020	2021	CAGR
World	216.7	224.3	230.4	229.0	232.0	1.7%
European Union	342.8	353.9	332.7	294.2	344.2	0.1%
Other Europe	295.2	266.0	235.7	243.5	276.0	**-1.7%**
Russia & other CIS	186.2	189.8	198.5	195.4	200.1	1.8%
USMCA	282.7	283.8	273.1	228.3	270.0	**-1.1%**
Asia	268.5	283.7	300.9	311.8	306.2	3.3%
Africa	28.3	28.9	30.2	26.2	27.0	**-1.2%**
China	544.6	585.6	636.0	699.2	666.5	5.2%
Japan	504.9	514.2	498.3	416.1	456.2	**-2.5%**
India	66.2	71.5	75.1	64.7	76.0	3.5%

Source: World Steel Association

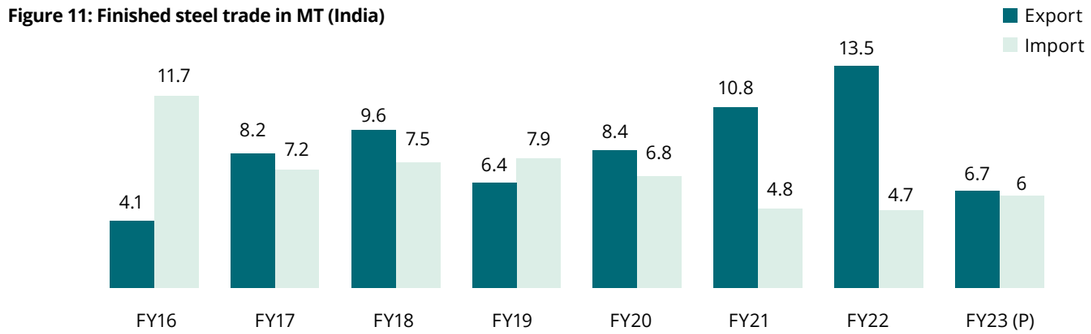
Trade

Traditionally, India was a net importer of finished steel, however, the tide turned in FY17 when India became a net exporter. With the only exception in FY19, India has always been a net exporter of finished steel since then. Even during FY23 when the government had imposed export duty on steel products for half of the year, India has still managed to be a net exporter. Finished Steel trade in India is shown in Figure 11.

Some key factors that helped India revive its trade deficit and become a trade surplus country in finished steel include domestic support to the industry, the introduction of anti-dumping duties and safeguard duties for steel products. The latest anti-dumping duties imposed by India include the import of stainless steel, seamless tubes, and pipes from China and the import of electrogalvanised steel from Korea RP, Japan, and Singapore. All such measures were not only directed to restrict the import of steel products at a competitive landed price, but also to improve capacity utilisation, price realisation, and profit margins for domestic producers.

[38]https://worldsteel.org/steel-topics/statistics/world-steel-in-figures-2022/#apparent-steel-use-per-capita-2017-to-2021

Figure 11: Finished steel trade in MT (India)

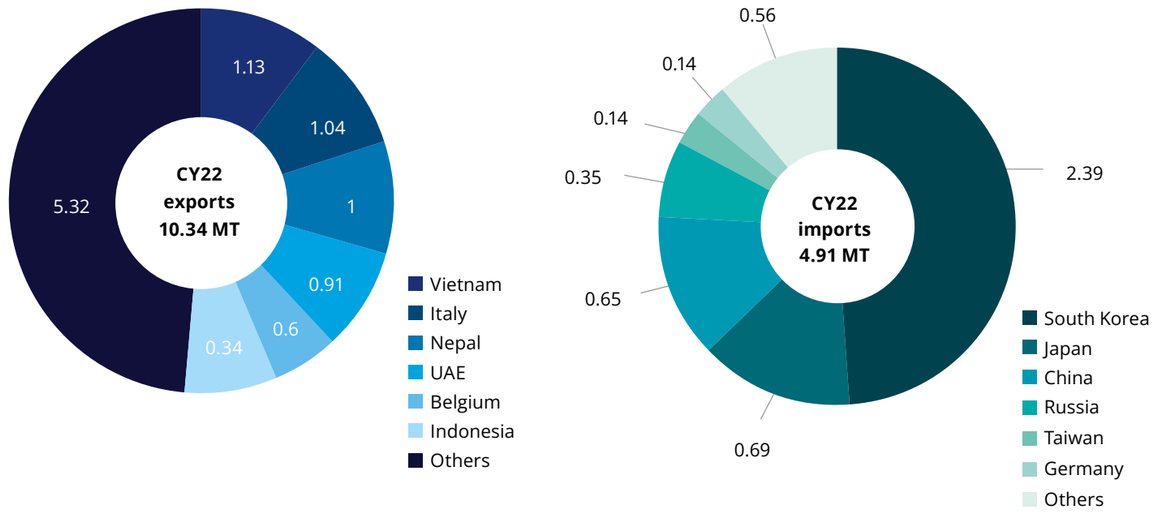


Source: JPC

In FY22, India imported 4.7 MT of finished steel, out of which 50 percent was imported from South Korea[39]. In FY18, South Korea replaced China as the largest exporter to India and since then has been the largest exporter consistently.

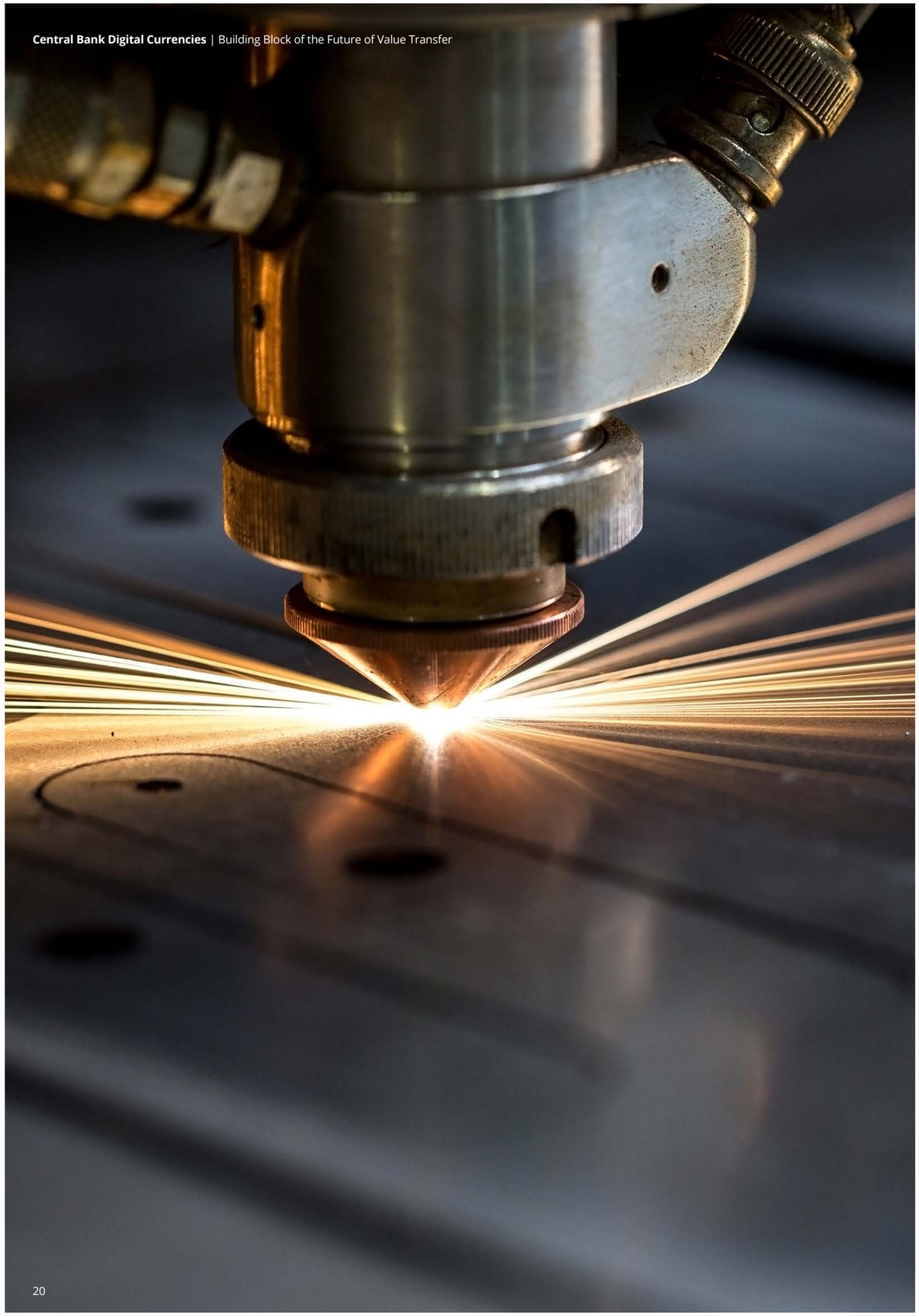
In terms of export, Nepal, Vietnam, Italy, and the UAE have been traditional destinations for the export of Indian steel, as shown below in Figure 12. In FY22, these four countries contributed to 40 percent of the total steel export from India. The export quantity increased by 25 percent in FY22 over the previous year on account of reduced supply from Russia and Ukraine. However, FY23 saw a sharp decline due to the imposition of export duty on steel products. The provisional figure for the export of finished steel from April 2022 to March 2023 stands at 6.72 MT[40].

Figure 12: Export and import destinations of finished steel (India)



Source: Steel Mint

[39]Joint Plant Committee
[40]SteelMint

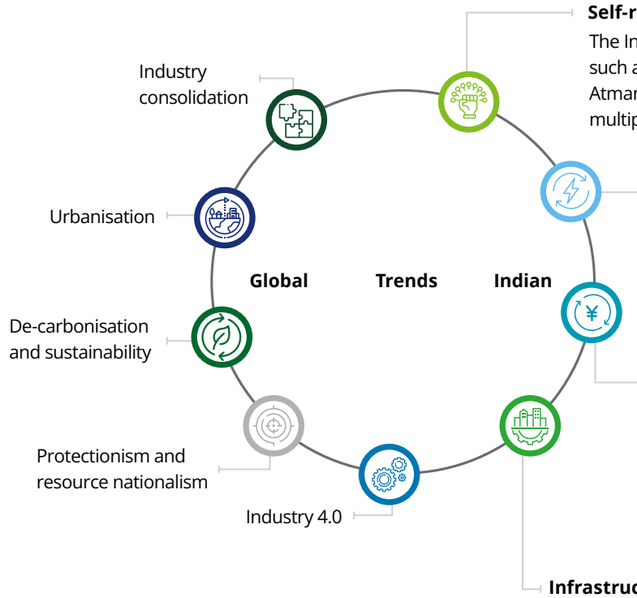


Opportunities for the Indian steel industry

Overview

The Indian steel industry is currently the second largest in the world. As India's economy grows, its steel demand is expected to grow substantially. While the outlook for the sector points to an optimistic future, it is important to track the global and domestic trends and themes that are driving the steel sector. The current section explores and presents a brief perspective on the important drivers in the Indian steel industry, as displayed below in Figure 13.

Figure 13: Megatrends shaping the Indian steel industry



Self-reliance and emergence as a manufacturing hub
The Indian government has embarked on ambitious missions such as Atmanirbhar Bharat and Make in India. As part of the Atmanirbhar Bharat, PLI scheme was recently introduced for multiple sectors.

Renewable energy and battery storage
Government has set an ambitious target to achieve 450GW renewable energy by 2030. Batteries will enable current energy transition towards electric mobility, integration of renewable energy through grid scale storage and increase energy access in India.

Recycling and circular steel economy
Transition to circular steel economy and production of steel through the recycled route entails lower carbon emissions, lower resource consumption and lower energy utilisation. Government has notified the steel scrap recycling policy in 2019 to enable availability of quality domestic scrap to the steel sector.

Infrastructure
Investments in physical and digital infrastructure via the Smart Cities mission, PMAY, Digital India will be instrumental in meeting the needs of connectivity and urbanisation

Source: Deloitte Analysis, Secondary Research, Press Information Bureau

Changing dynamics of Indian steel industry

The rapid infrastructure development in India along with the increasing population and urbanisation has led to a rise in demand for steel products. The automobile and manufacturing sectors are also significant consumers of steel, and the growth of these sectors has led to increased demand for steel. The same can be gauged from the fact that the combined Index of Eight Core Industries (ICI) increased by 7.4 percent (provisional) in December 2022 as compared with the index of December 2021[41]. The Eight Core Industries comprise 40.27 percent of the weight of items included in the Index of Industrial Production (IIP). Within the combined index, the index for steel stood at 171.6 with the base year as 2011–12 (base as 100)[42].

While the domestic steel sector is projected to grow multi-fold propelling the per capita domestic consumption from 76 kgs to an estimated 160 kgs by 2030, the orientation of the Indian steel sector as a net exporter is a theme that requires close examination. At the same time, the rapid urbanisation of the nation is expected to bring the theme of the rural steel market into the key deliberations regarding the further growth of the sector.

Export orientation of the Indian steel sector

India exported about 5.90 MT of finished steel from April 2022 to February 2023[43]. The major share of exports is generally finished flat products accounting for about 70–75 percent share with finished long products and semi-finished billets making up the balance of export quantities[44]. Exports from India are spread across various geographies of Southeast Asia, the Middle East, and Europe, amongst others. A perspective on key emerging markets for steel and drivers for the domestic sector is provided in Table 6.

Table 6: Key Emerging Markets for Export Orientation of Indian Steel

#	Region	Current Steel Trade Scenario	Key Takeaways for Indian Steel Sector
1	Asia (except China and Japan)	Vietnam, Singapore, Nepal, and Hong Kong were major export destinations in the region for Indian steel for FY2021–22. The region is a net importer of steel to the tune of ~10.5 MT (2021). The major categories of exports to this region include HR coils, HR flat products, amongst others and wire rods, bars, amongst other long products.	Optimise product portfolios for steel makers in India based on market assessment for target geographies and their corresponding maturity level of downstream capabilities. New market development and customer scoping by steel players with a focus on countries with high net imports of steel, such as Thailand and the Philippines.
2	Africa and the Middle East	Africa and the Middle East are net importers of steel with the UAE alone accounting for ~9 percent of exports from India for FY2021–22. Other major export destinations for FY2021–22 include Egypt, South Africa, etc. The region was a net importer of ~21.6 MT (2021).	The region has the advantage of geographical proximity to India as compared with other major steel export-oriented regions. Various government stimulus programmes are expected to drive steel demand in the region.
3.	The EU (EU 27)	The EU is a major net importer of steel worldwide with net imports of ~22 MT in 2021. In FY2021–22, Belgium, Italy, Poland, and Spain were some of the major importers of Indian steel.	The EU imports steel of specific grades and specifications, which are not manufactured in the region. Indian players can expand their footprint in this region with focussed assessments for specific products.
4.	USMCA	The USMCA region was a net importer of steel to the tune of ~36 MT in 2021. The USA alone accounted for 3 percent of India's exports for FY2021–22.	Flat products accounted for most of the steel imports in this region. The US imposed ad valorem tariffs of 25 percent on steel imports under Section 232 of the Trade Expansion Act of 1962 in 2018. The tariffs have since been removed, suspended, or replaced with quota deals on a case-by-case basis with multiple trade partners.
5	Other America	The region had a net import of ~12 MT for 2021 with major importers being Colombia (~3 MT) and Peru (~2.5 MT). However, the region has major exporters, such as Brazil, which had a net export of ~6.6 MT for 2021.	While the region is a major producer of iron ore, opportunities may be explored based on planned curbs on Chinese steel production in 2023. This is a result of the slump in iron ore futures and a broader risk aversion triggered by fears of a banking crisis.

Source: SteelMint, World Steel Association, CMIE Industry Outlook, S&P Global Commodity Insights
Note: Reported figures are for 2021 unless mentioned otherwise

[41]Ministry of Commerce & Industry, Press Information Bureau
[42]Ministry of Commerce & Industry, Press Information Bureau
[43]Secretary's DO Report on Iron & Steel, Joint Plant Committee
[44]JPC, SteelMint

India Steel 2023 Amrit Kaal Journey: Facilitating the Indian Growth Story | Emerging Themes for Indian Steel Industry

Brand India Label: An initiative by Ministry of Steel

The government has proposed to introduce new Brand India labelling norms for certain steel products manufactured under identified quality control metrics. The label would be given to products manufactured by following 13 sector specific metrics designed by the steel ministry in consultation with the industry. These metrics includes the production process, location, product design and quality standards for steel products. Currently, SAIL and Jindal Stainless will initiate a pilot manufacturing process of these world class steel products that would carry the Brand India label. After the completion of the pilot process, the government proposes to bring all local steel manufacturers to join the initiative and start promoting Brand India Steel in domestic as well as global markets. This will set new benchmarks for credibility and quality and strengthen country's domestic manufacturing in line with the Atmanirbhar Bharat initiative and showcase the strength of the Indian steel industry by leveraging the 'Brand India' label on steel products in both domestic and export markets.

Key Challenges & Opportunities

India's iron and steel policy is expected to promote indigenous manufacturing through widening the manufacturing base, sharing of know-how, product development as well as technological transfer by way of multi-lateral collaboration. The secondary steel sector in India currently contributes over 40 percent of the total capacity and will need to play a crucial role for India to reach 300 MT capacity. Many opportunities exist for the Indian steel sector in terms of market entry. However, there are several challenges with respect to the exports of finished steel. Some of these challenges include the following:

Strategy Formulation:
Indian steel players must formulate a defined strategy with regard to export orientation. In the past, steel exports was the major focus area during the dip in domestic demand. Further, the Indian steel sector may shift its focus from Hot-Rolled Coil (HRC)/plates and billets to more value-added products, such as galvanised steel, colour coated steel and other such products. The Indian steel sector may also explore the possibility of making its processes more robust and efficient to meet stringent requirements placed by some of the end-user sectors, such as the automotive and aerospace industries.

Policy Aids:
With regard to policy, some steel-importing countries and regions have implemented trade barriers and protectionist measures. For example, the EU has a quota system for import of steel by product type and country. Supplies beyond the fixed quota attract a duty of about 25 percent. In addition, the absence of major trade agreements has also contributed to lower exports of Indian steel.

Cost Competitiveness:
Even though there have been significant improvements in operational efficiencies in the recent years, Indian steel producers are still facing higher costs of about 5–10 percent as compared with the global average[45]. The major components of the additional costs include costs of finance (~12 percent vs. 3–5 percent in the EU) along with the costs for logistics and infrastructure. These factors place India at a disadvantage position as compared with other major steel producers in the region, such as China, South Korea, Japan. A tentative break-up of the cost premium for steel production in India is provided in Table 7.

Table 7: Cost Premium for Steel Production in India

S. No.	Particulars	Cost (US$/tonne)
1	Logistics and infrastructure	25–30
2	Power	8–12
3	Import duty on coal	5–7
4	GST compensation cess	2–4
5	Taxes and duties on iron ore	8–12
6	Finance	30–35
7	Total cost premium	80–100

Source: NITI Aayog, Achieving Green Steel: Roadmap to a Net Zero Steel Sector in India, TERI

[45]Achieving Green Steel: Roadmap to a Net Zero Steel Sector in India, TERI

Opportunities in rural steel

The current domestic steel consumption is skewed towards demand generation from the urban population with rural demand accounting for about ~15–16 percent of the overall demand. Further, with ~65 percent of the total population, the rural per capita steel consumption is ~1/10th of the urban per capita steel consumption at 19–20 kgs per capita[46]. About 65 percent of the rural consumption of steel is focussed on construction as the end use.

However, with lower per capita steel consumption and ample scope of urbanisation, rural steel consumption is expected to play a pivotal role in the Indian steel industry's growth. Multiple key initiatives by the government along with a host of consumption enablers are expected to drive up the steel demand in key end-use sectors of the rural economy (food processing and storage, agriculture and farming, dairy and animal husbandry, and rural infrastructure development). A summary of key policies and their affected sectors is provided in Table 8.

Table 8: Key policies and consumption enablers for rural steel

S.No.	Key Policies	Consumption Enablers	Key affected sectors
1	Pradhan Mantri Awas Yojana – Gramin	Increasing farm income	Construction & Infrastructure
2	Pradhan Mantri Gram Sadak Yojana	Labour availability	Construction & Infrastructure
3	PM Krishi Sinchayee Yojana	Demand for aspirational / lifestyle goods	Automobile (two-wheeler), construction and infrastructure
4	Galvanising Organic Bio Agro Resources (GOBAR) Dhan Yojana (Aims to positively affect village cleanliness and generate wealth and energy from cattle and organic waste)	46% share in national income generation	Animal husbandry, dairy
5	Deen Dayal Upadhyay Gram Jyoti Yojana (DDUGJY) (Continuous electricity supply to rural India)	Smart villages	Transmission and distribution
6	PM Kisan Sampada Yojana (Scheme for Agro-Marine processing and development of Agro-Processing clusters)		Animal husbandry, dairy, food processing, farm equipment
7	Jal Jeevan Mission Rural		Water and sanitation

Source: Secondary Research

Key Challenges & Opportunities

The key challenges in rural steel consumption lie across multiple factors, such as awareness, affordability, skill ecosystem, access to products.

Awareness:
Limited knowledge of steel-based solutions and lifecycle cost assessment for steel products is a key deterrent for increased steel adoption. At present, rebars and roofing sheets are being used in rural construction.

[46]https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1885805

Affordability:
The lower per capita income of the rural economy is leading to the usage of alternate products and inefficient/ make-shift solutions.

Skillset and ecosystem:
Lack of knowledge and vendors to carry out steel fabrication and awareness about application usage is another key challenge for rural steel market expansion.

Availability:
Due to the wide geographical spread, limited road access, and poor warehousing arrangements, the availability of steel is a constraint for the rural economy.

The Fast-Moving Consumer Goods (FMCG) sector can act as a potential benchmark for the steel industry towards rural penetration. A rural portfolio can potentially provide stable growth and resilience from market headwinds. Recognising the changing customer preference, the FMCG sector is utilising the fact that consumers in rural India are switching from unbranded, loose products to branded ones. The rural-specific distribution channel of the FMCG sector is making use of the local ecosystem of *Kirana* stores and other outlets being harnessed for Last Mile Connectivity (LMC). It is another learning that could be a takeaway for the Indian steel players to harness the networks of PDAs, *mandis*, and primary and secondary distributors to enhance channel presence.

Infrastructure sector and opportunity in prefabricated structures

The construction and infrastructure sectors account for more than 60 percent of the overall steel consumption. However, there is a huge infrastructure gap in the country. It is estimated that an infrastructure investment of US$ 4.5 trillion may be needed through 2040[47]. Over the next few years, capital expenditure is expected to remain high for Indian infrastructure players across sectors. The overall CAPEX in the infrastructure sector is expected to grow at 11–12 percent in the next 4–5 years.

Government initiatives, such as the construction of metro stations, new no-frill airports, international terminals, industry corridors, power plants, and ports, amongst others, which require heavy steel structures, are expected to drive the growth of the prefabricated structures market.

The expansion of nuclear energy in the country is important, as it is one of the ways to reduce CO2 emissions. India plans to triple its nuclear capacity by 2024. The solar energy sector also represents a huge opportunity and is witnessing a rapid rate of adoption across the country. Steel structures play an important role in mounting solar panels.

These infrastructure development activities by the Government of India (Table 9), and the infrastructure industry at large, are expected to boost the Indian metal fabrication market over the next few years.

[47]https://economictimes.indiatimes.com/news/economy/infrastructure/india-needs-4-5-trillion-by-2040-to-develop-infra-eco-survey/articleshow/62694945.cms?from=mdr

Table 9. Key policy initiatives and projects driving the steel demand from the infrastructure sector

National Infrastructure Pipeline	Dedicated freight Corridor
PM Awas Yojana – Urban and Rural	Bharatmala
UDAN	Sagarmala
National Electricity Plan	Smart city initiative

Structural steel is traditionally fabricated on site in India, mainly due to the lack of infrastructure for transporting heavy sections from an offsite workshop to the project site. This model of fabrication of steel structures is different from the model followed in developed countries.

However, the scenario is gradually changing. With the workshop delivery models being more efficient in terms of quality and timeliness, market players are moving away from on-site fabrication to fabrication in workshops. The time pressure is propelling the industry towards off-site fabrication. The workshop delivery model helps in reducing the time and cost of execution, in turn boosting the demand for steel structures in the country.

Most steel fabrication businesses (>90 percent) in India are Small to Medium-sized Enterprises (SMEs) with few employees and infrastructure. These companies serve a wide array of industries, such as manufacturing, construction, infrastructure. Factors, such as uncertain delivery schedules from steel manufacturers, funding, and volatility in prices of raw materials can create pressure on working capital, which remains a challenge for these SMEs, as the fabrication industry generally involves working capital-intensive operations.

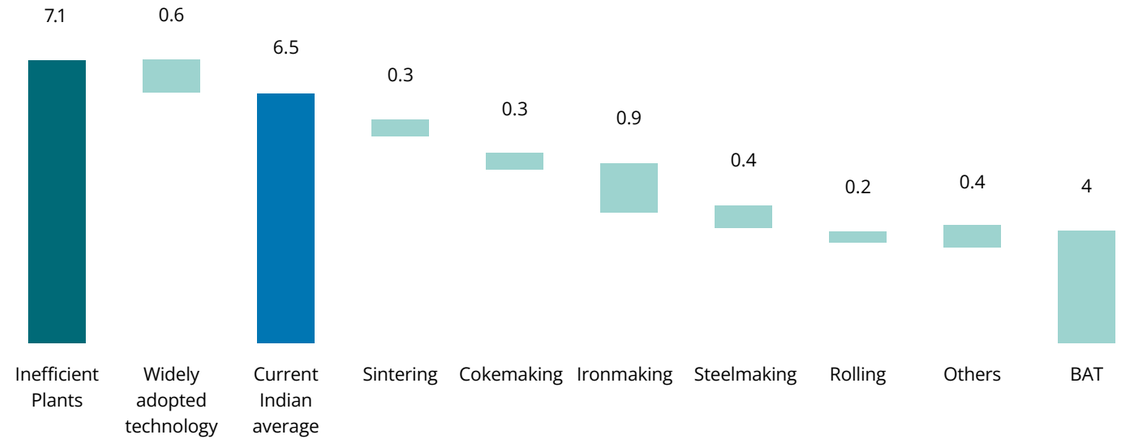
Focus areas for the Indian steel industry

Sustainability

Energy efficiency and decarbonisation

Steelmaking is an energy-intensive process that calls for the application of the best available energy-efficient technologies, particularly in the recently built capacities with long lifetimes. The application of the best available technologies has the potential to reduce energy and emissions by about 15 percent across the two primary steelmaking routes[48]. Further, older plants may be analysed for potential modernisation with regard to energy consumption. The average specific energy consumption of steel plants in India varies from 5.77 Gcal/tcs to 6.70 Gcal/tcs as compared with international standards of 4.5–5 Gcal/tcs[49]. A tentative energy consumption of each stage of steelmaking is provided in Figure 14.

Figure 14: Potential energy efficiency areas for blast furnace route of steel making



Source: Achieving Green Steel: Roadmap to a Net Zero Steel Sector in India, TERI, Secondary Research

Energy efficiency improvement is one of the key levers to the decarbonisation of the steel industry. On average, 1.8 to 1.9 tonnes of CO2 are generated per tonne of crude steel produced per international standards[50] with the Indian average ranging from 2.26 T/tcs to 2.8 T/tcs of CO2. Decarbonisation and growth of demand for green steel are expected to drive in the next few decades, globally. While regulatory landscapes across regions are driving the steel decarbonisation story, major steel producers across the globe have taken up significant decarbonisation targets. A non-exhaustive list of decarbonisation initiatives is provided in Table 10.

[48]Achieving Green Steel: Roadmap to a Net Zero Steel Sector in India, TERI
[49]Glossary of Terms & Definition commonly used in Iron & Steel Industry, Ministry of Steel website
[50]Glossary of Terms & Definition commonly used in Iron & Steel Industry, Ministry of Steel website

Table 10: Decarbonisation targets and initiatives by global and Indian steel makers (non-exhaustive)

S. No.	Steel producer	Decarbonisation target/initiative
1	SSAB	2020: The pilot facility to produce fossil-free sponge iron in Luleå was commissioned. 2021: SSAB produced the world's first fossil-free steel, produced using HYBRIT technology, and delivered to the customer. 2025: Replacement of BF with EAF at SSAB Oxelösund as demo plant 2030: Transformation of remaining BFs to mini mills with EAFs at SSAB Raahe & Luleå The HYBRIT* project is a pioneer in decarbonising steel production, using fossil-free electricity for the electrolysis of water to produce hydrogen.
2	ArcelorMittal	2030: It has the target of reducing CO2 emissions by 25 percent globally, and in its European operations by 35 percent. 2030: Direct Reduced Iron-Electric Arc Furnace(DRI-EAF) investments in Europe (Germany, Spain) and Canada, smart carbon and gas injection, souring of clean electricity, scrap utilisation
3	Thysenkrupp	2025: Initial commissioning of 2.5 MT capacity, replacing Blast Furnace with Direct Reduced Iron and iron melting technologies, which will avoid emissions of 3.5 MT of CO2 (investment of ~2 billion Euros) and full-scale by 2030.
4	H2Green Steel	2030: Greenfield steel plant in Sweden is producing 5 MT of steel with electricity from fossil-free sources and green hydrogen. H2 Green Steel is a new company founded in 2020, with the ambition to accelerate the decarbonisation of industry using green hydrogen.
5	United States Steel (USS)	2030: 20 percent reduction in CO2 emissions, achieved through process optimisation and Electric Arc Furnace (EAF) investments. 2050: Net Zero, achieved through mini-mill developments, Direct Reduction (DR) with NG(Natural Gas)/H2(Hydrogen), carbon capture, etc.
6	Tata Steel	Tata Steel plans to reduce CO2 emissions by at least 30 percent by 2030. Recently, Tata Steel's Dutch arm signed an MoU with Ford to supply its plants in Europe with green steel after 2030.
7.	JSW Steel	JSW TMT rebars have been recently certified with GreenPro ecolabel certification, conducted by CII with international standards and product for green product labelling. JSW developed products, such as Non-Grain Oriented Fully Processed (NGOFP) electrical grade of steel, which help in reducing core losses, further reducing Greenhouse Gas (GHG) emissions.
8	Jindal Stainless	Jindal Stainless Ltd. has partnered with Hygenco India Private Limited to install a Green Hydrogen Plant, which will enable Jindal Stainless Ltd. to considerably reduce its CO2 emissions by nearly 2,700 MT per annum. The hydrogen produced is planned to replace ammonia in its in-house annealing of stainless steel, which is part of the heat treatment process.

Source: Analyst Reports, Annual Reports, Secondary Research

Indian steelmakers have taken up various initiatives for decarbonisation with focussed initiatives in a host of areas, such as green labelling and the development of specialised steel products, amongst others. The carbon emission scenario in the iron ore and steel industry would also imply the use of syngas and hydrogen.

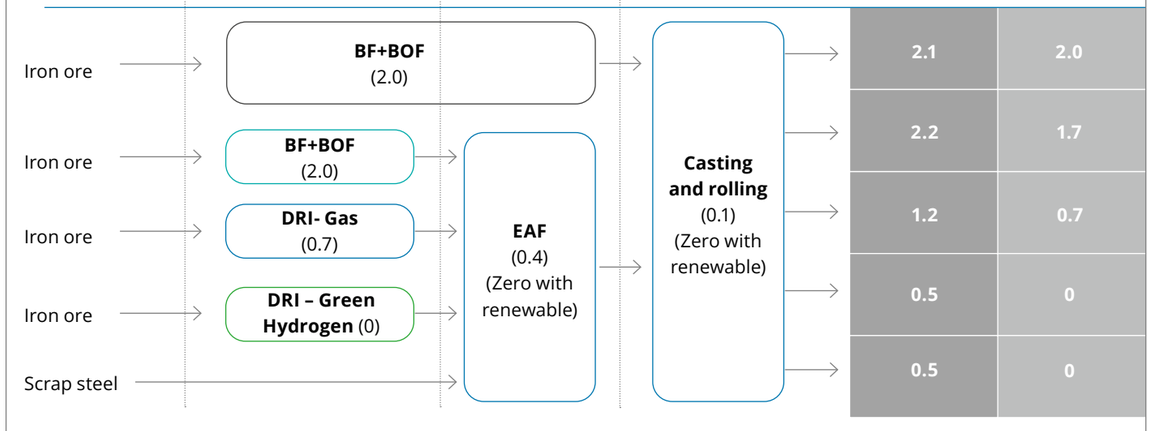
The production of steel currently relies on fossil fuels, primarily coal and natural gas, which are significant sources of greenhouse gas emissions. By using hydrogen as a feedstock in steelmaking, emissions can be significantly reduced. The most promising application of hydrogen in the steel industry is through direct reduction iron (DRI) technology.

DRI involves the use of a reducing agent, typically natural gas or coal, to convert iron ore into a usable metallic iron product. However, hydrogen can also be used as a reducing agent, with the only byproduct being water. Replacing fossil fuels with hydrogen in the DRI process has the potential to reduce emissions by up to 90%[51]. In addition, the use of hydrogen in steelmaking can improve energy efficiency, reduce operating costs, and improve the quality of the steel produced.

Recognising the potential of hydrogen in decarbonising the steel industry, Government of India has launched National Green Hydrogen Mission to promote the development of hydrogen infrastructure, including production and transportation, creating export opportunities for green hydrogen, and to support research and development in hydrogen technologies.

Figure 15 provides a tentative overview of the GHG intensities based on different kinds of inputs and processes.

Figure 15: Production routes and carbon intensity of various steel production methods



Source: Secondary Research

[51]https://www.sciencedirect.com/science/article/abs/pii/S095965262103972X

Decarbonisation of the steel industry at a large scale is the need of the hour based on net zero targets of the nation and the growing demand for green steel domestically as well as potential export markets. However, there are several challenges for the decarbonisation journey in the steel sector (globally and in India). Major challenges for decarbonisation of the steel sector have been listed in Table 11.

Table 11: Challenges for decarbonisation of the steel sector (non-exhaustive)

S. No.	Focus area	Key challenges
1.	Assets and technology	The young age of existing steelmaking assets
2.	Shortage/cost of green hydrogen and renewable electricity	Lack of green infrastructure for renewable electricity and hydrogen production The high cost of hydrogen will make green steel uncompetitive
3.	Raw material availability	Scarcity of high Fe-content iron ore needed for DRI, pressure on supply sources Limited availability of high-quality, prime scrap for EAF production
4.	Financing and capital expenditures	High asset investments needed, e.g., in the EU estimated 70–100 billion Euro Steelmakers have low-profit margins and are not able to absorb investment costs
5.	End markets	Demand for green steel from region/industry is variable Significantly higher 'green premium' prices of low carbon steel will be a challenge to get accepted The continued speed of industrialisation of China coupled with risks of a downturn
6.	Policy and regulatory	Lack of any clear certification standards for low-carbon steel A regulatory framework is needed that provides a level playing field

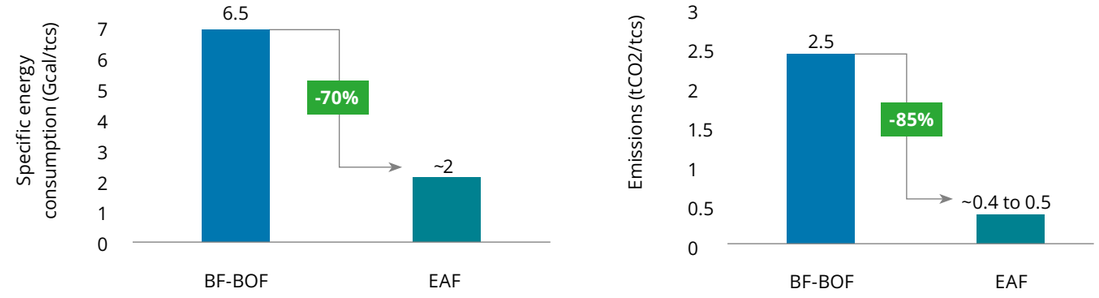
Source: Deloitte Analysis, Secondary Research

Circularity in the steel sector

Due to its endless capacity for use, reuse, and recycling, steel is a material ideally suited for the circular economy. While iron ore remains the primary source of steel making, used or re-used steel in the form of scrap is the secondary raw material used in the steel industry. A significant portion of the small steel manufacturers in the Indian steel industry uses scrap together with other inputs in the EAF/IF to produce steel. At present, there are more than 1,200 EAFs and induction furnaces operating in India, and are largely dependent upon scrap as the major feedstock[52]. The benefits of scrap-based steel production is highlighted in Figure 16.

[52]Steel Scrap Recycling Policy, Ministry of Steel, Press Information Bureau

Figure 16: Tentative benefits of scrap-based steel production



Source: Achieving Green Steel: Roadmap to a Net Zero Steel Sector in India, TERI

To develop a globally competitive steel industry, the Ministry of Steel adopted state-of-the-art environment-friendly technologies and released the Steel Scrap Recycling Policy in 2019. Ferrous scrap being the primary raw material for EAF/IF-based steel production, the policy envisages a framework to facilitate and promote the establishment of metal scrapping centres in India. The policy framework provides standard guidelines for collection, dismantling, and shredding activities in an organised, safe, and environmentally sound manner.

This is in line with the objective of the NSP, which envisages scrap-based steelmaking as one of the most important options to reduce GHG emissions with a target contribution of 35–40 percent from the EAF/IF route for the 300 MT steel production capacity target of 2030.

With the rise of finished steel production of ~250 MT as envisaged by the NSP, the corresponding demand for scrap is expected to touch 70–80 MT, requiring ~700 scrap processing centres, i.e., ~700 shredders. This shall correspond to be fed by ~2,800 to 3,000 collection and dismantling centres spread across the nation[53]. Secondary steel producers face a major challenge in terms of the availability of quality scrap. Scrap with less or no impurities shall result in better long products that are commonly used in the construction industry and in steel use. The increased production of vehicles and increased use of consumer durable white goods in the past two decades and their rapid obsolescence shall generate large quantities of end-of-life products. This shall result in the generation of a continuous flow of large ferrous scrap for recycling in steel production. An Inter-Ministerial Coordination Committee has been set up with the Secretary, Ministry of Steel as Convener and Secretaries of the Ministry of Road Transport & Highways (MoRTH), Department of Heavy Industry (DHI), Ministry of Environment, Forest & Climate Change (MoEF&CC), Department Revenue and Ministry of Labour and Employment as members. Their mission is to analyse the policy changes required for creating an organised steel scrapping ecosystem and monitor the operationalisation and enforcement of relevant laws/regulations[54].

[53]Steel Scrap Recycling Policy, Ministry of Steel, Press Information Bureau
[54]Press Information Bureau, Ministry of Steel, Press Information Bureau, Nov 2019

Raw material security

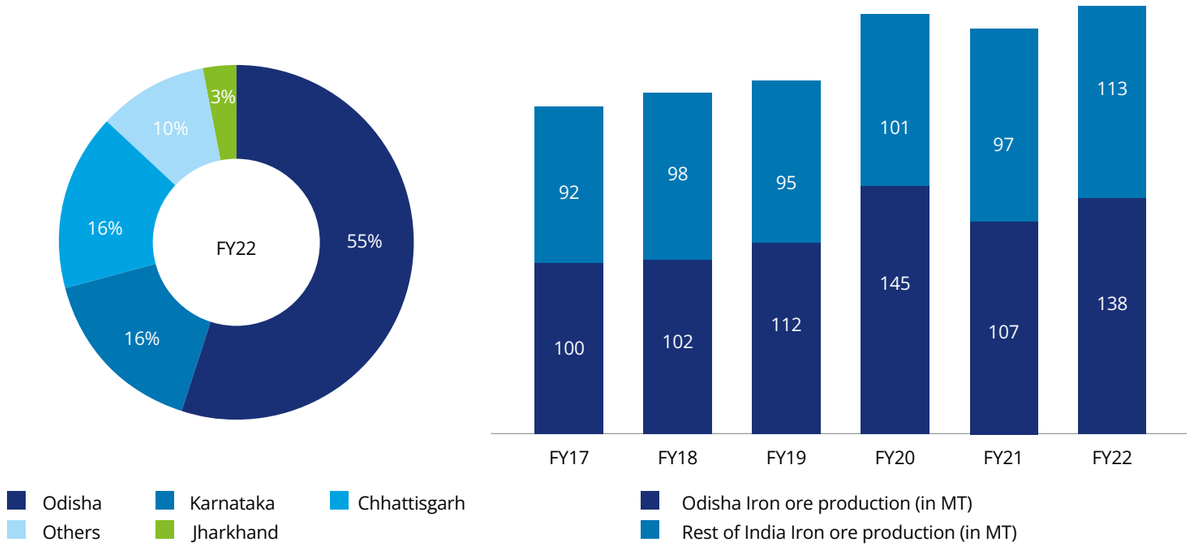
India has a total resource of over 33 billion tonnes of iron ore, which is concentrated in four major states (Odisha, Chhattisgarh, Karnataka, and Jharkhand)[55]. Odisha plays a dominant role in iron ore production, contributing more than 50 percent of the total production. The other states contribute about 40 percent of the total production (Figure 17).

India is a surplus producer of iron ore. The domestic production of iron ore in FY22 exceeded 250 MT against a domestic consumption of less than 200 MT[56]. As India expands its crude steel production capacity, with vast available resources, the supply is also expected to increase in line with the demand. Tentative iron ore requirement of the steel industry is shown in Figure 18.

Historically, iron ore mining in India has been dominated by merchant players with Odisha producing more than half of the domestic production. However, the trend is expected to change in short term except for NMDC Ltd and OMC (Odisha Mining Corporation). A paradigm shift has surfaced post the conclusion of the 2021 iron ore block auctions in Odisha (Figure 19).

However, concerns around prices, delays in the operationalisation of blocks due to delays in Environmental Clearance (EC), Forest Clearance (FC), regulatory approvals, funding issues, high taxes, and logistics constraints are adding to 'pushback' costs for secondary steel producers.

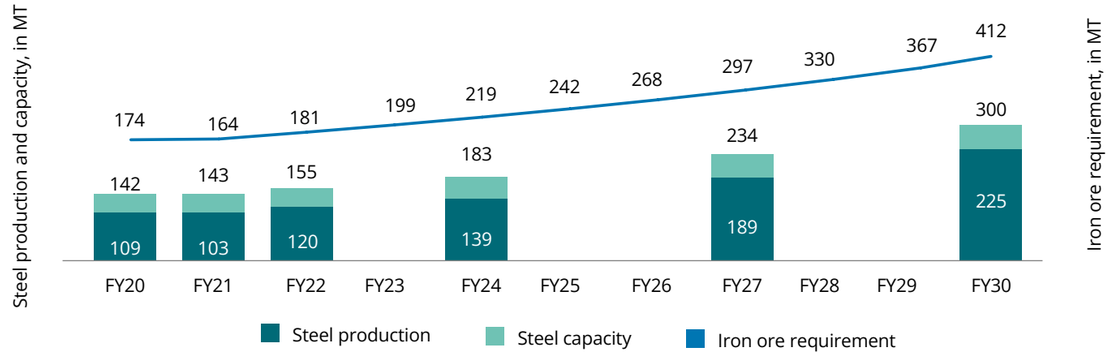
Figure 17: Dominance of Odisha in iron ore production in India



Source: Achieving Green Steel: Roadmap to a Net Zero Steel Sector in India, TERI

[55]Indian Bureau of Mines
[56]SteelMint

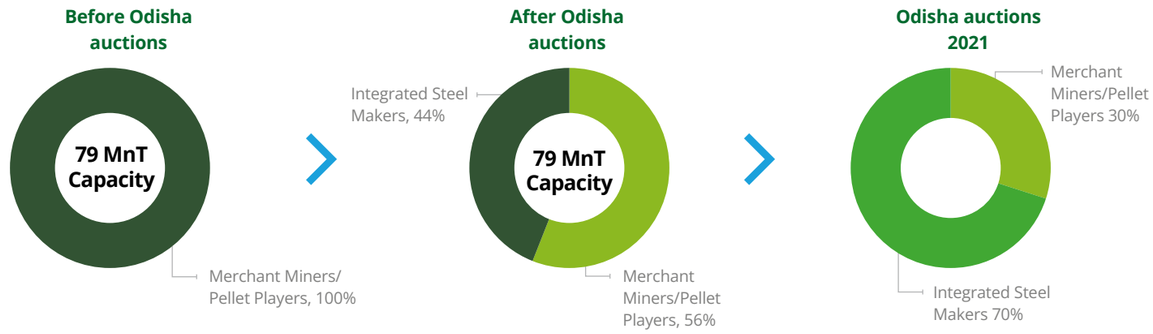
Figure 18: Tentative iron ore requirement for the steel industry



Source: Ministry of Steel, Secondary Research

Historically, iron ore mining in India has been dominated by merchant players with Odisha producing more than half of the domestic production. However, the trend is expected to change in short term except for NMDC Ltd and OMC (Odisha Mining Corporation). A paradigm shift has surfaced post the conclusion of the 2021 iron ore block auctions in Odisha (Figure 19).

Figure 19: Recent shifts in iron ore block ownership



Source: CMIE Industry Outlook, World Steel, Visual Capitalist, Global Newswire, GIA Research

On average the premiums have inched up from 104 percent in 2020 auctions to 124 percent in 2021 auctions. There is a shift in the ownership of iron ore capacities (Integrated steel players vs. merchant miners) pre-auction and post-auction. Further, the MMDR Amendment of Section 8(4) states that the period of mining leases of government companies (other than leases granted through auction) may be extended on payment of an additional amount (Equivalent to 150 percent of the royalty payable for iron ore) along with the MMDR Amendment of Section 8(5) and 8A(7A) stating that 50 percent of the production of mineral and coal from captive mines can be sold after meeting the requirement of the end-use plant and after paying the additional amount (such rates varies from 50 percent to 200 percent on royalty). These are some key changes along with high premiums in auctions, which are expected to increase iron ore prices in India.

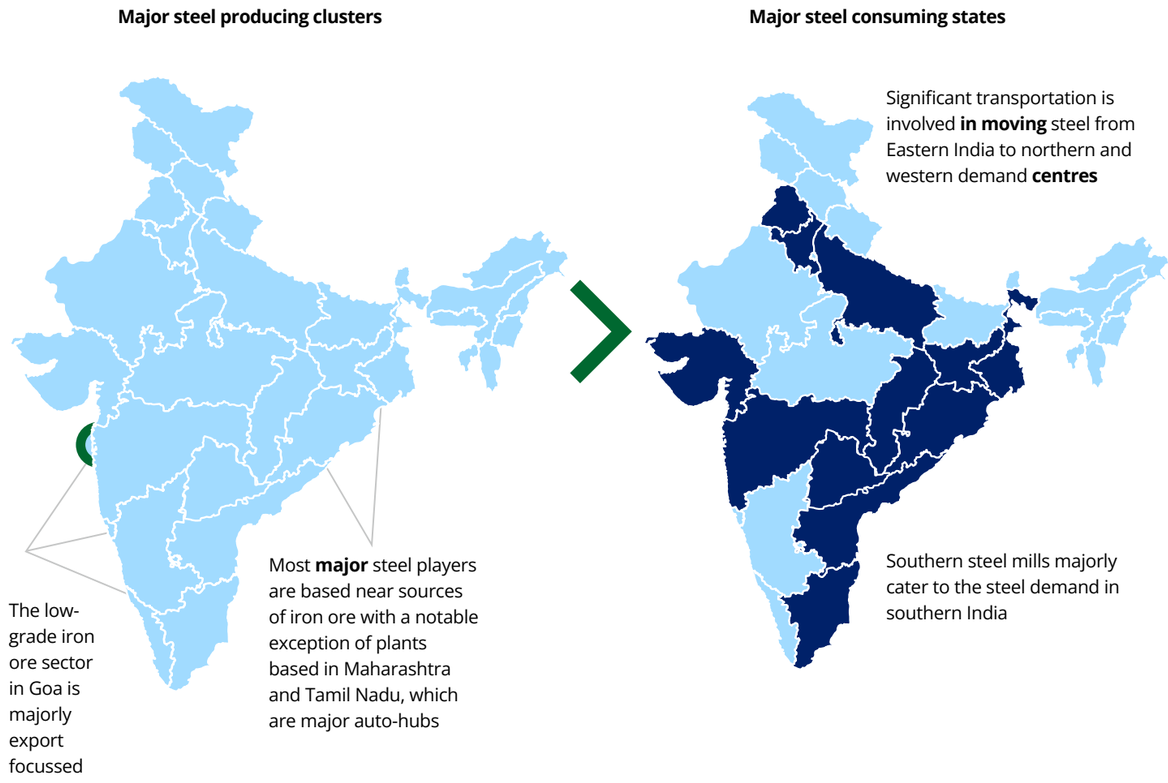
Several implications emerge from this trend of the shift of ownership:

- ~ 30 percent of the total production of India shall be captive in nature.
- Steel exports will witness growth with foreign technology providers and critical steel plant manufacturers set up manufacturing setup in India with iron ore exports coming down.
- Smaller players in the steel sector shall be reliant on large merchant miners, such as NMDC and OMC and express reduced interest in captive mines.
- Large steel players may continue to buy iron ore from merchant miners due to high costs in their captive mines.

Logistics

Logistics plays an important part in the iron and steel sectors. The inbound and outbound logistics are highly dependent on the lead distance of the iron-ore mine sources and the consumption markets of the final product, respectively. The Indian steel industry is disaggregated into regional clusters of supply and demand. Most of the steel plants are close to iron ore mines. Such a distributed profile requires significant inter-state long-haul movement from East and West India to North India where the auto and capital goods production clusters, major cities, and infrastructure project sites are located. Major clusters of steel production and consumption is shown below in Figure 20.

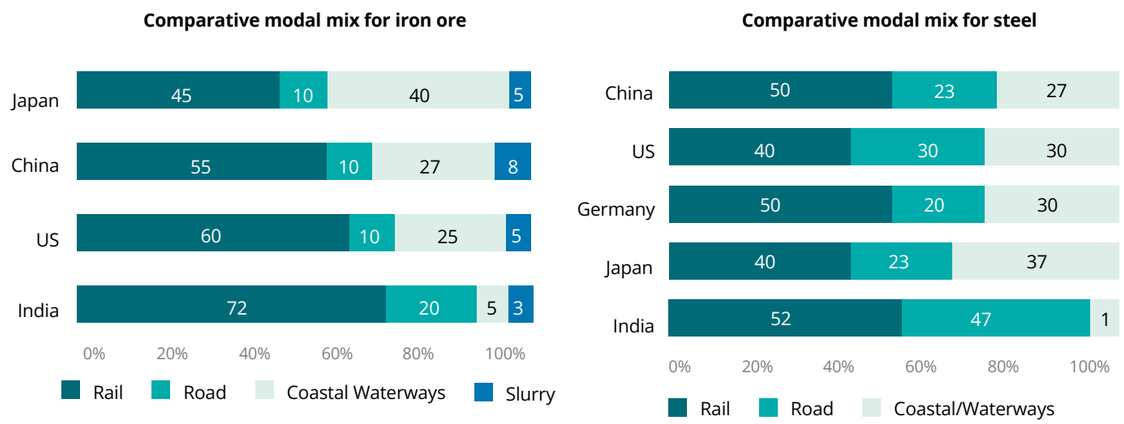
Figure 20: Major clusters of steel production and consumption



Note: High consumption states with >5 MTPA demand has been highlighted as major demand centres for steel
Source: Draft National Logistics Policy, Ministry of Commerce, Secondary Research

The modal share of inbound raw materials, such as iron ore and coal in India is heavily skewed towards railway transportation while that for steel is towards roadways. A comparative overview of the modal mix for iron ore and steel for India and other major steel producers globally is provided in figure 12.

Figure 21: Comparative modal mix for iron ore and steel logistics



Source: Draft National Logistics Policy 2019, Ministry of Commerce, Secondary Research

Key challenges

The major transportation and logistics constraints affecting the sector revolve around infrastructure, service provision, and operating and regulatory environment. A brief description of the key issues has been listed in Table 13.

Table 12: Key challenges for logistics in the steel sector

S. No.	Focus area	Key challenges
1.	Infrastructure	Analysis of railway line capacity against demand and identification of severe congestion required to plan for future capacity building.
		Primitive handling equipment at goods sheds and terminals.
		Constrained availability of rolling stock and lower rake turnaround time
2.	Service provision	High landed cost of rail transportation
		High terminal detention due to loading/unloading delays
		Low transit time guarantee in rail transportation
		Limited adoption of Radio Frequency Identification (RFID)/GDP services in trucks
		Skill development overlooked despite the road sector being manpower-intensive
		Optimisation of rake allocation
3.	Operating and regulatory environment	Formulation of integrated logistics policy to address requirements and concerns of the sector
		Inadequate and poor maintenance of weigh-in-motion instruments by Indian Railways.

Source: Deloitte Analysis, Secondary Research

The way forward – Sectoral Plan for Efficient Logistics (SPEL)

Prime Minister, Narendra Modi launched the PM GatiShakti National Master Plan for providing multimodal connectivity infrastructure to various economic zones in 2021. Under this initiative, the government has put forward the vision of developing a technologically enabled, integrated, cost-efficient, resilient, sustainable, and trusted logistics ecosystem in the country for accelerated and inclusive growth. Various interventions have been proposed under the policy, which is to be implemented through a Comprehensive Logistics Action Plan (CLAP).

One of the interventions proposed is the formulation of the SPEL to address logistics issues about infrastructure; processes; digital improvements; policies and regulatory reforms; capacity building for a better workforce, prioritise cross-sectoral cooperation duplicate efforts, and focus on optimisation of the modal mix. The SPEL is envisaged to be based on current Origin-Destination (OD) mapping, establishing the future supply mix along with future OD mapping and finally analysing the constraints to enable decision making on planning of infrastructure, such as First Mile Connectivity (FMC), trunk line infrastructure addition and LMC for clusters of the iron and steel sectors.

Policy and regulatory framework

To promote the domestic steel industry, the Government of India has been introducing fiscal and regulatory policy reforms to enable the growth of domestic steel production. Table 14 highlights key policies introduced during the past few years to facilitate the domestic steel players.

Table 13: key policies introduced in India in recent years

S.No.	Policy	Year of policy introduction	Remarks
1.	DMI&SP Policy	2017	Preference to Domestically Manufactured Iron & Steel Products (DMI&SP) in government procurement
			To promote growth and development of the domestic steel industry and reduce the inclination to use, low-quality low-cost imported steel
2.	General Financial Rules (GFR)	2017	Promote steel usage by amendment to consider lifecycle cost analysis in government projects
			Expected to help push for capital goods manufacturing in steel clusters
3.	National Steel Policy (NSP)	2017	Focus on growth in steel production, aspires to achieve 300 MT of steelmaking capacity by FY2030–31
			Per capita steel consumption to 160 kgs by FY2030–31
4.	Steel Scrap Policy	2019	Scrap policy and recycling efforts also aimed at reducing the carbon footprint
			Setting up scrap dismantling and processing centres

S.No.	Policy	Year of policy introduction	Remarks
5.	SIMS	2019	Steel Import Monitoring System (SIMS) to bring transparency and provide advanced information QCOs aimed at curbing imports of substandard steel items
6.	Promotion of Greenfield investments	2019	Addressing five key challenges - land availability, iron ore at competitive prices, statutory clearances, logistics infrastructure, and incentives Driven by steel CPSEs (Central Public Sector Enterprises), state governments, the steel ministry
7.	Steel Cluster Policy	2019	Six components – capacity expansion, cluster setup, capital goods, logistics, raw material security, and labour Ancillary and downstream clusters around ISPs Value-added clusters setup near demand centres
8.	Make in India (2014), Atmanirbhar Bharat (2020)	2020	Make in India to encourage manufacturing in India INR 20 lakh crore package as part of its Atmanirbhar Abhiyaan aimed at reviving economic activity Government notified changes in rules disallowing global tender up to INR 200 crore Government e-Marketplace (GeM) makes the country-of-origin mandatory with a Make in India filter (50 percent local content criteria) The steel sector declared an essential service during the lockdown
9.	Production Linked Incentive (PLI) Scheme	2021	Government has approved the inclusion of 'specialty steel' under the Production Linked Incentive (PLI) scheme with a five-year financial outlay of INR 6,322 crore to promote the manufacturing of 'specialty steel' It aims to attract capital investment, generate employment, and promote technology up-gradation in the steel sector

In addition to the above policy measures, regular tax reforms and changes in tax rates and duties are being done to promote and regulate the domestic steel industry.

Some of the recent tax measures concerning the steel industry are:

- In the budget 2021–22, the government revoked the Anti-Dumping Duty (ADD) and Countervailing Duty (CVD) on certain steel products while reducing customs duty uniformly to 7.5 percent on semis, flat, and long products of non-alloy, alloy, and stainless steels from 10–12.5 percent levels earlier.[57]
- To provide relief to MSME secondary steel producers the import duty on steel scrap was brought down to nil to support user industries hit hard by a sharp rise in steel prices.[58]
- With effect from 19 November 2022, the government has rolled back export duty on iron ore pellets and steel products, including pig iron, flat-rolled products of carbon steel and stainless steel, bars, rods, and non-alloy steel, vide Notification No. 58/2022-Customs dated 18 November 2022. Export duty on iron ore with a grade higher than 58 percent has been reduced from 50 percent to 30 percent.[59]

The policy and tax reforms work towards the common goal of removing the bottlenecks in the entire value chain associated with the steel industry, from the raw materials to the production of finished products. It seeks to achieve harmony amongst each of the associated industries whether mining, pet coke, pellet, sponge iron, etc., which would ensure the profitability and growth of each sector and the ecosystem.

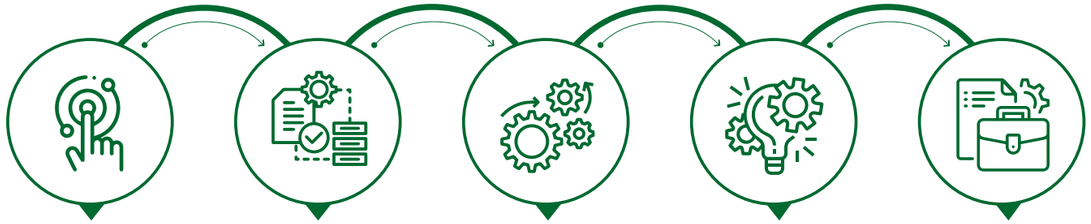
Digitalisation and Industry 4.0 in the steel sector

Digitalisation can help a steel company to improve its operational efficiency, achieve higher productivity, reduce wastage, and generate better profits in the long run. Digitalisation does not necessarily mean the usage of sophisticated instruments but rather focusses on how human efforts can be used more effectively and in a timely manner (with the help of any machine). The context of digitalisation and the degree to which it can be adopted also depends on the existing operational maturity of the steel company. A typical digital transformation journey has multiple stages as shown in Figure 21.

[57] Secondary Research
[58] https://economictimes.indiatimes.com/industry/indl-goods/svs/steel/government-extends-duty-exemption-on-steel-scrap/articleshow/89269481.cms?from=mdr
[59] https://pib.gov.in/PressReleasePage.aspx?PRID=1877232

Figure 22: Typical stages of digital transformation in a manufacturing company

The five phases of digital transformation



Digitise information	**Organise information**	**Automate processes**	**Streamline processes**	**Transform the business**
Changing from physical to digital form	Setting up databases for storage and retrieval	Eliminate human lapses through automating repetitive processes	Use digital technologies to transform individual operations	Transform operations, strategic directions, and value proposition

Source: A Sharper View: Analytics in the Global Steel Industry, Deloitte

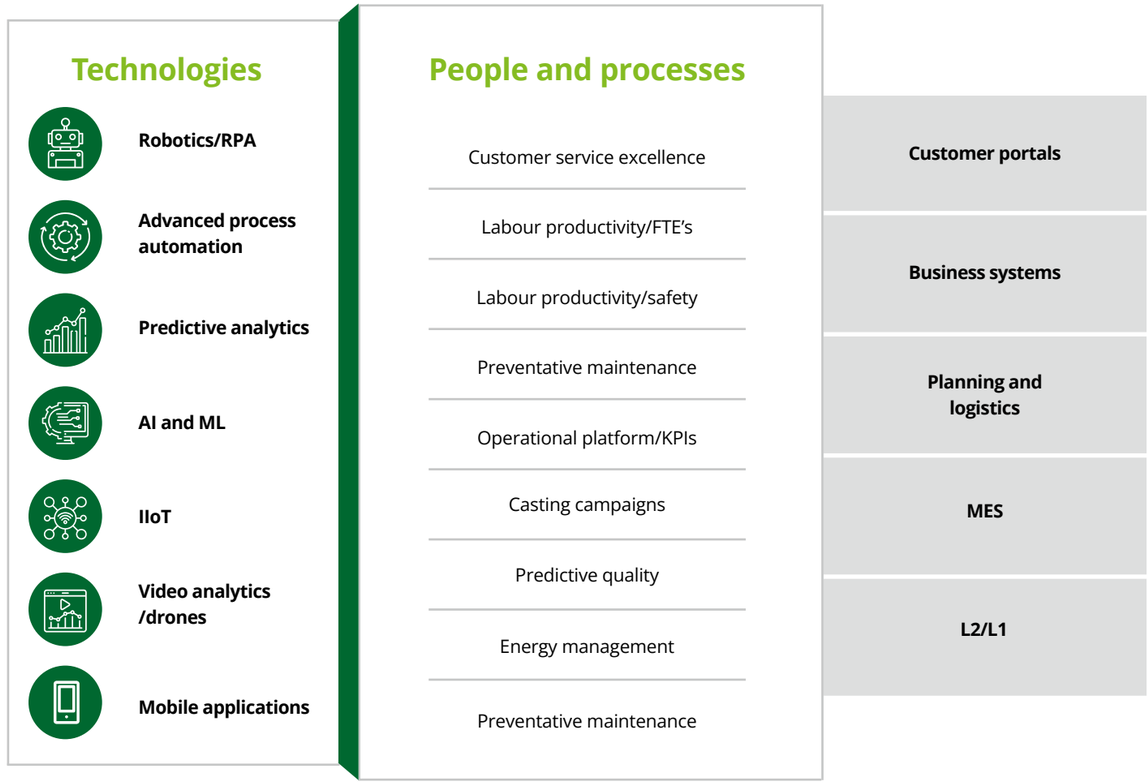
About 60 percent of the Indian crude steel production comes from the top six integrated steel players. The remaining 40 percent of the production comes from either the lower capacity integrated steel plants or from smaller players. From a process route perspective, about 28 percent of the crude steel is produced through the IF route (adopted by small-scale manufacturers with scattered geographical presence). The above figures indicate that the majority of the Indian steel sector is consolidated by large players. However, a large amount of steel is produced by the smaller players as well. The operational maturity of these different types of steel plants (integrated and non-integrated) varies significantly and hence, their digitalisation needs are also different.

Smaller companies are mainly focussing on stage 1 (digitising information) and stage 2 (organising information) and partly on stage 3 (automate operations). Larger integrated steel players are starting their journey from stage 3 and focussing on stage 4 (streamlining processes) and stage 5 (transforming the business). In the recent years, companies have started adopting Enterprise Resource Planning (ERP) software to aid them in their digitising journey and organising their information. The focus of digitisation for larger players remains on the automation of operations and streamlining processes.

In the past decade, Industry 4.0 has been driving the digital transformation initiatives of companies. Industry 4.0 refers to the intelligent networking of machines and processes for industry with the help of information and communication technology. This helps to monitor the manufacturing processes and equipment performance on a real-time basis, which allows timely interventions to ensure high-quality output. This involves multiple technologies, including the Internet of Things (IoT), cloud computing, Artificial Intelligence (AI) and machine learning, cybersecurity, digital twin, etc.

Figure 22 shows the various focus areas of the steel value chain and the digital initiatives that may be used across all of them.

Figure 23: Digital technologies that may be applied in the steel value chain



Source: Deloitte Analysis

Following are key digitalisation technologies and their applications in the Indian steel industry:

Robotics
Robotics can be used to replace manual inspection in hazardous areas and reduce accidents and casualties. For example, in an EAF, the robotised inspection system may be used to inspect the refractory lining of the furnace after the steel has been tapped. Similarly, robotics may also be used to check the quality of a carbon electrode in an EAF after every tapping. This ensures that faulty electrodes can be replaced early and melting productivity can be increased.

Advanced process automation
This finds application in blast furnace operation, which is highly dynamic and operates with hundreds of process parameters. Original Equipment Manufacturers (OEMs), such as primetals have developed blast furnace process control systems with advanced automation. The typical challenge faced by any blast furnace operator is determining the optimum burden mix, reducing coke consumption, and maintaining productivity and product quality. Such advanced process automation systems use sensors at different points of the blast furnace, analyse the data on a real-time basis and help the operator to make timely adjustments to the process parameters. This ensures high productivity by maintaining a uniform melt temperature and reducing fuel consumption.

Predictive analytics
This technology incorporates the usage of artificial intelligence and can help steel companies to optimise their operational performance. Predictive analytics can be used to reduce process fluctuations and maintain the optimum parameter. For example, in a cold rolling mill, it can be used to predict the mill vibration levels for maintaining the optimised steady-state speed. It uses real-time inputs from sensors, control systems, and product data to predict the probability of mill vibration and adjusts the steady-state speed accordingly. This improves the mill's efficiency as well as product quality.

Artificial Intelligence and Machine Learning
Artificial intelligence (AI) can be deployed in the steel industry to mitigate the costs associated with supply chain failures. Using predictive and preventive analytics tools, steel companies can analyse the supplier routes along with traffic in those routes and weather data to identify the probability of delays in delivery. Based on it the companies can predict the shortage of raw materials and correspondingly plan to avoid interruption in production.

AI can also help to improve decision-making processes and reduce manual interventions. An area where AI can be potentially applied is in casting and rolling. Once the molten steel strands come out on the rollers, it is very difficult to manually verify the end product's raw material composition. In addition, manually differentiating between strands of different heat numbers and sequence numbers can be challenging. AI algorithms can be used to track the details of the production process to enable real-time identification of deviations at any point. The operator can also monitor whether all parameters are always within acceptable limits. Once the AI platform identifies anomalies in the process, the system relays these changes to the operators, who can immediately intervene and alter the process parameters in real time.

Similarly, Machine Learning (ML) can be applied in solving the logistical challenges of Steel companies. ML can be used to track vehicles in real time and guide them on what routes to take based on past experience. These tracking and routing capabilities are enabled by machine learning algorithms. These algorithms analyse historical data to identify the best routes for executing deliveries. This can help Steel companies optimise their deliveries and achieve a reduction in their loading and unloading turnaround time.

Industrial Internet of Things (IIoT)
This technology refers to the extension and use of the IoT in the industrial sectors and applications. The basis of IIoT is to generate connected data from different sources and ensure their integration into a single platform. This results in the generation of actionable insights, which can help a company to improve its existing processes. An illustration of IIoT is the development of a digital twin. A digital twin is the virtual representation of a physical object or process. These digital twins can be used to simulate the actual physical conditions and predict the outcomes accurately. Tata Steel has started pilot trials of creating digital twins of their steel plants, through real-time data analytics, opening possibilities for data-driven 'smart factories' in the future. They have successfully developed digital twins for sinter plants (equipped with AI techniques) to achieve benchmark CO2 emissions.

Video analytics/drones
Video analytics can be used for surveillance, quality assurance, and production improvement in a steel plant.

- Surveillance: Drones/fixed cameras can be used to control the security of sensitive locations within the plant. It can be used to monitor unauthorised movement as well.
- Quality assurance: Video analytics can be used to detect jamming. For example, proper positioning of steel slabs into a furnace optimises the productivity in the mill. Proper alignment in the furnace is imperative to reduce the chance of jamming from a wedged slab. Video analytics can help to position the slab accurately. It can also be used to measure the smoothness on the surface of finished products.
- Production improvement: Knowing the length and speed of steel slabs is a piece of essential information for the accurate alignment of oxygen torches and mechanical cutters after the molding process. Through video analytics technology both the length and speed of the slabs can be measured to optimise subsequent processes. Similarly, level detection of molten metal can be done through photosensors that spontaneously detect infrared energy emitted from the heated material.

In conclusion, it can be said that digitalisation can have a wide gamut of applications in the Indian steel industry. It can help solve the challenges cost-effectively. However, it is not a one-stop solution. It is a gradual transformation journey and can only be successful if properly channelised through human efforts. Indian steelmakers need to create more awareness amongst their employees to ensure that digitalisation is embraced and driven positively.

Way forward

India has been steadily climbing the economic ladder. It now stands as the fifth largest economy[60] (six positions up since 2012). It is envisioned that India will become a US$ 32 trillion economy (second largest) at the end of 2047[61], 'Amrit Kaal'. Steel has been the bedrock of economic development in past and will continue to support overall economic development. Increasing urbanisation, push on infrastructure projects, logistics networks, industrial corridors, e-mobility, renewable energy, etc., would be key drivers for steel demand.

Digitalisation, technological development, and continuous R&D are dimensions that will help the steel industry unlock its full potential. These developments have enabled the steel value chain players in efficiency improvement, process optimisation, while new product developments have helped in gaining new market access (end usage as well as geographies). The technological developments, however, have much scope for growth, especially vis-à-vis green steel technologies, specialty steel, etc.

The industry is already gearing itself for capacity expansion to satiate domestic demand. Key players have laid out plans for medium-term capacity expansion plans and are continuously recalibrating towards the Amrit Kaal vision achievement. The policy framework is also evolving in line with the industry demand and follows a forward-looking approach. Vehicle scrapping policy and steel scrap recycling policy are some key initiatives to promote the circular economy and achieve India's net zero emission target timeline of 2070.

[60]https://economictimes.indiatimes.com/opinion/et-commentary/the-route-to-india-becoming-the-fifth-largest-economy-in-terms-of-gdp-over-the-last-eight-years/articleshow/93989544.cms?from=mdr
[61]https://pib.gov.in/PressReleasePage.aspx?PRID=1911174#:~:text=Union%20Minister%20of%20State%20for,and%20the%20global%20community%20alike.

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